IN THE ENVIRONMENT COURT
AT CHRISTCHURCH

I TE KŌTI TAIAO O AOTEAROA
KI ŌTAUTAHI

Decision No. [2023] NZEnvC 157

IN THE MATTER	of the Resource Management Act 1991
AND	the Report of a Special Tribunal for the making of a water conservation order for Te Waikoropupū Springs and associated water bodies
BETWEEN	NGĀTI TAMA KI TE WAIPOUNAMU TRUST & ANDREW YUILL (ENV-2020-CHC-28) (continued as set out in Annexure 2) Submitters

Court:	Environment Judge J J M Hassan Environment Commissioner J A Hodges Deputy Environment Commissioner M Pomare
Hearing:	at Nelson on 24-27 May 2022, and 27 June-1 July 2022 at Wellington on 1-5 August 2022 via AVL on 27 and 28 October 2022 at Christchurch on 17 and 18 April 2023
Appearances:	M Baker-Galloway and R Hill for Ngāti Tama ki Te Tauihu Trust and Andrew Yuill M Pemberton for Director-General of Conservation B J Matheson for Upper Tākaka Irrigators & others and Manawa Energy Limited C P Thomsen and C H Luisetti for Tasman District Council (via AVL) G Mather for Friends of Golden Bay (via AVL) S Gepp and C Iorns for Save Our Springs Aotearoa New Zealand Incorporated
Last case event:	19 June 2023

REPORT AND RECOMMENDATION ON TE WAIKOROPUPŪ SPRINGS WATER CONSERVATION ORDER – PART 1

Date of Report: 28 July 2023

Date of Issue: 28 July 2023

REPORT AND RECOMMENDATION TO THE MINISTER

for the making of a Water Conservation Order for Te Puna Waiora o Te Waikoropupū and Wharepapa Arthur Marble Aquifer

Part 1
Reasons and Recommendations

TO THE MINISTER FOR THE ENVIRONMENT

Recommendation

[1] Under s213, RMA,[1] the Court recommends to the Minister that:

(a) the Report of the Special Tribunal dated March 2020 on the making of a water conservation order for Te Waikoropupū Springs and associated water bodies be **accepted with modifications** according to the findings in this Report; and

(b) the Minister recommend to the Governor-General the making of the Water Conservation (Te Puna Waiora o Te Waikoropupū and the Wharepapa Arthur Marble Aquifer) Order 2023 ('WCO') on the terms in Annexure 1.

Introduction

Te Waikoropupū Springs and Wharepapa Arthur Marble Aquifer

[2] Te Waikoropupū Springs are part of the Tākaka catchment and are just to

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1 Resource Management Act 1991.

the northwest of Tākaka, Mohua/Golden Bay in Tasman District. Wharepapa Arthur Marble Aquifer is part of a highly complex and vast karst hydrogeological artesian system that, along with the Tākaka River and its tributaries, feeds the Springs.

[3] We find that, as Te Puna Waiora, the Springs remain in their natural state in accordance with tikanga Māori. For Ngāti Tama ki te Tauihu, Te Ātiawa and Ngāti Rarua, they are one of the most sacred places in Mohua (Golden Bay). They are a registered wāhi tapu,[2] and taonga tuku iho (treasured resource):[3]

Waikoropupū, Waikoropupū
Pupū ake te whenua
Pupū ake ko ngā waiora
Waikoropupū
Ngā puna wai o Tākaka
Ngā puna roimata wairua
Waikoropupū, Waikoropupū

Bubbling waters from the throat of the spring
Bubbling waters from the throat of the spring
Forever bubbling from the land
Forever bubbling for the health of the people and the spring waters
The spring waters of Tākaka
The tears of the spirit ancestors,
Waters bubbling from the throat of the spring
Waters bubbling from the throat of the spring.

[4] The exceptional clarity of those bubbling waters is renowned and connotes what we adjudge to be an outstanding spiritual quality. Te Waikoropupū are the largest freshwater springs in the southern hemisphere. They have important scientific and ecological value, being listed as a Water of National Importance for biodiversity.[4] Their underground ecology is understood to contribute to the

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2 New Zealand Heritage List/Rārangi Kōrero.

3 Manson, EIC at [22], stating that this waiata reflects the importance of Te Waikoropupū to Ngāti Tama and is the most commonly sung waiata by the iwi at formal events.

4 Ministry for the Environment's Sustainable Development Water Programme of Action – Waters of National Importance (WONI) led to the development of the FENZ (Freshwater Ecosystems of New Zealand) database.

Springs' exceptional water clarity. Amongst the diverse assemblage of small aquatic invertebrates inhabiting the groundwater feeding the Springs are stygofauna about which little is known (including their sensitivity to changes in water quality). Those qualities contribute to our judgment that the subject waters have outstanding values.

Background to the Court's inquiry and the parties and this Report

[5] In legal terms, a WCO is an Order in Council made by the Executive on the recommendation of the Minister. It is a form of secondary legislation within the meaning of the Legislation Act 2019. A WCO can prescribe restrictions or prohibitions on the exercise of a regional council's powers under s30(1)(e) and (f), RMA. As a unitary authority, Tasman District Council ('TDC') exercises those powers within Tasman District. The regional policy statement and relevant regional plan(s) must not be inconsistent with a WCO.[5] Where relevant, a WCO is a statutory instrument to which regard is given in the consideration of resource consent applications.[6]

[6] Monitoring data, primarily gathered by members of Friends of Golden Bay Inc. ('FOGB'), revealed a worrying progressive increase in the Springs of levels of potentially harmful nitrate-nitrogen ('NO_3-N'). For Ngāti Tama, as ahi-kā-ria,[7] that is a matter going directly to their tikanga responsibilities as kaitiaki for Te Waikoropupū.

[7] Ngāti Tama Ki Te Waipounamū Trust and Andrew Yuill ('applicants') initially applied for a WCO in December 2013.[8] That application was put on hold and the applicants were encouraged to further engage with TDC. They re-applied

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5 Sections 62(3), 67(4), RMA.

6 Sections 200, 104(1)(c), RMA.

7 The home people or resident iwi who have maintained continuous occupation of Mohua/Golden Bay.

8 Section 201, RMA provides that any person may apply to the Minister for the making of a WCO.

on 6 April 2017, seeking that a WCO apply to Te Waikoropupū Springs and the Wharepapa Arthur Marble Aquifer as the subject waters ('subject waters'). They sought that the WCO prescribe restrictions over various contributing surface waters and hydrologically connected groundwaters. These included the Tākaka River and its tributaries (including the Waingaro, Anatoki and Waikoropupū Rivers), the Tākaka Limestone Aquifer ('TLA') and Tākaka Unconfined Gravel Aquifer ('TUGA'). That application was referred to a Special Tribunal ('Tribunal').[9] Following their hearing, the Tribunal recommended to the Minister that a WCO be made (other than in respect to the Anatoki and Waikoropupū Rivers).[10]

[8] The applicant, TDC and various other parties before the Tribunal filed submissions to the Court thereby instigating our inquiry. Those parties included local farmers ('Farming Interests')[11] and Save our Springs Aotearoa New Zealand Inc ('SOS'). Other submitters included Manawa Energy Ltd[12] (operator of Cobb Hydro-Electric Power Scheme) and New Zealand King Salmon Co. Ltd (operator of a hatchery that draws water downstream of Te Waikoropupū). The Director-General of Conservation ('DG'), FOGB and Fonterra Co-operative Group Ltd ('Fonterra') joined the inquiry as s274 RMA parties.[13]

[9] Our report to the Minister on completion of an inquiry can recommend that a Special Tribunal's report be rejected or accepted with or without

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9 Sections 203 – 208, RMA. The Tribunal was chaired by barrister Camilla Owen and members Bob Dickinson, Lewis Metcalfe, Kevin Prime and Professor Jon Harding.

10 Special Tribunal Recommendation Report on Application for Water Conservation Order Te Waikoropupū Springs and associated water bodies, March 2020. No party seeks that the WCO be extended over the Anatoki or Waikoropupū River and we do not take this further.

11 Robert and Cherrie Chubb, Upper Tākaka Irrigators (a group of people operating three dairy farms).

12 Formerly known as Trustpower.

13 A number of parties engaged in pre-hearing Court-facilitated mediations, reaching settlements concerning how the WCO should address their interests. Those included Manawa (who maintained representation in the inquiry), NZ King Salmon and Fonterra (each of whom were excused but maintained watching briefs and engaged with the Court from time to time by memoranda).

modification (including any recommended WCO).[14] Our recommendation is for a WCO to be made on the modified terms in Annexure 1.

Structure of this Report

[10] This Report is in the following Parts:

(a) this **Part 1** comprises the Court's recommendations and related reasons including for the modified WCO in Annexure 1;

(b) **Part 2** comprises the Court's underpinning evidential findings and determinations on legal issues that arose in the course of the inquiry.

Some terminology used in this Report

[11] For ease of reference, acronyms we commonly use in this Report include:

(a) **NPSFM** to refer to the National Policy Statement for Freshwater Management 2020, the national policy statement of most relevance in our consideration of the WCO;

(b) **NO_3-N** to refer to nitrate-nitrogen, a contaminant of particular significance in the consideration of the WCO;

(c) **WAMARA** to refer to the Wharepapa Arthur Marble Aquifer recharge areas; and

(d) **WCO** to refer to a water conservation order including the order we recommend in Annexure 1.

Why is a WCO recommended over the subject and contributing waters?

[12] Our evidential findings as to why a WCO is recommended are in Part 2. In summary, we find that:

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14 Sections 210 – 213, RMA.

(a) the waters of Te Waikoropupū Springs are natural state waters, as Te Puna Waiora, in accordance with tikanga Māori;

(b) the Springs and Wharepapa Arthur Marble Aquifer have outstanding values;

(c) that natural state of the Springs and those outstanding values are at significant risk from human-induced pollution (particularly increasing levels of NO_3-N); and

(d) an effective and robust WCO is needed to preserve the Springs' natural state as far as possible and sustain and protect the outstanding values of the Springs and Wharepapa Arthur Marble Aquifer. The WCO needs to also extend to the contributing groundwaters and surface waters as are identified in the recommended WCO in Annexure 1.

Statutory framework and related principles[15]

Statutory considerations

[13] Under s212, RMA, we must (amongst other things):

(a) have particular regard to the purpose of a water conservation order and the other matters set out in s199; and

(b) have regard to various other matters. These include "the needs of primary and secondary industry, and of the community" and relevant provisions of specified RMA instruments (the most significant being the NPSFM). We must also have regard to such other matters as we think fit. On the evidence, we find that should extend to consideration of the precautionary principle.

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15 Further analysis of the matters we now discuss is in Part 2 (E).

The primacy of the WCO purpose

[14] Those s212 directions convey primacy to the s199 purpose over other considerations at least insofar as they may compromise that purpose. That primacy is also reflected in the expression of s199 as to the purpose of a WCO, especially in its commencing words "Notwithstanding anything to the contrary in Part 2".

[15] Part of the purpose of a WCO as described in s199(1) is to recognise and sustain the outstanding values of subject waters. Those are values that are either as afforded by waters in their natural state or that themselves warrant protection as outstanding. We interpret "sustain" in its ordinary sense (including "maintain").

[16] Primarily, a WCO fulfils its protective purposes through its specified restrictions or prohibitions on the exercise of regional council powers under s30(1)(e) and (f) (s200). As specified in s199(2), in the case of waters found in their natural state, those restrictions or prohibitions can serve to preserve that state as far as possible. In cases where waters are found not to be in their natural state, a WCO's restrictions or prohibitions can still serve to protect the recognised outstanding values of the subject waters. We understand that preserving natural state or protecting outstanding values can potentially call for the enhancement of the current state of the subject waters in particular circumstances.

How pt 2 is considered

[17] We interpret and apply pt 2, RMA through the lens of s199 and in the context of the consideration of the particular waters in issue and their identified values and characteristics. Subject to the primacy of the s199 purpose, we consider pt 2 provisions according to the guidance given by the Supreme Court in *Environmental Defence Society Inc v New Zealand King Salmon Co Ltd*.[16] Hence, in having regard to the NPSFM, we treat that instrument as fleshing out and giving context

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16 *Environmental Defence Society Inc v New Zealand King Salmon Co Ltd* [2014] NZSC 38.

to pt 2.[17]

How the NPSFM is considered

[18] In material terms, the NPSFM is aligned with s199 and that is a factor that leads us to give that instrument significant weight. Whereas plans are to not be inconsistent with a WCO, a regional plan must give effect to a NPS.[18]

[19] In substance, the NPSFM is a framework within which the subject waters will have to be managed. We were informed that TDC is well underway with work for the review of the operative Tasman Regional Policy Statement 2001 ('TRPS') and Tasman Resource Management Plan ('TRMP') intended to give effect to the NPSFM. The review is to produce a replacement/combined policy statement and plan to be called *Aorere ki uta Aorere ki tai – Tasman Environment Plan* ('TEP'). It is important, therefore, that we frame the WCO to be properly consistent, or at least not inconsistent, with the NPSFM.

[20] Consistent with NPSFM Obj 2.1, we have framed our recommended WCO to assist TDC to give first priority to the health and wellbeing of the Springs and their contributing water sources and ecosystems. The WCO recognises the interconnectedness of the whole environment within the WAMARA and is based on there being an integrated approach, ki uta ki tai, in accordance with NPSFM cl 3.5.

[21] We have also been guided by the interpretation of "baseline state" in NPSFM cl 1.4 in setting relevant limits in the WCO.

[22] More generally, we have sought to account for the NPSFM's directions as

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17 *Environmental Defence Society Inc v New Zealand King Salmon Co Ltd* at [90] and [151].

18 Other national level instruments of some relevance but little significance for the issues to be addressed include the National Policy Statement for Renewable Electricity Generation (already informing agreed exemptions for Cobb Hydro-Electric Power Scheme), the New Zealand Coastal Policy Statement 2010 and the Resource Management (National Environmental Standards for Freshwater) Regulations 2020.

to planning and monitoring in our design of related WCO provisions. We have borne in mind that the NPSFM is focussed on matters of national importance in freshwater management in New Zealand whereas the WCO gives targeted directions for the protection of the recognised outstanding values of Te Waikoropupū Springs and Wharepapa Arthur Marble Aquifer.

[23] We point out that the NPSFM significantly updated, and made more stringent, the 2017 version of that policy statement that was in effect at the time of the Tribunal's Report.

Our application of the precautionary principle

[24] Section 212 prescribes that the Court is to also have regard to "such other matters" as we think fit.

[25] Sections 199 and 200 allow for the application of the precautionary principle. In its ordinary meaning, "sustain" (as used in s199) includes "maintain". It can encompass due management of risk to protect the recognised values of waters from harm. Section 200 similarly provides that a WCO is "for any of the purposes set out in section 199". We read that to include what a WCO imposes by way of "restrictions or prohibitions on the exercise of regional councils' powers under paragraphs (e) and (f) of section 30(1) (as they relate to water)". Hence, it is open for us to apply the precautionary principle in the framing of a recommended WCO if we adjudge that to be required in the face of relevant scientific or other factual uncertainties.

[26] We apply the precautionary principle in the design of recommended WCO:

(a) limits for NO_3-N and flow allocation and related restrictions;
(b) overarching and related duties and discretions; and
(c) explicit provision for amendment of the WCO (cl 14).

Industry and other needs having particular regard to the WCO purpose

[27] Given the obligation to have regard to the needs of primary and secondary industry, and of the community, the Court actively enquired about these matters. We set out our evidential findings in Part 2.

[28] In our recommendations on the WCO, we have given primacy to the s199 purpose concerning the natural state of the subject waters and their outstanding values. Subject to that, however, we have had careful regard to farming and other industry and community needs. In particular, our evidential findings have informed how we have framed WCO restrictions and duties as they pertain to TDC's exercise of powers under s30(1)(e) and (f), RMA.

[29] An aspect of that is in allowing for due flexibility as to how TDC may implement or respond to those restrictions and duties. For instance, we have allowed for flexibility to enable TDC to formulate provisions on a basis that equitably and fairly considers individual farm circumstances. The restrictions and duties are framed in those terms to allow for sound water management and stewardship practices to be encouraged. The evidence revealed that some farmers are leaders in such practices. In addition, the needs of primary and secondary industry are reflected in the provision of the WCO that specify exemptions for, and scope limitations to exclude, a range of lawfully established or consented activities.

The Court's inquisitorial approach

[30] WCO proceedings are inquisitorial and designed ultimately to enable the Court to make a recommendatory report to the Minister. In particular, s213 prescribes that, on completion of its inquiry, the Court must:

> … make a report to the Minister recommending that the [Tribunal's] … report be rejected, or accepted with or without modifications, and, where appropriate, … include a draft water conservation order … or … recommend that the application

for a water conservation order be declined.

[31] That report then has the effect specified in s214 in regard to the making of a WCO (by Order in Council). In essence, the Minister cannot recommend on the making of a WCO except "in accordance with" the Court's s213 report.

[32] The WCO we recommend in Annexure 1 differs in material ways from the Special Tribunal's version and also from what particular parties put to us. Even where we have preferred a particular party's evidence on the science or tikanga, we have an overarching responsibility to ensure that the WCO we recommend is legally sound, effective and workable.

[33] However, the Court has sought to abide the principles of natural justice. That has encompassed recognition and application of tikanga in the conduct of the inquiry, including in karakia at the commencement and closing of each sitting day and on-site visits. As we discuss shortly, it has included providing various drafting iterations of the WCO to parties for submission.

Findings on the evidential and legal issues

[34] The expert and other evidence called by parties was voluminous.[19] Despite Court-directed and facilitated expert conferencing prior to the hearing, the pre-filed briefs and Joint Witness Statements ('JWS') revealed significant differences on several fundamental matters. For instance, largely contradictory opinions were offered on the likely sources and future loadings of NO_3-N, the contaminant of primary concern. There was also significant contention about the extent of harm being caused and risk posed for the ecology and outstanding values of the Springs. With a view to narrowing points of difference and ensuring we had a sound basis for making recommendations, we made directions for a number of rounds of Court-facilitated expert conferencing, including during the hearing. Our findings

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19 Refer to Part 1, Annexure 2 for a list of witnesses.

on these evidential issues are primarily in Part 2, as follows:

(a) Section A of Part 2 addresses the Tākaka River catchment;
(b) Section B addresses NO_3-N;
(c) Section C addresses cultural health and other matters of significance in accordance with tikanga Māori;
(d) Section C also addresses ecology;
(e) Section D addresses minimum flows and water allocation matters.

[35] Part 2 goes into significant detail in explaining the processes of evaluation that led to our evidential findings in support of the recommendations in this Report. That is with a view to this Report also serving TDC and the applicants and other parties in their response to the WCO. That is particularly in terms of assisting a better understanding of catchment dynamics so as to soundly underpin the planning response to the WCO.

Jurisdictional scope and other legal issues

[36] In regard to the settings for various WCO duties or restrictions considered during the inquiry, issues were raised as to the available jurisdictional scope and natural justice. Our determinations on these matters are primarily in Part 2 (E).

Engagement with parties in finalising our recommended WCO

[37] All parties were agreed that a WCO was needed to protect the Springs. Their differences were about how the WCO should be framed to those ends. From the outset, the Court encouraged parties to keep in mind the ultimate outcome of the inquiry was our recommendation to the Minister on the Tribunal's Report including our recommended WCO.

[38] In their original submissions to the Court, the applicants, SOS, FOGB and the TDC each sought significant changes to the Special Tribunal's recommended WCO. In particular, those parties sought prescriptive new restrictions pertaining

to how TDC was to approach monitoring and planning. TDC and the Farming Interests opposed those modifications both in jurisdictional and substantive terms. They pursued much more confined changes.

[39] Early in the inquiry, the Court provided parties with an "initial incomplete template draft" WCO. We directed parties to confer and update the Court on their preferences on how the recommended WCO should be framed.

[40] Once the evidence testing phase of the inquiry was concluded, the Court further engaged with parties about the substance of a modified WCO. That engagement was in several stages and ultimately informed what is now recommended in Annexure 1.

[41] A progress draft WCO was issued prior to an initial round of submissions heard in October 2022. Following that hearing, we issued a penultimate draft of this Report (including the penultimate draft WCO). That was for the purposes of final closing submissions and representations. Parties were heard on those on 17 and 18 April 2023.

[42] Final closing submissions on the penultimate draft WCO revealed that the inquiry has been a journey towards greater consensus between parties. While there were still some matters of significant difference, their ambit was significantly more confined than at the outset of the inquiry.

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Reasons for our recommended WCO

Overview and comparisons

The Tribunal's version

[43] The Special Tribunal's recommended WCO prescribed the Springs to be natural state waters with outstanding values and characteristics. It specified duties as to preservation and protection of the subject waters, but primarily relied on limit-based restrictions. These were for water quality and flow allocation (and also aquifer pressure). More unusually, the Tribunal recommended that these restrictions would also apply to an extensive area of contributing surface and groundwaters, notwithstanding that those waters do not themselves warrant recognition as having outstanding values. The Tribunal's version also prescribed scope limits and exemptions for existing lawfully established and some consented activities, reflecting s217.

Our recommended WCO

[44] Our recommended WCO in Annexure 1 qualifies how Te Waikoropupū is considered 'natural state' waters (namely as Te Puna Waiora in accordance with tikanga Māori). It modifies somewhat how the WCO prescribes the outstanding values of the subject waters. It specifies duties not only as to preservation and protection but also on several related matters. Its limit-based restrictions are for water quality and flow allocation but not aquifer pressure. Similar to the Special Tribunal's version, it extends those restrictions to contributing surface and groundwaters. However, it significantly modifies the design of those restrictions. It similarly specifies scope limitations and exemptions (although refining and expanding these where justified).

Heading and title and interpretation including as to cultural health monitoring

Cls 1 – 4

[45] Our addition to the title of "Te Puna Waiora o Te Waikoropupū Springs", at the request of the applicants, reflects our findings in Part 2.

[46] Clauses 3 and 4 are interpretation provisions, with cl 4 addressing the meaning and purpose of a cultural heath monitoring report. There are related duties and restrictions concerning cultural health monitoring in cls 6 and 8. In their final closing representations, FOGB sought that cl 4 be amended to the effect that there could be more than one cultural health monitoring report at any one time. We have not provided for that. As we explain in Part 2, it is important to maintain an approach of having only one report at one time for the purposes of the WCO, in the interests of clarity.

Te Waikoropupū Springs in their natural state as Te Puna Waiora in accordance with tikanga Māori

Cl 5(a)

[47] The Special Tribunal's recommended WCO prescribed the subject waters to be in their natural state.

[48] Clause 5 of our recommended WCO differs insofar as it prescribes that Te Waikoropupū Springs are outstanding water bodies in their natural state *as Te Puna Waiora in accordance with tikanga Māori*. We have also included in cl 3 related definitions of 'natural state' (as including that state in accordance with tikanga Māori) and tikanga Māori (as referring to that of Ngāti Tama ki Te Tauihu or other Manawhenua Iwi as the case may be).

[49] Our more qualified expression of 'natural state' reflects our findings and legal analysis in Part 2 (E). As we discuss, 'natural state' is not defined for RMA purposes and we find its ordinary meaning can encompass a tikanga Māori dimension. In evaluating whether the subject waters are natural state waters, we are not confined to western science: we also evaluate through a mātauranga Māori lens. The subject waters suffer from human-sourced contamination, notably NO_3-N. Nevertheless, the unchallenged evidence is that they are Te Puna Waiora in accordance with tikanga Māori. We accept that evidence. That concerns a relationship of wai and Manawhenua which is inter-generational and pertains to cultural health and wellbeing. It is measured in Manawhenua's enunciation that the waters are Te Puna Waiora. As such we find they are in their natural state in accordance with tikanga Māori.

[50] Fundamentally, the WCO seeks to sustain healthy relationships, especially as between TDC and Manawhenua and Manawhenua and the Springs. The duties are framed to identify important dimensions of those relationships, particularly in regard to upholding Manawhenua's rangatiratanga and the associated kaitiakitanga responsibilities in relation to the Springs, including as to cultural monitoring.

Te Waikoropupū Springs and Wharepapa Arthur Marble Aquifer have specified outstanding values and characteristics

Cl 5(b) and (c)

[51] Part 2 sets out why we find that Te Waikoropupū Springs and Wharepapa Arthur Marble Aquifer have the outstanding values we prescribe in cl 5(b). As we discuss in Part 2 (E), we have generally applied an evaluative benchmark of "out of the ordinary on a national basis" in adjudging them 'outstanding'. In essence, the evidence leaves us satisfied that, for relevant specified values, Te Waikoropupū Springs and Wharepapa Arthur Marble Aquifer are extraordinary at least nationally. We are not aware of any superior examples in New Zealand.

[52] As did the Special Tribunal, we find that the specified outstanding values

should include various specified ecological, natural science and biodiversity values. That includes the underground ecology of Wharepapa Arthur Marble Aquifer which may well contribute to the extraordinary clarity of the Springs. The Springs are listed as Waters of National Importance for biodiversity.

[53] The benchmark of 'out of the ordinary on a national basis' is not appropriate for specified tikanga Māori values. Rather, the measure of 'outstanding' for those values pertains to the relationship that the wai has with Manawhenua, in accordance with tikanga and mātauranga Māori. The evidence revealed that the Springs as Te Puna Waiora and Wharepapa Arthur Marble Aquifer are at the heart of that relationship. As such, their associated specified values are outstanding. That different measure for our judgment that the values are outstanding applies to aspects of each of cls 5(b)(i), (ii) and (viii) as to:

(a) values afforded by the waters in their natural state as Te Puna Waiora in accordance with tikanga Māori;
(b) significance in accordance with tikanga Māori, including in relation to history, kaitiakitanga, mahinga kai, wāhi tapu, wāhi whakahirahira, waiora and customary protection of flora and fauna; and
(c) spiritual values.

[54] Nor is the benchmark of 'out of the ordinary on a national basis' suitable for our evaluation of whether the Springs have outstanding spiritual values for people and communities more generally. We accept the evidence of Mr Moran and Ms Sanson on these matters.[20] They explained how they find the Springs to have a sacredness that is unique and spiritually renewing and hence outstanding. In essence, their experience was that the subject waters are extraordinary in those terms. Those are of course personal experiences. Nevertheless, our site visits enabled us to appreciate how the special qualities of the Springs include the way people experience them as spiritually rejuvenating and renewing. It is associated

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20 EIC, Moran dated 29 March 2022, EIC, Sanson, 29 March 2022.

with the vibrancy and purity of the waters in their peaceful setting. We adjudge that the Springs have outstanding spiritual values.

[55] In their final closing representations, FOGB suggested that cl 5(b)(v) of the penultimate draft WCO (as to indigenous wildlife) duplicated cl 5(b)(iv) (as to indigenous flora and fauna) and so could be deleted. We have taken up that suggestion.

Geographic extent of the contributing waters

Cl 5(d)

[56] Similar to the Special Tribunal, we recommend that the WCO's duties and restrictions extend to the defined 'Contributing Groundwaters' and 'Contributing Surface Waters'. Wharepapa Arthur Marble Aquifer is part of a vast and complex karst hydrogeological artesian system of contributing groundwaters. The Springs are also fed by the waters of the Tākaka River and Waingaro River and their tributaries. For the WCO to achieve its s199 purpose, its duties and restrictions need to encompass those contributing waters.

Duties – overarching matters

Cls 6, 7 and 8(f) – (i) and 9(e) and (f)

Introduction

[57] In this next part of our discussion of reasons for our recommended WCO we deal with the several duties we have prescribed. These are primarily in cls 6 – 8 (although there are also some duties in cl 9).

[58] The Special Tribunal's recommended that the WCO prescribe duties as to:

(a) preservation of subject waters in their natural state (cl 5); and

(b) protection of the contributing waters for their contribution to the subject waters' outstanding characteristics (cl 6).

[59] We specify primary duties on those matters with some clarifications and refinements (cl 6(a)). In addition:

(a) cl 6 prescribes various other duties as to the cultural importance of the Springs and the role of Manawhenua in their protection and as to monitoring;
(b) cl 7 prescribes a duty as to timely notification of planning proposals in response to the WCO;
(c) cl 8 as to water quality prescribes associated duties concerning investigation and further actions where NO_3-N concentration limits are exceeded (together with some associated discretions); and
(d) cl 9 as to flow allocation prescribes duties to ensure new takes of water that contribute flow to the Springs are controlled by a cease take regime and that there is a justified need for the take.

[60] Clause 6 also prescribes a duty as to recognition and encouragement of sound primary production practices in accordance with an ethic of stewardship. Unlike other duties, this is expressed to be subject to the primary duties as to preservation and protection in cl 6(a).

Jurisdiction

[61] Counsel for the Farming Interests submitted that it is not clear whether there is jurisdictional scope for including in a WCO duties as to monitoring and consultation with Manawhenua. Mr Matheson submitted that the appropriate statutory instrument for such purposes was the regional plan.

[62] For the reasons we give in Part 2 (E), we are satisfied that there is a sound jurisdictional basis for including in the WCO each of the relevant duties we recommend. Under s200, a WCO is for any of the purposes in s199. It can impose

"restrictions or prohibitions" on the exercise of a regional council's powers under s30(1)(e) and (f). As commonly understood, a duty is something a person has a moral or legal responsibility for. The duties we prescribe impose responsibilities on TDC pertaining to how it exercises its powers under s30(1)(e) and (f) and in that sense the duties are forms of restrictions.

[63] We bear in mind the importance of the different statutory purposes of WCOs and NPSs in relation to regional plans. Those are considerations that inform our framing of duties in regard to monitoring and planning matters, as we later discuss.

Principles

[64] Each of the respective duties we prescribe is on the basis of our findings in Part 2 concerning what is needed in order for the WCO to fulfil the purpose in s199 in regard to Te Waikoropupū and the WAMARA.

Relationships

[65] One necessary set of ingredients for the success of the WCO concerns relationships. That is both as between Manawhenua and this taonga and as between Manawhenua, as kaitiaki, and TDC in their exercise of powers under s30(1)(e) and (f), RMA. There are of course limits to the extent to which any statutory instrument can ensure healthy relationships. Inevitably, if the Springs are to be sustained as Te Puna Waiora and their outstanding values to remain protected, much will rely on good will and other endeavours beyond the parameters of a WCO. However, properly-framed duties concerning these relationships can assist as enduring points of reference and measures of accountability.

Scientific uncertainty and knowledge gaps and the precautionary principle

[66] As we explain in Part 2, the scientific and other evidence does not enable

us to soundly determine harm thresholds in regard to contaminants. Therefore, our focus must be on minimising the risk of unacceptable harm to the Springs and their natural state and outstanding values.

[67] Prescribing limit-based restrictions, while necessary, is not sufficient to minimise the risk of harm and hence fulfil the s199 purpose. That is the case for each set of restrictions in cls 8 and 9. In accordance with the precautionary principle, we have prescribed the various related duties as additional components for an effective management approach. The duties are intended to allow for sensible adaptive management, as knowledge improves, as well as being an ongoing point of reference for accountability purposes. The duties are most prescriptive in regard to NO_3-N given the significant risk that contaminant poses. As that set of duties emphasise, TDC's exercise of powers under s30(1)(e) and (f) must continue to be soundly informed by both western science and mātauranga Māori.

Encouragement of sound primary production practices according to an ethic of stewardship

[68] The farming sector in particular will face significant challenges in adapting practices so as to help preserve the natural state waters of the Springs as Te Puna Waiora and sustain and protect their outstanding values. An important ingredient of adaption is for TDC to encourage sound primary production practices in accordance with the ethic of stewardship. That should inform their design of planning controls, for example. Hence, we have specified an associated duty.

The WCO is a living instrument

[69] In all of those respects, whether or not the WCO fulfils its s199 purposes will rely on it being implemented in the context of a changing environment and evolving understandings. Hence, the duties serve to maintain the freshness of the WCO as a living statutory instrument.

Duties as to relationships

Cl 6

Evaluation

[70] A purpose of the WCO is to preserve the subject waters in their natural state as Te Puna Waiora in accordance with tikanga. For Manawhenua, the health of that state is considered in relationship or whakapapa terms. These are taonga for Manawhenua Iwi who are kaitiaki. As kaitiaki, Manawhenua Iwi have an inherent responsibility to protect and preserve the mauri of these taonga, Te Waikoropupū and the connected waters. The mauri in turn protects the resource to ensure its continued existence and support for the people. Through the lens of s199, we apply ss 6(e), 7(a) and 8 to our consideration of the evidence about that. Therefore, we recognise and provide for Manawhenua's relationship with the waters, have particular regard to their kaitiakitanga and take into account Treaty principles including those pertaining to the role the WCO can play in active protection.

[71] Kaitiakitanga is a matter that s7(a) RMA directs us to have particular regard to. If natural state in accordance with tikanga is to be preserved as far as possible, there needs to be a related ongoing recognition and facilitation by TDC of Manawhenua's kaitiakitanga. That is in exercising its powers under s30(1)(e) and (f) in relation to the subject waters and activities that may impact on them. An aspect of that concerns cultural health monitoring by Manawhenua. The importance of effective ongoing monitoring for protection of the Springs is overwhelming. The evidence of Manawhenua as to why that needs to include cultural health monitoring was unchallenged and we accept it.

[72] The Acknowledgement in the Schedule is expressed in terms largely as proposed by the applicants. The related duty in cl 6(b)(i) is also supported by TDC. That is similarly the case for the duty in cl 6(b)(iii) as to providing Ngāti Tama ki Te Tauihu and other Manawhenua Iwi with an opportunity to partner

with TDC in its exercise of s30(1)(e) and (f) powers to assist to achieve the overarching duty in cl 6(a).[21]

[73] On the evidence, particularly as to the relationship of Manawhenua with the subject waters, we find that a good faith partnership approach between TDC and Manawhenua will be central to successful protection of the Springs. It aligns with the relationship that prevails between DOC and Manawhenua for the reserve that largely encompasses the Springs. We find the language and intent of partnership, rather than mere consultation, duly accords with s199 and ss6(e), 7(a) and 8, RMA.

[74] These are necessary ingredients for protection of the Springs and hence fulfilment of the purposes of the WCO under s199. The health of the relationship between TDC and Manawhenua will in turn help uphold the important relationship between Manawhenua and the subject waters according to rangatiratanga and kaitiakitanga.

[75] As this set of duties is fundamentally about relationships, the duties are framed in terms that allows for due flexibility in how they are applied. They serve as a measure of accountability over time.

[76] Clause 6(b) requires TDC to have regard to the 'Acknowledgement' (in the Schedule to the WCO), recognise and where appropriate assist the exercise of rangatiratanga and kaitiakitanga by Manawhenua Iwi in accordance with tikanga Māori, and provide Ngāti Tama ki Te Tauihu and other Manawhenua Iwi with an opportunity to partner with it.

[77] Clause 6(c) also pertains to the recognition and enablement of Manawhenua's kaitiaki role. One aspect of that concerns cultural health

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21 Closing submissions for TDC dated 14 October 2022 and associated App A, referring to s47 of the of the Ngāti Kōata, Ngāti Rārua, Ngāti Tama ki Te Tauihu, and Te Ātiawa o Te Waka-a-Māui Claims Settlement Act 2014.

monitoring by Manawhenua Iwi. Clause 6(c)(i) imposes a related duty on TDC to have particular regard to any current cultural health monitoring report provided to it by Manawhenua Iwi in the preparation of any proposed plan or plan change affecting or pertaining to the subject waters or their contributing waters. That is in accordance with the duty in cl 3(1)(d), Sch 1 RMA to consult with affected tangata whenua.

[78] Enabling the effective exercise of kaitiakitanga encompasses ensuring Manawhenua Iwi are duly informed of relevant consent applications. Clause 6(c)(ii) requires TDC to duly consider the interests of Manawhenua Iwi when making decisions on the assignment of consent applications to public notification, limited notification or non-notification processing tracks.

[79] It was particularly encouraging to observe that initial differences on this set of duties as between the applicants and TDC were largely resolved by the close of the inquiry.

Why we have not referred to ki uta ki tai and Te Mana o te Wai

[80] We do not take up the applicants' suggestion that we include a principle for the WCO to be interpreted and applied to uphold principles of ki uta ki tai and Te Mana o te Wai. Those are matters directed by the NPSFM.

Duty as to the timely notification of plan proposals in response to the WCO

Cl 7

Introduction

[81] In their s209 submission, the applicants sought that the WCO be significantly modified to ensure TDC acted with due priority in making necessary changes to its RPS and regional plan in response to the WCO. TDC and the Farming Interests submitted that what the applicants sought was overly

prescriptive, beyond jurisdiction and would impose an undue cost burden on ratepayers.

[82] As part of our reframing of the WCO's approach to both limit-based restrictions and duties, we included in the penultimate draft WCO a duty as to the timely notification of plan proposals. We gave our reasons for it in the associated draft of this Report provided to parties for the purposes of final closing submissions. This new duty was substantially unopposed in those submissions.

Evaluation

[83] We refer to our evidential findings and analysis of legal principles in Part 2 (E). While we find that the WCO should give direction on these matters we have deliberately framed the duty to avoid undue prescription. This is in recognition of the statutory purpose of a WCO with regard to a local authority's exercise of its regional planning functions.

[84] Hence we prescribe a "best endeavours" duty to notify a proposed policy statement and regional plan to assist to achieve the purposes of the WCO by 31 December 2024. That date was proposed to achieve effective alignment with what TDC intends in regard to its giving effect to the NPSFM. The duty is intended to be aligned with the specifications in s62(3) and s67(4) that a regional policy statement and regional plan must not be inconsistent with a WCO.

[85] At the suggestion of some parties in their final closing submissions, we have clarified that the duty applies only to a policy statement or plan that affects land and freshwater in the WAMARA or the Waingaro catchment.

General duty as to monitoring

Cl 6(d)

The Special Tribunal's approach

[86] The Special Tribunal recognised the importance of monitoring for the protection of the Springs. However, their Report reflects an understanding that there is only limited jurisdictional scope to incorporate monitoring restrictions in a WCO.[22]

The initial positions of the parties

[87] In their submission and evidence, the applicants sought that the WCO include a comprehensive monitoring framework. This would have encompassed an extensive list of water quality attributes including those not the subject of prescribed limits. Those included ammoniacal nitrogen, un-ionised ammonia nitrate, dissolved (soluble) inorganic nitrogen, dissolved organic carbon, Escherichia-coli ('E-coli'), pH, temperature, electrical conductivity, biomass abundance and heavy rainfall events. They also sought the addition of te hauora o te wai (cultural health) monitoring as well as requirements for TDC to agree with Manawhenua about suitable monitoring locations within the Wharepapa Arthur Marble Aquifer and the TUGA.[23] SOS, FOGB and the DG adopted similar positions.

[88] For TDC, Mr Thomsen submitted that any requirements that necessitated TDC funding would offend the Local Government Act 2002 ('LGA 02') (as this would not go through its required funding processes).[24] Counsel maintained that regional plans are a more effective instrument for the setting of monitoring

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22 Report of the Special Tribunal, dated March 2020, at [304].

23 Section 209 submission for the joint applicants, dated 1 May 2020.

24 Closing submissions for TDC, dated 14 October 2022, at [44].

requirements in that they can apply "an adaptive management approach through the use of monitoring and triggers".[25] On the other hand, he observed that "it is relatively rare for monitoring programs [*sic*] to even be found in plans".[26] Rather than prescribing monitoring requirements, Mr Thomsen invited the Court to record its relevant findings in its associated report only.[27] For the Farming Interests, Mr Matheson emphasised the importance of ensuring water quality monitoring is both "scientifically targeted" and "cost effective".

The Court's approach in the penultimate draft WCO

[89] As part of our reframing of the WCO's approach to both limit-based restrictions and duties, we proposed to parties a significant revision of what they had sought. The penultimate draft WCO provided for cultural health monitoring through the various provisions we discuss under the heading 'Duties as to relationships'. We prescribed in cl 8 a number of specifications on how various water quality attributes are to be calculated or measured for the purposes of related water quality restrictions. In regard to NO_3-N, we included associated duties as to follow up investigations and actions in certain circumstances (as we discuss shortly).

[90] However, we did not prescribe a detailed set of monitoring requirements and methods for various water quality attributes, for the reasons stated in our draft Report (and now in Part 2 to this Report). Instead, we prescribed a general monitoring duty in cl 6.

Submissions on the penultimate draft WCO

[91] In their final closing submissions, the applicants urged the Court to reconsider whether to prescribe detailed monitoring specifications for the range of

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25 Opening submissions for the Farming Interests, dated 18 May 2022.
26 Closing submissions for TDC, dated 14 October 2022, at [43].
27 Closing submissions for TDC, dated 14 October 2022, at [50]-[55].

water quality attributes they had initially pursued. They pointed out that data on those attributes could be readily gathered. As for E-coli, FOGB submitted that this should not be impeded by the Court's finding that waterfowl sources of this contaminant would make monitoring problematic. FOGB also sought that we revisit the decision to not specify prescriptive groundwater monitoring. They asked that the WCO prescribe that TDC use Crown entity GNS for monitoring.

[92] As for the proposed general monitoring duty, the applicants sought that this also require TDC to make such information publicly available within reasonable timeframe.

[93] In their final closing submissions, other parties generally did not oppose these aspects of the penultimate draft WCO. Counsel assured the Court that TDC would make monitoring information publicly available, whether or not the Court prescribed it.

Evaluation

[94] We do not agree that having a monitoring duty in the WCO would offend the LGA 02. The position is no different from where a regional plan must be amended to accord with other higher order regulatory instruments such as NPS or National Environmental Standards. The funding of what may be required in those terms is a separate matter for TDC to address in accordance with its legal obligations, including as may be specified in the LGA 02.

[95] As for how duties are framed, we bear in mind the different purposes of NPSs and WCOs under the RMA. As we further discuss in Part 2 (E), plans must "give effect" to NPS and be "not inconsistent with" a WCO. Those different statutory directives reflect an intention that, in a relative sense, a WCO is intended to allow greater scope for the exercise of discretion in how a plan is framed in response to it. Along the same lines, whilst s45A(2) RMA expressly provides that a NPS can include monitoring direction, there is no equivalent provision for a WCO to do so.

[96] We also recognise the importance of framing any duty in a way that is compatible with the NPSFM. The NPSFM cl 3.18 gives the following direction on monitoring:

> **3.18 Monitoring**
>
> (1) Every regional council must establish methods for monitoring progress towards achieving target attributes states and environmental outcomes.
>
> (2) The methods must include measures of:
>
> (a) mātauranga Māori; and
>
> (b) the health of indigenous flora and fauna.
>
> (3) Monitoring methods must recognise the importance of long-term trends, and the relationship between results and their contribution to evaluating progress towards achieving long-term visions and environmental outcomes for FMUs and parts of FMUs.

[97] In particular, we note the requirement in cl 3.18(3) for methods to evaluate "progress towards achieving long-term visions and environmental outcomes for FMUs and parts of FMUs" (i.e. freshwater management units). Under the NPSFM, the identification of FMUs and related monitoring methods is to be according to the directions of the NPSFM. To maintain compatibility with NPSFM cl 3.18(3), we consider that any monitoring duty in the WCO needs to be framed in flexible terms.

[98] We acknowledge that it may well be practicable to gather data on a range of other water quality attributes at the same time as the monitoring required to be undertaken for NO_3-N under cl 8 is undertaken. However, the evidence does not provide sufficient understanding of the various other attributes[28] to enable us to set meaningful monitoring directions in place. That is not to say efforts should not be made to gather helpful information on these things. That can only serve to improve the quality of planning approaches taken. However, we do not have a

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28 Ammoniacal nitrogen, un-ionised ammonia nitrate, dissolved (soluble) inorganic nitrogen, dissolved organic carbon, E-coli, pH, temperature, electrical conductivity or biomass abundance and heavy rainfall events.

sound basis, at this time, to prescribe related monitoring requirements.

[99] As for E-coli, we acknowledge that there is significant cultural sensitivity associated with any leaching or discharge of that contaminant into waters, particularly the subject waters. However, a confounding factor not resolved in the evidence is that this contaminant can be from a variety of sources, including waterfowl that visit and at times inhabit Te Waikoropupū Springs. On the evidence, we could not determine meaningful related limits or cost-effective monitoring requirements.

[100] Our findings on why it would not be appropriate to include prescriptive duties as to groundwater monitoring are in Part 2 (E). We are not persuaded by FOGB's final closing submissions that we revisit those findings. Nor would it be appropriate to prescribe that TDC use any particular laboratory for monitoring purposes.

[101] Therefore, we include in cl 6(d) a simply expressed general duty that TDC undertake regular monitoring for the purposes of the WCO's restrictions as to water quality and flow allocation (as specified in cls 8 and 9). That applies alongside the duties to have particular regard any cultural monitoring report prepared by Manawhenua and to duly consider Manawhenua's interests in regard to choices as to notification or non-notification of consent applications.

[102] We have specified in cl 6(d) that TDC must make monitoring information publicly available within reasonable timeframes, as the applicants requested in their final closing submissions. We accept TDC's assurances that it intends doing so in any case. However, the value of making this explicit is as a reminder to anyone who may come to be involved in the implementation of the WCO over coming years. That is particularly given the importance of an enduring relationship between TDC and Manawhenua, as we have discussed.

Ancillary matters as to approach and funding

[103] Under the heading 'Ancillary matters' later in this Report, at the request of TDC, we make associated recommendations on how it should approach monitoring so as to overcome the serious inadequacies of its approach to date. We also bring to the Minister's attention important funding considerations. These are addressed in statements on behalf of TDC and the applicants that are provided with this Report.

Duties and discretions as to investigation and follow up as to NO_3-N

Cls 8(e) – (g)

Introduction

[104] This set of duties supplements the limit-based restrictions in cl 8(a) as to NO_3-N the general effect of which is to avoid any increase in concentrations in this contaminant in the Springs and achieve a stepped reduction in them to at or below 0.41 mg/l from 1 January 2038. In the penultimate draft WCO put to parties for final closing submissions, the equivalent duties were specified in cls 6 and 8 but we have now rationalised this, bringing them within cl 8 as the relevant clause for the related water quality restrictions.

[105] The inclusion of these duties in the penultimate draft WCO in association with the related limit-based restrictions in cl 8 was part of a reframing of the Tribunal's WCO in light of the evidence and cases presented. We provided our related reasons to parties in the draft of this Report provided to them for the purposes of final closing submissions. We refer to our discussion of submissions in relation to timely notification of plan proposals and monitoring. In what they require and the fact that they pertain only to NO_3-N, this set of duties is significantly more targeted than the applicants and supporting parties had preferred. On the other hand, they restrict TDC's exercise of discretion in response to the WCO significantly more than TDC and the Farming Interests had

preferred.

Evaluation

[106] There are two sets of relevant duties in regard to NO_3-N, the first with a related discretion.[29] As is explained in Part 2 of this Report, NO_3-N poses the most significant risk to the health of the Springs and their natural state and outstanding values. In view of that, and applying the precautionary principle, we find that associated duties should be prescribed to supplement the related limit-based restrictions.

The duty in cl 8(e)

[107] Clause 8(e) imposes on TDC a duty to ensure that the relevant regional plan assists to implement the water quality restrictions in cl 8(a) to (c). It further requires TDC to ensure that from 1 January 2038, the measured concentrations of NO_3-N in the Main Spring and Fish Creek Springs do not exceed 0.41 mg/l or such lower limit as may be specified in the regional plan.

[108] In effect limit-based restrictions are intended primarily to inform changes to relevant regional plans. That is because a regional plan must not be inconsistent with a WCO and the restrictions pertain to the relevant regional council's exercise of planning and consenting powers (under s30(1)(e) and (f)). The relatively greater prescription in relation to NO_3-N reflects the seriousness of the risk this contaminant presents for the subject waters and their outstanding values and the complex and poorly understood sources of that risk within the catchment. That demands a strategic response, not an ad hoc consent by consent one. As such, the duty specifies that TDC must ensure the relevant plan implements the restrictions.

[109] The second aspect of the duty reinforces the intention that TDC proactively

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29 Clauses 8(a)-(g) are to be read in conjunction with cls 8(h)-(i). Those latter subclauses pertain to when relevant concentrations are deemed exceeded and associated restrictions and duties breached and prescribe methods to be applied in measurement and calculation.

use its available powers, both in planning and consenting terms, to bring NO_3-N down such that, by 1 January 2038, measured concentrations in the Springs do not exceed 0.41 mg/l (or such lower limit as may be specified in the regional plan). Importantly, 0.41 mg/l is not prescribed to imply a safety threshold against harm. As we explain in Part 2, the evidence does not allow for such a finding. Rather, it is the limit we can safely determine as appropriate on the evidence available. As the overarching duty in cl 6(a) intends, this does not remove from TDC its responsibility to continue sound investigation of these matters and regulate accordingly.

The related discretion in cl 8(f)

[110] In addition, cl 8(f) specifies that TDC has discretion to include in the regional plan provisions that prescribe more stringent NO_3-N limits and/or allow for stepped or incremental reductions in that contaminant. That is so as to achieve the specified reduction in concentrations of that contaminant in the Springs by 1 January 2038. Importantly, that discretion is governed by the purpose of the WCO including the overarching duty in s6(a) as to the protection of the Springs.

The duty in cl 8(g)

[111] Clause 8(g) prescribes a duty that applies if it is triggered by specified NO_3-N concentration exceedances in the Springs. The duty is to duly investigate the causes and take associated actions as may be practicably available to rectify them. At any time prior to 1 January 2038, the trigger is concentrations exceeding 0.44 mg/l. Thereafter that trigger is 0.41 mg/l. In each case, that is subject to any more stringent trigger as may be specified under a regional plan.

Accounting for natural fluctuations in contaminant concentrations

[112] It can be expected that there will also be natural fluctuations in the concentrations of a contaminant such as NO_3-N over time. One rise or fall may not itself be significant. A certain number of exceedances, however, can be a cause

for concern as to trends. Limit-based restrictions and duties need to be calibrated to account for those fluctuations. Despite our inquiries, the experts were not able to agree on a precise number of exceedances as being appropriate as a trigger for this duty. We adjudge that this number should be seven as it shows more unders than overs for any given 12 month period, and hence on average an indicator of sufficient concern to act. This is as provided for in cl 8(h) as to when exceedance is deemed to have occurred. That provision, together with cl 8(i) on measurement and calculation methodologies, also applies to all limit-based restrictions (including for other attributes) and related duties.

Duties in cl 9 as to water allocation restrictions

[113] As these duties are on confined matters and closely pertain to related water allocation restrictions, we deal with them in that context in our discussion of cl 9.

Duty as to sound primary production practices and the ethic of stewardship

Introduction

[114] We explain in Part 2 why we consider it important to encourage sound primary production practices and stewardship. That must of course be subject to achieving the protective purposes of a WCO in s199.

Submissions in response to the penultimate draft WCO

[115] No party ultimately opposed the inclusion of a related duty in the WCO. In his written representations, Mr Penny expressed concerns about farming practices but he did not attend the hearing during which evidence on such matters was tested. Nor did he make any representations about the specific WCO provisions put to parties for their consideration, including this proposed duty. While we understand that he would prefer a fundamentally different approach to be taken, we refer to our findings in Part 2 as supporting the Court's recommended approach.

[116] In their final closing representations, FOGB recommended that the WCO include an associated definition of "stewardship". It also invited the Court to consider rephrasing the duty as:[30]

> Subject to achieving subclause (a), any exercise of powers under section 30(1)(e) and (f) of the Act must recognise and encourage sound production and planning practices that lead to long-term sustainability and protection of the natural environment within the WAMARA.

Evaluation

[117] We are satisfied that this duty, as it was framed in the penultimate draft WCO, reflects our evidential findings in Part 2. That is including in the fact that, by contrast to other duties, it is expressed to be subject to achieving the overarching protection duty in cl 6(a). That reflects the primacy of the s199 purpose for a WCO. In particular, the consideration of pt 2 is through the lens of s199, including as to the "ethic of stewardship" in s7(aa) RMA.

[118] Subject to that rider, sound primary production practices in accordance with the ethic of stewardship are plainly important and to be encouraged including in how planning regulations are set in response to the WCO. The evidence of Mr Sowman is a demonstration of those practices. We are in no doubt that the restrictions we recommend for both water quality and flow allocation purposes will be highly challenging for farmers. The specified duty is intended to help inform TDC's discretionary judgements in how they frame planning restrictions on a basis that is both equitable and rewarding of sound existing and future farming practices.

[119] We do not include a related definition of 'stewardship' as it is a well-understood concept already included without definition in the RMA. Similarly, we do not adopt FOGB's suggested rephrasing of the duty as those matters are better

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30 For FOGB, at [49]-[51].

expressed in the primary duty in cl 6(a).

The scope of the Court's recommended limit-based restrictions

[120] Similar to the Special Tribunal's approach, our recommended limit-based restrictions are on the grant of consent for or permitting of relevant activities that would offend prescribed limits. In addition to water quality and flow allocation matters, the Special Tribunal's recommended limit-based restrictions in relation to alterations in "aquifer pressure". No party sought that we maintain such restrictions for aquifer pressure alterations and we did not find any sound evidential basis for doing so.[31] Therefore, we recommend limit-based restrictions as to water quality and flow allocation only, as specified in cls 8 and 9 as we now discuss.

Water quality restrictions: cl 8

Terminology

[121] In addition to NO_3-N, other acronyms we use for this topic include DRP to refer to dissolved reactive phosphorus and DO to refer to dissolved oxygen.

Revised structure

[122] Before we discuss the various water quality restrictions, we note that have restructured cl 8 from the version in the penultimate draft WCO. In particular:

(a) the various limit-based restrictions have been separated into subclauses: cl 8(a) for NO_3-N, cl 8(b) for DRP and cl 8(c) for DO and water clarity;

(b) cl 8(d) specifies a duty concerning what TDC must satisfy itself of before adjudging that relevant resource consent applications are

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31 Joint memorandum of counsel, dated 5 May 2022.

complete for processing purposes;

(c) cl 8(e) – (g) prescribe related duties and discretions as we have discussed;

(d) cl 8(h) and (i) prescribes when the specified concentrations and limits are deemed exceeded for the purposes of the limit-based restrictions for NO_3-N and DRP. Clause 8(i) specifies requirements as to measurements and calculations for those attributes as well as DO and water quality. These matters were formally addressed in a single subclause.

Limit-based restrictions for NO_3-N

Cl 8

Introduction

[123] As we explain in Part 2, NO_3-N is the contaminant of greatest threat to the ecological and cultural health of the subject waters and their outstanding values, as well as to the quality of their contributing waters. We further explain in Part 2 that the evidence does not enable us to determine with any certainty a safe threshold against harm in regard to this contaminant.

[124] For the relevant restrictions, the Special Tribunal prescribed a uniform limit for NO_3-N of 0.44 mg/l.

Engagement with parties in the development of a staged limits approach

[125] After the testing of the evidence, we reported to parties that we found the Special Tribunal's recommended limit would not be fit for the s199 purpose. In our 23 September 2022 Minute, issued prior to hearing a first round of closing submissions in October 2022, we signalled our preliminary view that a NO_3-N limit of 0.40 mg/l would be needed. That was significantly lower than any party had proposed.

[126] Farming Interests and TDC urged that we maintain the Tribunal's 0.44 mg/l recommended limit and its related restrictions. They submitted that there was no jurisdictional scope to recommend such a significant change from that recommendation and that it would be contrary to natural justice principles. They further submitted that 0.44 mg/l represented the "current" water quality state for NO_3-N and that the WCO could not require enhancement of that state. Moreover, they submitted that as the case for the WCO was made notwithstanding that current state, it would uphold the s199 purposes to maintain the limit for the purposes of specified water quality restrictions.[32] Our findings and determinations on those submissions are in Part 2 of this Report.

[127] Following that engagement with parties, we proposed a revised staged limit-based approach in the penultimate draft WCO for final closing submissions. This was designed to achieve stepped or incremental reductions in NO_3-N concentrations in the Springs to a revised limit of 0.41.mg/l by 30 June 2035. This was to be measured and calculated as a "five-year rolling median concentration". This staged approach focussed on contaminant discharge activities (not then also extending to relevant water use activities).

[128] Under that staged approach, Stage 1 was from the commencement of the Order through to what we then specified as 30 June 2035. In this initial stage, the emphasis in the limit was to avoid any increase on current state, being the state we determined on the evidence before the Court as we report in Part 2, and to stabilise and commence the process of NO_3-N reduction. On that basis it prohibited any point or diffuse discharges of contaminants until:

> … the five year rolling median concentration of NO_3-N in the Main Spring and Fish Creek Springs, as measured and calculated in accordance with subclause (d), has remained at not more than 0.41 mg/l for a continuous period of not less than five

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32 TDC closing submissions, dated 14 October 2022, at [96]-[100], SOS closing submissions, dated 13 October 2022, at [3.10]-[3.20].

years;.

[129] In Stage 2, the prohibition applied unless the concentration of NO_3-N in the Main Spring and Fish Creek Springs was less than 0.41 mg/l.

Final closing submissions on the two-stage limit

[130] By contrast to the issues raised with the Court's initially-signalled 0.40 mg/l regime, final closing submissions on the two-stage limit approach raised only relatively confined issues.[33] Rather than significant points of contention, these were primarily about drafting anomalies. There were some general drafting points concerning cl 8 on which parties largely agreed. As we discuss shortly, one was as to the need to also apply the limit-based restrictions to relevant uses of water (i.e. not just discharge activities). Another was as to some unintended overreach (as we discuss below).

[131] A further point of general consensus was as to the need to have Stage 2 specified as commencing on a later date in view of the fact that measurements and calculations are to be on the basis of a five-year rolling median concentration. That point also pertains to other water quality attributes for which cl 8 prescribes limit-based restrictions. However, as counsel for the Farming Interests helpfully pointed out, the effect of the five-year rolling limit approach would have been that the Stage 2 limit of 0.41 mg/l for NO_3-N would need to have been achieved by mid-2032 (i.e. 2.5 years ahead) and "then all subsequent values would need to be below 0.41mg/l".[34] Other parties did not dispute his related submission that such an outcome would not have reflected the findings in Part 2, specifically concerning the timeframe anticipated to be needed to allow farmers to reduce nitrate loads, especially given the lag effects.

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33 In making that observation, the Court acknowledges that directions made for the purposes of final closing submissions did not allow parties to revisit the Court's substantive findings and determinations as are set out in Part 2.

34 Farming Interests response to points arising, dated 18 April 2023, at p 3.

[132] On behalf of FOGB, Mr Mather urged the Court to be cautious about making concessions that may delay necessary changes to protect the Springs. However, no other parties opposed the amendment that Mr Matheson proposed to remedy the issue, namely to have Stage 2 specified to commence from 1 January 2038 (i.e. adding 2.5 years). The applicants and SOS were generally supportive of that change.[35]

Evaluation

[133] Part 2 of this Report sets out why we find that the Special Tribunal's 0.44 mg/l limit is unsuitable for achieving the s199 purpose of a WCO.

[134] Unlike the procedures available to the Special Tribunal, the Court has had the advantage of rigorous cross-examination and other means to deliver up the best available evidence. Even so, we have found the task of deriving suitable NO_3-N limits a highly challenging forensic exercise. The length of Part 2 reflects that. It is far from ideal that such a range of 'first principles' catchment management matters have needed to be developed through two rounds of contested inquiries. It is plainly preferable that such matters are already within the knowledge of the relevant statutory authority responsible for catchment management, in this case TDC. We acknowledge, however, the real resourcing and funding challenges that are presented to TDC and refer to Part B for our discussion of these matters.

[135] As we explain in Part 2, despite the volume and complexity of the evidence before us, we were not in a position to determine with any confidence what a safe threshold for NO_3-N would be. Therefore, we could not soundly prescribe a NO_3-N limit that would itself protect against ecological harm and associated degradation or loss of the recognised outstanding values of the Springs. In that context, we have approached our consideration of limits and duties in accordance with the precautionary principle.

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35 Transcript 18 April 2023, at p 30.

[136] In Part 2 (E), we set out why we do not accept that there are either jurisdictional scope or natural justice barriers to departing from the Special Tribunal's 0.44 mg/l limit regime. In Part 2, we explain why we find it appropriate to adjust our originally-signalled 0.40 mg/l to a staged approach with the Stage 2 limit being instead 0.41 mg/l. As we explain in Part 2, we find that the specification of any higher limit would place the undisputed outstanding values of Te Waikoropupū at an unacceptable level of risk. That is especially given the major uncertainties as to when a water quality and ecology tipping point might be reached, the high variability in NO_3-N concentrations known to occur in the Springs and the potential for increased variability as a result of climate change.

[137] In view of the five-year rolling median concentration approach to measurements and calculations, as is prescribed in cl 8, we have adjusted our initial drafting such that Stage 2 instead commences on 1 January 2038. As we discuss below, we make other drafting refinements to cl 8 in response to final closing submissions, including to both encompass relevant water use activities and fix some overreach issues in the clause.

[138] As part of that package of modifications to the Special Tribunal's recommended WCO, we are satisfied that the s199 purpose will be assisted by including in the WCO a staged approach to reduction of NO_3-N concentrations in the Springs, in summary to the following effect:

(a) from the commencement of the WCO to 31 December 2037, no increase in NO_3-N until the five year rolling median concentration in the Springs has remained at not more than 0.41 mg/l for a continuous period of not less than five years;

(b) from 1 January 2038, no exceedance of 0.41 mg/l. in the five year rolling median concentration of NO_3-N (or of any lower limit as may be specified in the regional plan).

Limit-based restrictions for other water quality attributes and related matters

Cl 8

Introduction

[139] Remaining aspects of cl 8, as included in the penultimate draft WCO, were relatively uncontentious in final closing submissions.

[140] In addition to NO_3-N, cl 8 prescribes limit-based restrictions for:

(a) DRP (in excess of 0.005 mg/l);
(b) DO (any reduction below 45%); and
(c) water quality (below a median value of 72 metres or a fifth percentile value of 68 metres).

[141] Those specified limits substantially accord with the recommendations of relevant experts (as included in their JWS following expert conferencing). None was significantly opposed, and no other approach was proposed by any party in final closing submissions. We did not maintain the Special Tribunal's limit-based restriction for ammoniacal nitrogen as no party sought that and we found no evidential basis for doing so.

Extension of limit-based restrictions to land uses

[142] In the penultimate draft WCO provided to parties for final closing submissions, cl 8 applied only to discharge activities. The consensus position of parties in their closing submissions was that was an oversight. As our findings in Part 2 set out, the evidence plainly reveals the consequences that water uses such as irrigation can have for the quality of waters of the Springs. Upholding ki uta ki tai to ensure integrated management of the catchment (a central NPSFM principle) encompasses an holistic consideration of water quality, water quality indicators and

the related aspects of water abstraction. Therefore, we have clarified this aspect of cl 8.

Measurements and calculations for the purposes of limits

[143] Where a WCO relies on limit-based restrictions in regard to water quality attributes, it is important that it is clear as to when limits are breached and how related measurements and calculations are undertaken. In particular, such limits very much rely on sound methodologies being applied at the Springs, as monitoring is undertaken.

[144] One change we initially made to the Special Tribunal's approach was to bring all matters into cl 8. The Tribunal also relied on scheduling but we found that to lead to some interpretive difficulties. As we have explained, in the recommended WCO in Annexure 1 we further refined this approach so as to have separate subclauses dedicated to when exceedance is deemed to have occurred for NO_3-N and DRP and to requirements as to measurements and calculations. The penultimate draft WCO had all such matters addressed in a single subclause. Aspects of that subclause were also replicated in those subclauses specifying the limit-based restrictions. We have sought to overcome those further potential sources of interpretive difficulty in the version of cl 8 we now recommend.

[145] There were some confined matters raised concerning measurements and calculations in final closing submissions:

(a) parties were agreed that, for NO_3-N and DRP, calculations of the five year rolling median should be on the basis of the latest 60 monthly samples. We have adopted that sensible suggestion;

(b) TDC sought that various references in the measurement and calculation provisions to "any 12-month period" be changed to refer to a hydrological year (i.e. 1 July – 30 June). By a change to cl 3 (on interpretation) we have allowed for this. We have not mandated it though, as we did not receive any evidential justification to do that.

Rather, this was a matter raised by counsel, on instruction, in his final closing submissions; and

(c) TDC sought an exemption to the measurement regime for NO_3-N and DRP to account for the fact that Fish Creek Springs regularly run dry. However, in response, counsel for the applicants conveyed the explanation she had received from experts that there are established protocols for such eventualities (e.g. simply recording on any particular occasion where it occurs that no result could be observed). We accept that to be the case and have left the relevant provisions substantially unchanged in this respect.

Remediating unintended overreach

[146] Parties also agreed that there was unhelpful overreach in the penultimate draft of cl 8. In particular, relevant provisions imposed restrictions on or "any point source or diffuse discharge … of any contaminant into water (and onto land in circumstances in which it may enter water)". That was unqualified and hence would have caught such activities even if they had no relationship to the Springs.

[147] Parties differed to some extent on how best to remedy this overreach. The Farming Interests and TDC preferred that qualifying words be added that would essentially mean that the relevant limit-based restrictions would only apply if the relevant discharge or water use would "be likely to cause or contribute to a net increase in NO_3-N concentration" (or similar). The applicants and SOS opposed the "net effect" qualifier as overly permissive and exposing the Springs to undue risk.

[148] Given our findings in Part 2, we consider that to confine the applicable limits to activities that may cause or contribute to a "net increase" in contaminant concentrations would not be appropriate. Firstly, it would somewhat impede the role of the relevant restrictions in achieving material reductions in those concentrations. That is particularly important for NO_3-N as Part 2 explains.

Furthermore, we find the applicants' approach better accords with the tikanga, and in particular that of Ngāti Tama in their exercise of kaitiakitanga. Therefore, we have addressed the overreach issue in relevant subclauses by the addition of the words "would be likely to cause or contribute to".

Information to be included in consent applications

[149] The penultimate draft WCO provided to parties for final closing submissions included the following provision in cl 8 on water quality restrictions:

> (e) An application for consent to authorise any point source or diffuse discharge of any contaminant into water (or onto land in circumstances in which it may enter water) in the Wharepapa Arthur Marble Aquifer Recharge Area is incomplete for the purposes of section 88 of the Act unless it includes information to the reasonable satisfaction of the Council as to:
>
> (i) any relevant matters as may pertain to subclauses (a) to (c); and
>
> (ii) the cultural health or hauora of Te Waikoropupū Springs as identified in any cultural health monitoring report or in consultation with Manawhenua Iwi.

[150] Mr Matheson observed that he was not aware that this matter was raised during the hearing. However, he did not signal that it was of substantive concern to the Farming Interests. As for the drafting of the subclause, he submitted that there would not appear to be jurisdiction for a WCO to effectively fetter the discretion of a consent authority under s88(3), RMA. He suggested this difficulty could be overcome by the clause being framed to simply direct what information must be included in any application. That would then leave s88(3) RMA to be applied without the WCO purporting to direct the outcome of that process.[36] He proposed in essence that the words "is incomplete for the purposes of section 88

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[36] Final closing submissions for the Farming Interests, dated 11 April 2023, at [27]-[30].

of the Act unless it includes" be replaced with "must contain".

Evaluation

[151] While the inclusion of this provision in the penultimate draft WCO was not previously signalled, we are satisfied this does not give rise to any natural justice or scope difficulty provided it is properly framed. One value that we identify in it is in helping to bring focus to the purposes of the WCO in the consideration of consent applications. Another is in helping to reinforce the importance of cultural health monitoring and related engagement with Manawhenua. In both respects, therefore it was designed to assist to achieve the s199 purposes of the WCO.

[152] We accept that a provision that purports to modify the application of s88 RMA (as to information specifications for a consent application) would be ultra vires. Whilst we appreciate the suggestion offered by counsel for remediating this aspect, we are concerned that it could also be ultra vires insofar as it may be read to invalidate a consent application that did not meet its specifications.

[153] We come back to first principles and, in particular, s200, RMA. As we have noted, that provides that a WCO serves to impose restrictions and prohibitions on the exercise of TDC's powers under s30(1)(e) and (f). On reflection, we find that the better approach would be to frame this provision as a form of restriction on the discretion that TDC may exercise in its consideration of the completeness or otherwise of consent applications.

[154] The relevant discretion is in s88(3). It prescribes circumstances where a consent authority may determine that an application is incomplete, including where the application is adjudged to not include a proper assessment of effects on the environment ('AEE') as per the requirements of Sch 4. Rather than using mandatory language, we consider the better approach is one that allows for the exercise by TDC of properly-informed discretion. That accords with s88(3). Furthermore, we can proceed on the premise that TDC must act reasonably in accordance with its statutory functions, including in regard to the s199 purposes

of the WCO.

[155] Furthermore, consistent with our expansion of the limits in cl 8(a) – (c) to encompass relevant uses, a similar expansion should be made to the scope of this provision.

[156] Therefore, we have revised what is now cl 8(e) to read:

> (e) For the purposes of s88(3) of the Act, in respect to any application for a resource consent to which any of subclauses (a) to (c) apply, relevant information for assessment of whether the application is incomplete includes whether or not the application includes an assessment in regard to the cultural health or hauora of Te Waikoropupū Springs as identified in any cultural health monitoring report or in consultation with Manawhenua Iwi.

Limit-based restrictions as to flow allocation

Cl 9

Introduction

[157] The Special Tribunal recommended that the WCO include limit-based restrictions on permitting or granting consent to water takes (in its cl 7 and definitions).

[158] One limit that triggered those restrictions was as to mean annual low flow. That was to the effect that the restriction applied if any flow allocation that the consent or rule would allow would cause the flow of groundwater from the Springs to fall below a mean annual low flow of 6895 litres per second.

[159] In addition, the restrictions would have been triggered if specified surface water and/or groundwater abstraction limits concerning the subject waters or the WAMARA applied. There were relatively more complex. As we understand their

intention, they generally applied to abstractions additional to those that were already authorised. A further exemption was specified by reference to the following stated outcome:

> The cumulative consented consumptive abstraction from the waters in Schedule 2 exceeding 10% of the 7-day mean annual low flow at Te Waikoropupū Springs (10% of the mean annual low flow being 766 litres per second), provided that this subclause will only permit additional consumptive abstraction from the waters in Schedule 2 or from a groundwater abstraction point within the recharge zone of the Arthur Marble Aquifer if monitoring of NO_3-N at Te Waikoropupū Springs has established that the annual median of monthly samples of NO_3-N has not increased for a period of 3 consecutive years.

[160] As is the case for the water quality restrictions, our revised flow allocation restrictions are on the grant of consent or permitting by rule of the specified activities. Those are takes of surface or groundwater from the WAMARA (and also encompass takes from the Waingaro at least pending any plan change) that would contravene the specified limits. We prescribe two such triggering limits. One is based on a defined "allocation limit" and the other on a defined "minimum flow".

Initial positions of parties in the inquiry

[161] Parties were agreed that the Special Tribunal's recommended regime would be unduly complex and prone to interpretative difficulty.[37] However, they initially differed significantly about how that regime should be modified.

[162] As we set out in Part 2, a significant point of difference was as to the appropriate allocation limit.[38] There were essentially two camps of opinion:

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37 Joint memorandum, dated 5 May 2022.

38 We leave aside discussion of the Farming Interests' submissions on an earlier proposed concept of "mean annual low flow" (or 'MALF') as this is overtaken by the formulation that we ultimately adopted on the recommendation of TDC, namely 'minimum flow'.

(a) the applicants sought that the allocation limit be reset so as to reflect current allocation and use and, hence, be in the order of 500 l/s "or less". They were concerned that, without proper allocation settings, there would be a decrease in water quality in the subject waters and harm caused to their ecosystem health. In those and other respects, they were concerned that the Tribunal's 766 l/s allocation limit was neither appropriate nor justified in needs terms.[39] They urged the Court to reset the limit on a precautionary basis consistent with tikanga Māori.[40] The applicants were supported in these matters by SOS and the DG.[41] Similarly, FOGB sought that the WCO prohibit further water approvals for irrigation until NO_3-N concentrations remained below their preferred limit (0.40 mg/l) for at least five years;[42]

(b) the Farming Interests and TDC opposed the greater stringency sought by those parties. Mr Matheson submitted that an allocation cap of 766 l/s would be "inherently precautionary, and there is no need to further reduce that limit to the volume of the current takes (i.e. of about 500 l/s) in response to the precautionary approach".[43]

The Court's initially-proposed revised regime

[163] After the evidential phase of the inquiry was concluded, the Court engaged with parties on how we should revise the Special Tribunal's limit-based restrictions on flow allocation. The key elements of the revised approach proposed in the penultimate draft WCO for the purposes of final closing submissions were:

(a) a limits-based restriction to the effect of prohibiting the grant of consent or permitting by a plan of takes of surface or groundwater

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39 Applicants closing submissions, dated 30 September 2022, at [92].

40 Closing submissions for the applicants, dated 30 September 2022, at [92], [93].

41 Speaking notes on behalf of the DG, dated 27 October 2022, at [40].

42 Final submissions for FOGB, dated 7 October 2022, at [78].

43 Closing submissions for the Farming Interests, dated 13 October 2022, at [4.8].

from the WAMARA (and also from the Waingaro catchment pending any plan change excluding it) where specified limits were contravened; and

(b) two related limits:

(i) an allocation limit defined as a "maximum allowable combined take of surface water and groundwater" of 766 l/s or any lesser volume per second as may be prescribed by a regional rule; and

(ii) a minimum flow limit (ie of flow from Main Spring) of 6895 l/s or any greater flow as may be prescribed by a regional rule.

[164] The Court's revised regime also provided a discretion for TDC to prescribe more stringent flow allocation and/or minimum flow limits through the regional plan.

[165] Our reasons for this revised approach (and our preference for it over other approaches preferred by parties) were provided to the parties in a draft of this Report provided for the purposes of final closing submissions. Substantially, they remain as explained in Part 2 of this Report.

[166] In addition, it prescribed certain duties that we discuss shortly. One concerned the imposition of cease take requirements. The other concerned the need for TDC to be satisfied, before allowing takes of water that contributes to flow at the Springs, that there was a reasonable need for the take that could not otherwise be met.

Final closing submissions

[167] Final closing submissions revealed a significant narrowing of parties' differences on how the limit-based restrictions for flow allocation should be framed (acknowledging that our directions precluded parties from revisiting our findings and determinations in Part 2). In particular, no issue was taken with the essential aspects of the revision, based on having both allocation and minimum flow limits.

[168] As for drafting clarifications and refinements, some parties sought that cl 9 be amended so as to expressly link to cl 8.

[169] TDC sought that the provision enabling TDC to exclude the restrictions from the Waingaro catchment be extended to encompass the Upper Tākaka River mainstem. That was on the basis of a passage from the evidence of TDC witness, Mr Thomas, in which he referred to both the upper Tākaka and the Waingaro River in giving his opinion on appropriate flow allocation restrictions.

[170] This suggested expansion of the provision was opposed by the applicants, SOS and the DC as unjustified. On the other hand, the applicants sought that this provision be amended to tighten the available discretion to exclude the Waingaro catchment by plan change. They proposed that the discretion be available only if TDC was duly satisfied that it would not materially impact upon achievement of the relevant duties in cl 6 and the water quality limit-based restrictions in cl 8.

[171] The applicants and supporting parties also sought that TDC's discretion to impose more stringent flow allocation limits be subject to a requirement to obtain an independent peer reviewed expert assessment.

Evaluation

[172] Our reasons for not taking up the alternative approaches preferred by parties to the flow allocation limit-based restrictions are set out in Part 2. Part 2 also explains why we find the specified allocation and minimum flow limits the most appropriate.

Importance of holistic approach to sources of pollution

[173] It is plainly important that the various sources of harm and risk to the Springs and their outstanding values are considered holistically. In particular, the evidence reveals that the increases in water allocation and associated irrigated areas that occurred from 2005 resulted in increased NO_3-N concentrations at Te

Waikoropupū.

[174] Our recommended WCO reflects the specifications of s217(1) RMA to the effect that no WCO shall affect or restrict any resource consent granted or lawful use established in respect of the subject water body before the WCO was made. We note that the common expiry date for existing resource consents to take water in the WAMARA is 31 May 2034, as compared to the 1 January 2038 date specified in cl 8(a) for the NO_3-N limit of 0.41 mg/l to be met. No reduction in current consented take volumes can be required, given s217, RMA. However, any new consent applications would need to be determined in light of relevant plan provisions at the time.

[175] It will be a matter for TDC how it frames relevant plan provisions so that the requirements of cl 8 are met. However, before any additional allocations of water are made, there needs to be confidence that water quality limits are being met and a very high level of certainty that future water allocation for additional irrigation will not increase NO_3-N concentrations reaching Te Waikoropupū.

[176] We are satisfied that the change we have made to cl 8 (so as to also encompass relevant water uses) sufficiently addresses this. There is no need to also include any explicit linkage to cl 8 within cl 9 insofar as the flow allocation limit-based restrictions are concerned. That is in light of the clarification we have made in cl 8 to encompass water use within its ambit.

Discretion to allow for a more stringent allocation limit and/or minimum flow regime

[177] Our inclusion of the discretion to allow the regional plan to prescribe a more stringent allocation limit and/or minimum flow regime reflects our application of the precautionary principle, given the uncertainties concerning harm thresholds for the Springs as we discuss in Part 2. Arguably the RMA already enables such an approach. However, this explicit provision reinforces the intention in the overarching duties for the purposes of s199 RMA.

[178] We find it would be overly-prescriptive and unwarranted to specify any duty to arrange for independent peer reviewed expert assessment to inform any exercise of the discretion. The discretion is expressed to be to better achieve cl 6(a). That overarching duty to preserve the Springs in their natural state as Te Puna Waiora and to recognise, sustain and protect their outstanding values already informs all exercises by TDC of its relevant powers under s30(1)(e) and (f). The discipline of planning processes will also help ensure due rigour.

Capacity to exclude the Waingaro and whether this extends to the Upper Tākaka mainstem

[179] To reinforce the holistic approach to sources of pollution harm, we see merit in adding a specification that TDC must also be satisfied that any exclusion of the Waingaro from the flow allocation restrictions would not compromise the achievement of cl 8. As for referencing duties, we find it sufficient to refer only to the overarching protective duty in cl 6(a).

[180] We have not extended this discretion to allow for exclusion of the Upper Tākaka mainstem. As we made clear to parties, their opportunity for final closing submissions did not extend to seeking that we revisit our evidential findings in Part 2. Having said that, we record that the predominant focus of the discussion in the inquiry on this matter, including in evidence, was confined to the Waingaro. Acknowledging that Mr Thomas also made mention in his evidence of the Upper Tākaka mainstem, this was not sufficiently explored, as our Part 2 findings demonstrate. We are concerned that there could be unintended consequences in acceding to TDC's request. Hence, we decline to do so.

[181] For those reasons, we are satisfied with the modified flow allocation limit-based regime as set out in Annexure 1 and recommend it accordingly.

Associated duties as to cease take regimes and reasonable needs justification

Cl 9

Introduction

[182] We refer to our discussion of principles under the heading "Duties – overarching matters" which we intend to also apply to the duties we discuss now. On the basis of our findings in Part 2, we included in the penultimate draft WCO, as part of revised flow allocation regime duties that TDC ensure that:

(a) all new water takes that contribute to the flow at Te Waikoropupū Springs are controlled through a cease take regime that may include rationing to ensure that the flow from the Main Spring is equal to or greater than the minimum flow at all times; and

(b) there is a reasonable need to take water that contributes to the flow at Te Waikoropupū Springs instead of from a source that does not.

Final closing submissions

[183] The applicants and SOS each sought that the duty concerning the cease take regime be tightened. That was to the effect of prescribing 7661 l/s as a cease take trigger so as to ensure that flow at the Springs remained at or greater than the defined minimum flow.

[184] In his written representation, Mr Penny proposed that the cease take regime be replaced with a prohibition on irrigation if there has been more than say 10mm of rain in the previous week. In his view, that would be easier to implement and monitor (by contrast for example to a regime based on flow at the Springs

dropping below 90% of MALF).[44]

Evaluation

Duty as to the cease take regime

[185] As is set out in Part 2, the cease take regime drew to some extent from our findings on Dr Young's recommendations on how such regimes should be designed. That included his observation that, while all non-essential abstractions should cease, those for reasonable domestic and stock drinking requirements and firefighting are generally allowed to continue. We also comment on the importance of designing these restrictions to allow for TDC to undertake proper community consultation (in addition to peer review of Dr Young's recommendations).

[186] It is not the proper role of a WCO to prescribe the detailed elements of cease take arrangements and nor does the evidence before us enable us to do so. That extends also to procedures and limits as to how the taking of water recommences after any cease take requirement no longer applies. All such matters are properly to be addressed through the regional plan, including in accordance with appropriate WCO restrictions.

[187] We have considered Mr Penny's alternative approach but do not prefer it as it is was not presented in evidence and is not in accordance with our evidential findings in Part 2.

[188] We recommend the inclusion of the cease take regime duty on that basis, as part of cl 9. We have further refined the drafting including by bringing this duty and the one we next discuss into a single subclause.

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44 Steve Penny representation, at [18].

Duty as to reasonable need to take

[189] As we set out in Part 2, the evidence reveals that increases in water allocation and associated irrigated areas that occurred prior to 2005 resulted in increased concentrations of NO_3-N in the Springs. Given the risks that are presented to the Springs and their outstanding values, it is plainly important to apply the precautionary principle with respect to flow allocation. For those reasons, we included this duty to supplement the flow allocation limit-based restrictions we have discussed (and the explicit discretion allowing these to be made more stringent through a plan change). The duty was not substantially opposed in final closing submissions and we remain satisfied that it is an appropriate part of this regime. We recommend it accordingly.

Consequential changes to the headings to clauses 8 and 9

[190] As these clauses both comprise restrictions and duties, we have updated their headings from the penultimate draft WCO to reflect that.

Provisions as to exemptions and scope

Cls 10 – 13

Introduction

[191] The Court's recommended cls 10 – 13 revise and replace the Tribunal's equivalent exemption and scope provisions (coincidentally also cls 10 – 13). In substantive terms, most of our recommended modifications reflect agreements reached during Court-facilitated mediation prior to the hearing.

[192] That is particularly the position for cl 10 (exemptions for Cobb Hydro-Electric Power Scheme) and cl 11 (exemptions for the NZ King Salmon hatchery). It is also largely the position in regard to cl 12 (exemptions for dairy sheds), although this provision was further refined during the inquiry at the unopposed

request of counsel for the Farming Interests. Similarly, cl 13 as to scope essentially accords with the positions agreed by parties during mediation. However, as we discuss shortly, we made some refinements to the version of it in the penultimate draft WCO, in response to final closing submissions on behalf of the Farming Interests.

[193] We note that we sought and received feedback from NZ King Salmon and Fonterra on various refinements made to these provisions, given that those parties elected not to attend or be represented during the hearing. From responses they provided by memoranda, we understand they are satisfied with our final recommendations. That is also the case for Manawa, although they maintained representation before us (Mr Matheson).

Principles

[194] We discuss relevant principles in Part 2 (E). Exemptions for existing consents and lawful uses generally reflect the RMA's standard exemptions for those matters in relation to WCOs (s217). In particular, s217 specifies:

> No water conservation order shall affect or restrict any resource consent granted or any lawful use established in respect of the water body before the order is made.

[195] Also relevant to our consideration of these provisions is our consideration of the needs of primary and secondary industry and of the community (s212(a)).

Cls 10 – 12

[196] We have noted the concerns expressed by Mr Penny about farming practices in his written representations. Aside from those concerns, no party opposes the exemptions specified in cls 10, 11 and 12 for dairy shed operations, NZ King Salmon's hatchery and the Cobb Hydro-Electric Power Scheme. We find that they are supported on an analysis of relevant principles and are appropriate in that they will not materially compromise the protective purposes of

the WCO.

Cl 13

[197] Similarly, cl 13 of the penultimate draft WCO was refined through pre-hearing mediation and further engagement with relevant parties during the inquiry. In essence, that version reflected s217 RMA in prescribing that nothing in the WCO:

(a) affects or restricts resource consents and activities meeting the specifications in cl 13(a);

(b) prevents the grant of resource consents that would otherwise contravene cls 8 and 9 provided that they fall within one of eight specified use classes; or

(c) limits specified statutory take or use exemptions as prescribed in s14(3)(b) or (e).

Submissions

[198] With the possible exception of Mr Penny, no party opposed those scope limit and exemption provisions in their written closing submissions or representations.

[199] The essence of the concern expressed on behalf of the Farming Interests was that cl 13(a) did not go far enough. In particular, those concerns were as to cls 13(a)(ii) and (iii) of the penultimate draft WCO which read to the effect that nothing in the WCO "affects or restricts":

> (ii) any activity that was both authorised under section 20A or section 124 of the Act and lawfully established prior to the commencement date; or
>
> (iii) any other activity in respect of the waters of Te Waikoropupū Springs or of Wharepapa Arthur Marble Aquifer or the Contributing Surface Waters and the Contributing Groundwaters that was a lawful use under the Act prior

to the commencement date.

[200] Those cl 13(a)(ii) and (iii) exemptions closely reflect s217(1) and, as such, the statutory limits of what a WCO can affect or restrict, particularly in relation to "any lawful use established in respect of the water body before the order is made".

[201] Mr Matheson explained that the Farming Interests accept that their resource consents to take and use water for irrigation are protected only for a limited term. However, he noted that a range of necessary farming activities (e.g. discharges of dairy shed effluent) are presently not under the auspice of resource consents. Rather, they can proceed lawfully for instance as permitted activities under the regional plan. Those normal operational farming activities could be caught by TDC bringing in new plan controls to implement the restrictions in cl 8 and 9 of the recommended WCO. He urged that the drafting gap be remedied as it could lead to cessation of farming "within 3 years".

[202] On behalf of FOGB, Mr Mather argued caution as to the overriding importance of protecting the Springs. However, other parties generally acknowledged the Farming Interests' concerns and the need to expand the exemptions in cl 13(a)(ii) and (iii) to some extent to address them.

[203] Differences centred on how the new exemption should be qualified so as to avoid undermining the intentions of the WCO, particularly for NO_3-N.

[204] Counsel for the applicants and SOS submitted that what the Farming Interests sought could undermine the intention to reduce NO_3-N concentrations in the Springs to 0.41 mg/l (or any lower limit prescribed by the regional plan) by 1 January 2038. They proposed that this be addressed in part by limiting the additional exemption to apply only until that date. That was in addition to any exempted activity having to satisfy two pre-requisites, namely that the activity:

(a) must not increase their contribution of NO_3-N or DRP to the WAMARA beyond that occurring as at the date of commencement of the WCO; and

(b) must be demonstrated to be consistent with regional plan provisions that require stepped or incremental reductions in loads/concentrations in order that the measured concentration of NO_3-N in that water body from 1 January 2038 does not exceed 0.41 mg/l or such lower limit as may be specified in the regional plan.

[205] Counsel for the DG supported that approach to the provision.

[206] The Farming Interests did not oppose the first of those pre-requisites. As for the second, the Farming Interests ultimately preferred the following alternative expression:

> (ii) demonstrate stepped or incremental reductions in loads/concentrations from the WAMARA.

[207] The Farming Interests submitted that such qualifications would be sufficient and opposed the proposed additional time bar as unwarranted. TDC supported the Farming Interests on that matter.

Evaluation

[208] The Farming Interests fairly identified a need to enhance the exemptions specified in cl 13(a) in the penultimate draft WCO. In application of the principles we have noted, we find that should be addressed by supplementing that subclause to prescribe a further exemption (which we number cl 13(b), consequentially renumbering subsequent subclauses).

[209] The drafting proposed for the Farming Interests appears to confine the additional exemption to "water quality" limits i.e., matters under cl 8. It would appear at least possible, however, that cl 9 could also impact existing lawful flow allocation activities (e.g. as may be permitted by a plan). As such, we have encompassed both provisions in our revised cl 13 (but with drafting refinements

for consistency).

[210] The additional exemption should be qualified by provisos that constrain what is exempted so as to avoid undermining the s199 purpose of the WCO and, in particular, as to the need to reduce NO_3-N loadings in the Springs.

[211] To those ends, we prescribe two provisos:

(a) the first generally reflects the consensus that the activity must not increase the contribution of NO_3-N or DRP to the WAMARA from those activities above that occurring as at the date of commencement of the WCO;

(b) the second essentially reflects the Farming Interests' recommendation as being the clearest and simplest expression of this proviso.

[212] We do not make the additional exception time-limited as we find that is not warranted. In particular, the two-stage limit based restriction approach in cl 8 (and the flow allocation restrictions of cl 9) still operate to require TDC to institute a properly effective strategic approach to ensuring that the s199 purpose of the WCO is achieved.

Provision as to amendment of the WCO

Cl 14

[213] There is no equivalent to cl 14 in the Tribunal's version of the WCO. It is framed according to s216 RMA. As we have discussed, it is recommended as part of a set of provisions reflecting the precautionary principle in view of the significant present scientific uncertainties on the risks presented for the natural state of the Springs and their outstanding values. In final closing submissions, no party disputed the appropriateness of including it in the penultimate draft WCO.

Acknowledgement as to Ngāti Tama ki Te Tauihu and their relationship with Te Puna Waiora o Waikoropupū

Schedule

[214] The Acknowledgement included in the Schedule as to Ngāti Tama ki Te Tauihu and their relationship with Te Puna Waiora o Waikoropupū is self-explanatory and was well-settled by parties prior to its inclusion in the penultimate draft WCO. Nor were any issues raised about in in final closing submissions. It is an operative part of the WCO in conjunction with the duties in cl 6. It also serves as a helpful point of reference in the implementation of the WCO as a living statutory instrument.

Maps and related boundary definition matters

[215] The recommended WCO includes definitions that rely on the WCO incorporating various maps and plans to generally depict the geographic extent of relevant features. In particular:

(a) Figure 1 is of the WAMARA;

(b) Figure 2 is of Te Waikoropupū Springs (i.e. Fish Creek Springs and Main Spring);

(c) Figure 3 is of the "contributing ground waters" and "contributing surface waters"; and

(d) Figure 4 (termed "Figure X" in the penultimate draft WCO) is of the unconfined Wharepapa Arthur Marble Aquifer.

Submissions and issues raised by the Court in the final hearing

[216] In the hearing of final closing submissions, counsel raised various issues as to the scale, accuracy and clarity of various figures which the Court had intended to include in the recommended WCO. These figures were as had been provided in evidence or for the Court's earlier site visits. Counsel for the applicants

expressed their wish for the downstream boundary location of the WAMARA to be 'ground-truthed'. Counsel for the Farming Interests observed that, at the scale shown, some property-owners may not be able to clearly tell whether the WAMARA traversed their property. Counsel for TDC explained that the boundary shown on the proposed figures was prepared based on maps held in TDC's GIS system. The Court also asked as to whether the figures were able to be scaled up and down as may be required for the purposes of the Parliamentary Counsel Office ('PCO'). We asked TDC to make further inquiries and update the Court by memorandum of counsel.

Initial response on behalf of TDC

[217] That memorandum was subsequently filed on 31 May 2023. The memorandum attached updated versions of Figs 1 – 4 which counsel had circulated to other parties for comment. Mr Thomsen also confirmed that the relevant images could be made available to the Registry in an appropriate format for reproduction in the WCO by the PCO.

[218] In addition, the memorandum attached a statement on TDC letterhead which explained:

> … the information held in respect of the location of the downstream WAMARA boundary. In summary, the [statement] provides background information on the identification of the downstream boundary. It confirms that information can be obtained from Council now and that it will soon be available on its website. TDC's intention is that the WAMARA boundary will, eventually, be incorporated into the freshwater plan for the proposed Tākaka freshwater management unit at a scale that allows property-specific identification of its location. It will therefore be subject to further scrutiny under that process.

[219] Additionally, the memorandum reported:

> Council and the Applicants have conferred on the process outlined in the Boundary Memorandum and the Applicants were provided with a draft of the

> Boundary Memorandum. TDC confirms, as requested by the Applicants, its agreement in good faith, to keep the parties updated with any work related to the identification of the downstream boundary, including pre-notification consultation on the freshwater management plan (as explained in the Boundary Memorandum).
>
> The Applicants have asked this [sic] counsel to record their position is that, should the Tākaka freshwater management unit planning process result in a different mapping alignment to that which is published in the final WCO, then this may be an appropriate matter to be amended under section 216(3) of the Act, being a minor / technical amendment.

Further memoranda filed

[220] The Court did not invite further memoranda. However, the applicants filed one in response to TDC's initial memorandum and that prompted a further response on behalf of TDC.

The applicants' 7 June 2023 memorandum

[221] In their 7 June 2023 memorandum of counsel, the applicants recorded some concerns and reservations about what TDC had covered in its initial memorandum, but emphasised that they will in any case abide the Court's decision on all matters raised.

[222] They commented that it was unclear whether TDC would provide to PCO the metadata /GIS layer of the figures or whether this would be included in final WCO. Allied to that, they expressed concern that the coarseness of what would be provided in the figures would "dictate land activities" affected by the WCO and "lead to uncertain regulation". They also noted that they would be concerned were any subsequent amendment to the metadata/GIS layer through the notification of, or decisions on, a future Freshwater Plan to inadvertently change how the WCO is interpreted. Counsel also suggested that:

> … the final WCO to be gazetted should include, or incorporate by reference, the same exact information currently held in the TDC metadata / GIS layer, in order that the Order is duly certain and prescriptive for land use activities affected.

[223] In addition, the applicants invited the Court to make a direction in this Report concerning the approach that can be taken by PCO.

Further response from TDC

[224] We do not need to traverse all aspects of TDC's further memorandum in response, dated 18 June 2023. Counsel reported on a further potential procedural issue that since came to his attention concerning the version of Fig 1 provided to the Court with the initial memorandum. It had been initially supplied to the Court for the purposes of its site visit rather than being formally produced as an exhibit. Counsel reported that, out of an abundance of caution, he has enquired of parties and none object to his suggestion that it be admitted by consent. We do so by consent, according it the appropriate appellation ('TDC1 – by consent').

Evaluation

[225] We are satisfied with the updated figures provided by TDC reflect our findings and are fit for incorporation into the WCO.

[226] We have carefully considered the concerns raised by the applicants in their memorandum. To avoid any remaining doubts, we amend the relevant definitions in the WCO. These now clarify that the relevant features may also be depicted in any associated Geographic Information System map held by the Council as at the commencement date.

[227] Subject to that clarification, we consider it sufficient to simply direct TDC to provide any assistance as PCO may, through the Minister's relevant advisers (eg at Ministry for the Environment) call for in order to ensure the Figures included in the WCO are in accordance with our findings in this Report. We make that

direction later in this Report.

[228] Bearing in mind that there may be a need to further assist the Ministry for the Environment in their instruction of PCO for the promulgation of the WCO (e.g. on any matters of style or formatting), we have supplemented that direction somewhat (as we discuss shortly).

[229] We bear in mind that the WCO will itself inform processes of updating or replacing the regional plan insofar as the RMA requires those instruments to be not inconsistent with a WCO. Hence, we are not concerned about the spectre of associated amendments to the metadata/GIS layer effectively bypassing the statutory processes for amending a WCO.

Remaining matters

[230] Whilst the recommended WCO in Annexure 1 reflects our substantive findings and related recommendations, we appreciate that we are not fully appraised of PCO's current stylistic or formatting preferences for secondary legislation. This Report does not preclude PCO from making stylistic or formatting changes for the purposes of according with its current approaches in these matters, provided that this does not impact the substantive intent or effect of the recommended WCO in Annexure 1.

[231] If anything beyond that is called for, we reserve leave to the Minister (and the Ministry for the Environment) to join the proceedings and seek further or amended directions for the purposes of assisting on any matters of drafting or formatting style. Insofar as necessary for those purposes, we have also reserved capacity to supplement this Report under s213.

****

Ancillary matters

Introduction

[232] The matters we discuss in this 'Ancillary matters' do not comprise our reasons for recommending the modified WCO in Annexure 1. They go beyond the parameters of s213 RMA but pertain to the effective implementation of the WCO.

Recommendations to TDC concerning its monitoring programmes

[233] We commence by recording that the overall impression left by the evidence is that TDC has failed to manage the catchment on an integrated basis to date. That includes a failure to review what monitoring data there is to consider linkages between surface, ground and spring water quality. We further note Mr Bush-King's recommendations as to TDC translating what is known about the hydrology and hydrogeology of the aquifer system into an integrated resource management plan.

[234] The Court is further concerned about apparently significant shortcomings in TDC's groundwater and surface water monitoring programmes. It was unclear on the evidence whether those programmes are designed, as we find they need to be, to provide early warning of up-catchment changes in water quality that could adversely affect the values of Te Waikoropupū.

[235] We find those programmes require an independent expert review to take account of the evidence put before the Court, particularly the importance of total nitrogen and dissolved organic carbon.

[236] We strongly encourage TDC to arrange for independent peer review of both programmes by one or more suitably qualified and experienced experts. That review should consider the matters raised above. In relation to the groundwater programme, it should also consider:

(a) the limitations imposed by the practical difficulties and cost of drilling into the Arthur Marble and difficulties in determining bore locations that are representative of flows and contaminant levels reaching Te Waikoropupū Springs;

(b) the need to understand and document the hydrological settings of and any natural variabilities and uncertainties associated with any monitoring locations;

(c) the extent to which monitoring results will contribute to the effective management of the Springs; and

(d) the need for practicability and reasonableness of expectations in what monitoring programmes can achieve, recognising benefits, costs and other demands on TDC resources. While all parties and the Court agree that monitoring is important, it should not be monitoring for monitoring's sake. It is important that reliance can be placed on monitoring results to contribute to the preservation and protection of Te Waikoropupū.

Desirability of TDC continuing to engage with FOGB members in regard to monitoring

[237] The WCO does not prescribe that TDC continue to engage with FOGB members in their monitoring. Nevertheless, it should not be overlooked that the data gathered by those members that showed increasing levels of NO_3-N in the Springs was instrumental in instigating the WCO application. The reliability of the data gathered by FOGB members and scientists volunteering their time was acknowledged by TDC. We encourage TDC to consider how it might continue collaboration with FOGB members for the purposes of the WCO.

Matters that the Minister may wish to consider

Timing for the making of the WCO

[238] We were informed by TDC that it is well underway with work in

preparation for notification of its intended TEP.

[239] Ideally, promulgation of the WCO should precede notification of that proposed plan so as to inform its provisions.

Funding issues as to monitoring and associated statements on behalf of TDC and the applicants

[240] As our findings in Part 2 of this Report make clear, Te Waikoropupū has been rendered at significant risk in a context of longstanding inadequate monitoring and inadequate catchment management by TDC. If the outstanding values of these waters are to be protected, that approach to monitoring must change significantly. The necessary monitoring and other work for the effective implementation of the WCO can be expected to involve significant resourcing and expenditure. Counsel for TDC and their witness, Mr Bush-King, informed us that TDC has a limited rating base and faces significant resourcing challenges in regard to monitoring.

[241] Section 26 RMA enables the Minister to make grants and loans to assist in achieving the purpose of the Act. Mindful of that and the concerns raised, the Court invited TDC to record their concerns in a statement that could be suitably attached to our Report.

[242] On 23 November 2022, TDC provided an initial statement in response.

[243] During the final hearing of closing submissions, the applicants indicated that Ngāti Tama may also benefit from grants or other funding from Central Government for cultural health monitoring it intends on undertaking, pursuant to the Court's recommended WCO. The applicants then signalled their wish for these needs to be also brought to the Minister's attention in this manner.

[244] After the close of the hearing, TDC filed a memorandum of counsel dated 31 May 2023. The memorandum relevantly records:

> Council and Ngāti Tama discussed the same and agreed the most appropriate approach was for Ngāti Tama to prepare an addendum to be attached to the Statement, which could be included in Annexure 4.
>
> Accordingly, attached as Appendix 1 to this memorandum is a modified Statement referring to the Ngāti Tama annexure and appending the same to it. It is proposed this version replace the Statement filed with the Court in November 2022.

[245] We have provided copies of these statements of request on behalf of TDC and the applicants with this Report. We commend them to the Minister for consideration as properly consistent with our findings in this Report.

CONCLUSION

Directions

[246] Under ss 269 and 278, RMA:

(a) TDC is **directed** to provide any assistance as PCO may, through the Minister's relevant advisers (eg at Ministry for the Environment) call for in order to ensure the Figures included in the WCO are in accordance with our findings in this Report;

(b) leave is reserved to the Minister to join the proceeding under s274 so as to seek further or amended directions for the purposes of assisting on any matters of drafting or formatting style so as to ensure due finalisation and promulgation of a WCO in accordance with Annexure 1. Insofar as necessary for those purposes, the capacity to supplement this Report under s213 remains reserved. In all other respects, this Report is final and complete.

[247] On the basis set out, we:

(a) commend the recommended WCO in Annexure 1 to the Minister for consideration, inviting its promulgation at the earliest practicable opportunity; and

(b) invite the Minister to also consider the associated comments we make in Part 2 of this Report as they pertain to the exercise of your related RMA functions.

[248] This Report represents the collective inputs of the Court as a whole. In the circumstances, we find it appropriate to record each of our signatures.

____

J A Hodges
Environment Commissioner

____

M Pomare
Deputy Environment Commissioner

____

J J M Hassan
Environment Judge

THE SEAL OF THE ENVIRONMENT COURT NEW ZEALAND

Index to Annexures

ANNEXURE 1

The Court's Recommended Water Conservation Order

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Te Puna Waiora o Te Waikoropupū Springs and the Wharepapa Arthur Marble Aquifer Water Conservation Order

1 Title

This order is the Water Conservation (Te Puna Waiora o Te Waikoropupū Springs and the Wharepapa Arthur Marble Aquifer) Order 2023.

2 Commencement

This order comes into force on the 28th day after the date of its notification in the New Zealand Gazette.

3 Interpretation

(a) In this order, unless the context otherwise requires:

Acknowledgement refers to the statement in the Schedule.

Act means the Resource Management Act 1991.

allocation limit has the meaning given in clause 9.

any 12-month period means a period of twelve consecutive months as determined by the Council as most appropriate for the purposes of this Order and may include a hydrological year.

Cobb Hydro-Electric Power Scheme has the meaning given in clause 10.

Commencement date means the date that this Order comes into force under clause 2.

Contributing Groundwaters means all groundwater within the Wharepapa Arthur Marble Aquifer Recharge Area and within parts of the Tākaka limestone aquifer and the Tākaka unconfined gravel aquifer generally shown in Figure 3 and as may be further depicted in any associated Geographic Information System map held by the Council as at the commencement date.

Contributing Surface Waters means the waters of those parts of the Tākaka River and Waingaro River and their tributaries that are within the Wharepapa Arthur Marble Aquifer Recharge Area generally shown in Figure 3 and as may be further depicted in any associated Geographic Information System map held by the Council as at the commencement date.

Council means Tasman District Council a unitary authority within the meaning of the Local Government Act 2002.

DO means dissolved oxygen.

DRP means dissolved reactive phosphorus.

Fish Creek Springs refers to the artesian upwelling outside the Main Spring but within Te Waikoropupū Scenic Reserve in the general vicinity of Fish Creek as shown in Figure 2 and as may be further depicted in any associated Geographic Information System map held by the Council as at the commencement date.

Hatchery has the meaning given in clause 11.

Hydrological year means a year commencing on 1 July and ending on 30 June.

Main Spring refers to the main permanently artesian upwelling of Te Waikoropupū Springs and includes Dancing Sands Spring as shown in Figure 2 and as may be further depicted in any associated Geographic Information System map held by the Council as at the commencement date.

Manawhenua Iwi means each of Ngāti Tama ki Te Tauihu, Te Ātiawa and Ngāti Rarua.

Minimum flow has the meaning given in clause 9.

`**Natural state** includes that state in accordance with tikanga Māori.

Ngāti Tama ki Te Tauihu means the collective descendants of an ancestor of Ngāti Tama ki Te Tauihu including:

(i) individuals who are descendants by birth or legal adoption or Māori customary adoption in accordance with tikanga Māori; and

(ii) whanau, hapū or other group of such individuals.

NO_3-N means nitrate-nitrogen being the concentration of nitrogen present in the form of the nitrate ion.

Tikanga Māori refers to the tikanga of Ngāti Tama ki Te Tauihu or any other Manawhenua Iwi as the case may be.

Te Waikoropupū Springs means the waters of Main Spring and Fish Creek Springs as generally shown in Figure 2 and as may be further depicted in any associated Geographic Information System map held by the Council as at the commencement date.

Wāhi tapu has the same meaning as in section 6 of the Heritage New Zealand Pouhere Taonga Act 2014.

Wharepapa Arthur Marble Aquifer means the waters of the confined and unconfined aquifer underlying the Tākaka Valley, South Island as generally shown in Figure 4 including that part within the Wharepapa Arthur Marble Aquifer Recharge Area, and as may be further depicted in any associated Geographic Information System map held by the Council as at the commencement date.

Wharepapa Arthur Marble Aquifer Recharge Area or **WAMARA** means the parts of the Tākaka River basin from which surface and ground water drains or percolates into underlying gravel and marble to contribute to the recharge of that part of the Wharepapa Arthur Marble Aquifer that feeds Te Waikoropupū Springs as generally shown in Figure 1 and as may be further depicted in any associated Geographic Information System map held by the Council as at the commencement date.

(b) Subject to subclause (a), words and phrases used in this Order have the same meanings as in the Act.

4 Meaning and purpose of cultural health monitoring report

(a) In this Order **cultural health monitoring report** means a written report to the Council by or on behalf of Manawhenua Iwi on results of their monitoring over any relevant seasons in accordance with tikanga Māori of the hauora (health) of Te Waikoropupū Springs (and which may include their monitoring of the wai, taonga species and their habitats and riparian margins) and that also records the methodologies and approaches employed for that monitoring.

(b) A cultural health monitoring report may be prepared or updated annually by or on behalf of Ngāti Tama ki Te Tauihu and all or any Manawhenua Iwi but, for the purposes of this Order, there may be only one such report at any one time.

5 Te Waikoropupū Springs and Wharepapa Arthur Marble Aquifer and their contributing waters

(a) Te Waikoropupū Springs are outstanding water bodies in their natural state as Te Puna Waiora in accordance with tikanga Māori.

(b) Te Waikoropupū Springs and Wharepapa Arthur Marble Aquifer have the following outstanding values and characteristics:

- (i) amenity, intrinsic values and cultural health values afforded by waters in their natural state as Te Puna Waiora in accordance with tikanga Māori;
- (ii) significance in accordance with tikanga Māori including in relation to history, kaitiakitanga, mahinga kai, wāhi tapu, wāhi whakahirahira, waiora and customary protection of flora and fauna; and
- (iii) habitat for indigenous stygofauna and biofilm; and
- (iv) habitat for other indigenous fauna and flora; and

(v) biodiversity values; and

(vi) wild, scenic, and natural values including water quality, water clarity, contribution to artesian flow, karst geology and the aquifer system; and

(vii) scientific and ecological values including water quality, water clarity, artesian flow, ecosystem services and ecological processes; and

(viii) spiritual values.

(c) Te Waikoropupū Springs also have outstanding recreational values.

(d) The Contributing Surface Waters and Contributing Waters contribute to the outstanding values and characteristics in subclauses 5(b) and 5(c).

6 Overarching duties

(a) In exercising any powers under section 30(1)(e) and (f) of the Act, in relation to Te Waikoropupū Springs or Wharepapa Arthur Marble Aquifer or Contributing Groundwaters or Contributing Surface Waters, the Council must:

(i) preserve as far as possible Te Waikoropupū Springs in their natural state as Te Puna Waiora in accordance with tikanga Māori; and

(ii) recognise, sustain and protect the outstanding values and characteristics, as specified in clause 5(b) and (c), of Te Waikoropupū Springs and Wharepapa Arthur Marble Aquifer.

(b) To assist to achieve subclause (a), in exercising any power under section 30(1)(e) and (f) of the Act, the Council must:

(i) have regard to the Acknowledgement; and

(ii) recognise and, where appropriate, assist the exercise of rangatiratanga and kaitiakitanga by Manawhenua Iwi in accordance with tikanga Māori; and

(iii) provide Ngāti Tama ki Te Tauihu and other Manawhenua Iwi with an opportunity to partner with it.

(c) To assist to achieve subclause (a), in exercising any powers under section 30(1)(e) and (f) of the Act, the Council must:

(i) when preparing any proposed policy statement or proposed plan affecting or pertaining to Te Waikoropupū Springs or Wharepapa Arthur Marble Aquifer or Contributing Groundwaters or Contributing Surface Waters have particular regard to any current cultural health monitoring report provided to the Council by Manawhenua Iwi; and

(ii) in making decisions as to the notification, limited notification or non-notification of consent applications for discharge permits or water permits in relation to or affecting Te Waikoropupū Springs duly consider the interests in accordance with tikanga Māori of Ngāti Tama ki Te Tauihu and other Manawhenua Iwi.

(d) To assist to achieve subclause (a), the Council must undertake regular monitoring for the purposes of clauses 8 and 9 and make such information publicly available within reasonable timeframes.

(e) Subject to achieving subclause (a), any exercise of powers under section 30(1)(e) and (f) of the Act must recognise and encourage sound primary production practices in accordance with an ethic of stewardship.

(f) No power under section 30(1)(e) and (f) of the Act may be exercised in relation to Te Waikoropupū Springs or Wharepapa Arthur Marble Aquifer or Contributing Groundwaters or Contributing Surface Waters except in accordance with clauses 8 and 9.

7 Notification of proposals to ensure no inconsistency

To assist to achieve the purposes of this Order, the Council must use its best endeavours to notify any proposed policy statement and proposed plan that affects land or freshwater in the WAMARA or the Waingaro catchment by no later than 31 December 2024.

8 Restrictions and duties as to water quality

(a) From the commencement date, no resource consent may be granted to authorise and no rule may permit the use of water or any point source or diffuse discharge in the WAMARA of any contaminant into water (and onto land in circumstances in which it may enter water) that would be likely to cause or contribute to:

(i) any increase in the concentration of $NO_3 – N$ in the WAMARA until the five year rolling median concentration of NO_3-N in the Main Spring and Fish Creek Springs has remained at not more than 0.41 mg/l (or of any lower limit as may be specified in a regional plan under subclause (f)) for a continuous period of not less than five years; or

(ii) from 1 January 2038, any exceedance of 0.41 mg/l. in the five year rolling median concentration of NO_3-N (or of any lower limit as may be specified in a regional plan under subclause (f)).

(b) From the commencement date, no resource consent may be granted to authorise and no rule may permit the use of water or any point source or diffuse discharge in the WAMARA of any contaminant into water (and onto land in circumstances in which it may enter water) that would be likely to cause or contribute to any concentration of DRP in the Main Spring or Fish Creek Spring in excess of 0.005 mg/l.

(c) From the commencement date, no resource consent may be granted to authorise and no rule may permit the use of water or any point source or diffuse discharge in the WAMARA of any contaminant into water (and onto land in circumstances in which it may enter water) that would be likely to cause or contribute to:

(i) any reduction in the fifth percentile DO saturation in the Main Spring below 45%; or

(ii) any reduction in the water clarity in the Main Spring below a median value of 72 metres or a fifth percentile value of 68 metres.

(d) For the purposes of s88(3) of the Act, in respect to any application for a resource consent to which any of subclauses (a) to (c) apply, relevant information for assessment of whether the application is incomplete includes whether or not the application includes an assessment in regard to the cultural health or hauora of Te Waikoropupū Springs as identified in any cultural health monitoring report or in consultation with Manawhenua Iwi.

(e) The Council must:

(i) ensure that the relevant regional plan assists to implement subclauses (a) to (c) and achieve clause 6(a); and

(ii) ensure that, from 1 January 2038, the concentration of NO_3-N in the Main Spring and Fish Creek Springs does not exceed 0.41 mg/l or such lower limit as may be specified in the regional plan.

(f) For the purposes of subclause (a) and clause 6(a), the Council may, without limitation, include in the relevant regional plan provisions:

(i) to prescribe a NO_3-N limit lower than 0.41 mg/l; or

(ii) to achieve stepped or incremental reductions of NO_3-N in order that the concentration of that attribute in Te Waikoropupū Springs from 1 January 2038 does not exceed 0.41 mg/l or such lower limit as may be prescribed by the plan.

(g) If the concentration of NO_3-N in Te Waikoropupū Springs exceeds 0.44 mg/l at any time prior to 1 January 2038 or thereafter exceeds 0.41 mg/l (or at any time exceeds any lesser NO_3-N limit as may be prescribed in a regional plan), the Council must:

(i) duly investigate potential and likely causes of that exceedance, including with the assistance of both independent technical and mātauranga Māori experts; and

(ii) take such action as is practicably available in the exercise of its relevant powers power under section 30(1)(e) and (f) of the Act to rectify that exceedance as soon as practicable.

(h) For the purposes of this clause, in the case of NO_3-N and DRP, specified concentration limits are deemed not to be breached except where there are seven or more exceedances of the relevant limit as measured and calculated under subclause (i) recorded in monthly data in any 12-month period.

(i) For the purposes of this clause, the Council must regularly and without delay undertake all measurements and calculations as may be necessary, applying the following methods:

(i) calculations of NO_3-N concentrations must be as a five-year rolling median of monthly samples (based upon the latest 60 monthly samples);

(ii) calculations of DRP concentrations must be as a five-year rolling median of monthly samples (based upon the latest 60 monthly samples);

(iii) calculations of DO saturation and water clarity are to be by use of datasets collected over a consecutive 3-month period from October to January, the first such datasets being collected prior to the expiry of the first anniversary of the commencement date and subsequent datasets being collected at not more than five yearly intervals thereafter;

(iv) measurements of DO must be continuous measurements taken as close as practicable to the Main Spring vent (and, subject to any necessary access agreement or authorisation preferably directly above the Main Spring vent);

(v) measurements for water clarity must be by use of a calibrated transmissometer suitable for measuring high clarity water or other suitable advanced instrumentation.

9 Restrictions and duties as to flow allocation

(a) In this clause:

(i) **allocation limit** means a maximum allowable combined take of surface water and groundwater of:

A. 766 litres per second; or

B. any lesser volume per second as may be prescribed by a regional rule in accordance with subclause (g);

(ii) **minimum flow** means a minimum flow of water from the Main Spring of:

A. 6895 litres per second; or

B. any greater flow per second as may be prescribed by a regional rule in accordance with subclause (g).

(b) Subclause (c) applies to any take of surface water or groundwater:

(i) from the WAMARA; or

(ii) unless a regional plan provides otherwise, from the Waingaro catchment.

(c) No resource consent may grant and no rule may permit any take of surface water or groundwater that would cause or contribute to:

(i) the allocation limit being exceeded; or

(ii) the flow of water from the Main Spring being less than the minimum flow.

(d) A regional rule may prescribe that subclause (c) shall cease to apply to the Waingaro catchment provided that the Council has duly satisfied itself, on the basis of independent peer reviewed expert assessment, that it will not compromise achievement of clause 6(a) or clause 8.

(e) The Council must ensure that for all new takes of water that contribute to the flow at Te Waikoropupū Springs:

(i) the take is controlled through a cease take regime that may include rationing to ensure that the flow from the Main Spring is equal to or greater than the minimum flow at all times; and

(ii) there is a reasonable need to take that water instead of taking water from a source that does not contribute to that flow.

(f) To better achieve clause 6(a), a regional rule may prescribe that:

(i) the allocation limit be a lesser volume of water than 766 litres per second; or

(ii) the minimum flow be a greater volume of water than 6895 litres per second.

10 Exemptions for Cobb Hydro-Electric Power Scheme

(a) In this clause, **Cobb Hydro-Electric Power Scheme** means the hydroelectric power scheme, and all associated structures and activities (including the Cobb Reservoir), located on the Cobb River and Tākaka River, including any enhancements or modification of or development or material changes to that scheme within the Cobb River or adjacent catchments, and any new works, structures and activities associated with those enhancements, or modifications, development or material changes.

(b) Nothing in this Order affects or restricts:

(i) the exercise of any resource consent for the Cobb Hydro-Electric Power Scheme in effect as at the commencement date; or

(ii) the grant or variation of any resource consent for the continued operation or maintenance of the Cobb Hydro-Electric Power Scheme, provided that the consent remains on the same or similar conditions as those in force as at the commencement date; or

(iii) the making or changing of any provision (including any objective, policy or rule) of a regional plan authorising the continued operation or maintenance of the Cobb Hydro-Electric Power Scheme, provided the provision made or changed is the same or similar in its authorising effect to any objective, policy, or rule in force or resource consent in effect as at the commencement date.

(c) Nothing in this Order affects or restricts the grant or variation of any resource consent authorising the development, or material changes to the operation, configuration or maintenance, of the Cobb Hydro-Electric Power Scheme, provided that:

(i) the flow of groundwater from Te Waikoropupū Springs would not be reduced; and

(ii) the water quality in the Wharepapa Arthur Marble Aquifer and Te Waikoropupū Springs would not be reduced; and

(iii) the outstanding characteristics and values in clause 5 are preserved.

(d) Nothing in this order affects or restricts the making of an objective, policy, or rule in a regional plan authorising the development, or material changes to the operation, configuration or maintenance, of the Cobb Hydro-Electric Power Scheme, provided that:

(i) the flow of groundwater from Te Waikoropupū Springs would not be reduced; and

(ii) the water quality in the Wharepapa Arthur Marble Aquifer and Te Waikoropupū Springs would not be reduced; and

(iii) the outstanding characteristics and values in clause 5 are preserved.

11 Exemptions for the NZ King Salmon hatchery

(a) In this clause **hatchery** mean the hatchery in the vicinity of Te Waikoropupū Springs which is operated by the New Zealand King Salmon Co. Limited at the commencement date.

(b) Nothing in this Order affects or restricts:

(i) the exercise of any resource consent for the hatchery in effect as at the commencement date; or

(ii) the exercise of any activity conducted in the course of the hatchery's operations which was lawfully and ordinarily conducted as at the commencement date; or

(iii) the granting or variation of any resource consents for the continued operation or maintenance of the hatchery, provided that any resource consents are made subject to similar terms and conditions to those applying under any resource consent authorising the hatchery as at the commencement date; or

(iv) the making of an objective, policy, or rule in a regional plan for the continued operation or maintenance of the hatchery, provided that the hatchery remains authorised (by the regional plan or resource consent) on substantially the same terms as at the commencement date.

(c) Nothing in this Order affects or restricts the granting or variation of any resource consent authorising the hatchery or any material change to the hatchery's operation, configuration or maintenance, provided that:

(i) the flow of groundwater from Te Waikoropupū Springs would not be reduced; and

(ii) the water quality in the Wharepapa Arthur Marble Aquifer and Te Waikoropupū Springs would not be reduced; and

(iii) the outstanding characteristics and values in clause 5 are preserved.

(d) Nothing in this Order affects or restricts the making of an objective, policy, or rule in a regional plan authorising the development, or material changes to the hatchery's operation, configuration or maintenance, provided that:

(i) the flow of groundwater from Te Waikoropupū Springs would not be reduced; and

(ii) the water quality in the Wharepapa Arthur Marble Aquifer and Te Waikoropupū Springs would not be reduced; and

(iii) the outstanding characteristics and values in clause 5 are preserved.

12 Exemptions for dairy sheds

(a) In this clause **reasonable water demand requirements** means the calculated water demand requirements of a dairy shed within the WAMARA as assessed over the period from 1 July 2018 to 30 June 2022.

(b) Nothing in this Order affects or restricts any of the following for the take or use of surface water or groundwater for the reasonable water demand requirements of any dairy shed that was in operation at 31 January 2018:

(i) any grant or variation of any resource consent; or

(ii) any transfer of any resource consent; or

(iii) any grant of any other authorisation.

(c) For the avoidance of doubt, nothing in this clause restricts a regional plan rule requiring that dairy shed water be used more efficiently than the volume calculated in accordance with this clause.

13 Scope of Order

(a) Nothing in this Order affects or restricts:

(i) any resource consent granted prior to the commencement date until the expiry or lapse of that consent provided that the consent remains subject to the same or similar terms and conditions as apply as at the commencement date; or

(ii) any activity that was both authorised under section 20A or section 124 of the Act and lawfully established prior to the commencement date; or

(iii) any other activity in respect of the waters of Te Waikoropupū Springs or of Wharepapa Arthur Marble Aquifer or the Contributing Surface Waters and the Contributing Groundwaters that was a lawful use under the Act prior to the commencement date.

(b) Nothing in clause 8 or clause 9 affects or restricts any regional policy statement or plan from enabling the continuation of activities as described in clause 13(a)(ii) and (iii) despite any water quality limit in this Order being exceeded, provided that those activities:

(i) do not increase their contribution of NO_3-N or DRP to the WAMARA above that occurring from those activities as at the date of commencement of the Order; and

(ii) demonstrate stepped or incremental reductions in loads/concentrations from the WAMARA.

(c) Nothing in this Order prevents the grant of a resource consent that would otherwise contravene clause 8 or clause 9 provided that:

(i) the consent authority is satisfied that the exercise of the consent would not compromise the purposes of this Order; and

(ii) the consent is justified by exceptional circumstances and is in accordance with the purpose of the Act or is for any of the following purposes:

A. protection or restoration or rehabilitation or enhancement of water quality, ecosystem services, karst systems, aquifer processes, water quantity, cultural, spiritual and tikanga Māori values, wildlife and aquatic habitats or any related research; or

B. construction, removal, maintenance or protection of any road, ford or bridge or any network utility operation (as defined in section 166 of the Act); or

C. flood management works or soil conservation or related matters undertaken pursuant to the Soil Conservation and Rivers Control Act 1941 or the Act; or

D. protection of human or animal health; or

E. hydrological or water quality investigations or monitoring; or

F. domestic onsite wastewater systems, subject to compliance with normal industry practice in New Zealand; or

G. application of herbicides for the control of pest plants; or

H. necessary maintenance of works and structures.

(d) Nothing in this Order limits:

(i) section 14(3)(b) of the Act relating to the taking or use of water for an individual's reasonable domestic needs or for the reasonable needs of an individual's animals for drinking water; or

(ii) section 14(3)(e) of the Act relating to the taking or use of water for emergency or training purposes in accordance with section 48 of the Fire and Emergency New Zealand Act 2017.

14 Amendment of this Order

(a) It is acknowledged that this Order is made on the basis of presently limited scientific knowledge as to the nature of the karst aquifer system and associated effects on Te Waikoropupū Springs.

(b) Therefore, for the purposes of section 216 of the Act, technical amendments to this Order may be required from time to time to better achieve its purpose.

Schedule

Acknowledgement

Ngāti Tama ki te Waipounamu Trust a trust entity of Ngāti Tama ki te Tauihu (together with Andrew Yuill) was a joint applicant for this Water Conservation Order. The following statement is an acknowledgement, with the support of Tasman District Council, of relevant background to the making of the application.

(i) Ngāti Tama ki Te Tauihu claim descent from Tamaariki who arrived in Aotearoa on the Tokomaru waka from Hawaiki and established settlements in Northern Taranaki.

(ii) In the nineteenth century, Ngāti Tama ki Te Tauihu under Te Pūoho ki Te Rangi and other Ngāti Tama rangātira were instrumental in establishing permanent settlements, including pā and kainga in Te Tauihu through raupatū (conquest) and intermarriages.

(iii) Te Puna Waiora o Te Waikoropupū is a wāhi tapu and one of the most sacred places in Mohua.

(iv) The vitality of Te Puna Waiora o Waikoropupū is synonymous with the famed taniwha, Huriawa, who symbolises the purity and pristineness of the water across the region. Huriawa ensures that the integrity of sub-terranean aquifers in the region continue to flow as a source of sustenance to the land and the people. Huriawa also regulates the flow of freshwater out to sea.

(v) The health and wellbeing of Te Puna Waiora o Waikoropupū, Huriawa, and Ngāti Tama, are inextricably linked.

(vi) In April, 2013, Ngāti Tama ki Te Tauihu signed a Deed of Settlement with the Crown in recognition of the impacts of Crown actions against Ngāti Tama ki Te Tauihu and breaches against Te Tiriti o Waitangi. The Deed of Settlement provided for Te Korowai Mana (an overlay classification, as set out in Ngāti Kōata, Ngāti Rārua, Ngāti Tama ki Te Tauihu, and Te Ātiawa o Te Waka-a-Māui Claims Settlement Act 2014) with protection principles for Te Puna Waiora o Te Waikoropupū, to acknowledge and recognise, the traditional, cultural, spiritual and historical values of Ngāti Tama with Te Waikoropupū. The protection principles direct the Minister of Conservation to avoid harm to, or the diminishing of, Ngāti Tama values for Te Puna Waiora o Te Waikoropupū; and associated provisions in the Ngāti Kōata, Ngāti Rārua, Ngāti Tama ki Te Tauihu, and Te Ātiawa o Te Waka-a-Māui Claims Settlement Act 2014 apply to the Minister, the Director-General of Conservation, the New Zealand Conservation Authority and Conservation Boards.

(vii) As kaitiaki, Ngāti Tama ki Te Tauihu continue to uphold its kinship relationship with Te Puna Waiora o Te Waikoropupū, through Huriawa.

(viii) The cultural wellbeing of Ngāti Tama ki Te Tauihu and the protection of this wāhi tapu are fundamental to Ngāti Tama ki Te Tauihu identity. If the health of the Puna is pristine wai-ora, then it will be reflected in the health and wellbeing of the ahi-kaa-roa whānau o Ngāti Tama ki Te Tauihu.

(ix) Therefore, the making of the application for this Order reflects Ngāti Tama values and principles with respect to, and the immense natural, cultural, historical, traditional and spiritual importance of, Te Puna Waiora o Te Waikoropupū and Wharepapa Arthur Marble Aquifer to Ngāti Tama ki Te Tauihu.

Figure 1

Wharepapa Arthur Marble Aquifer Recharge Area (WAMARA)

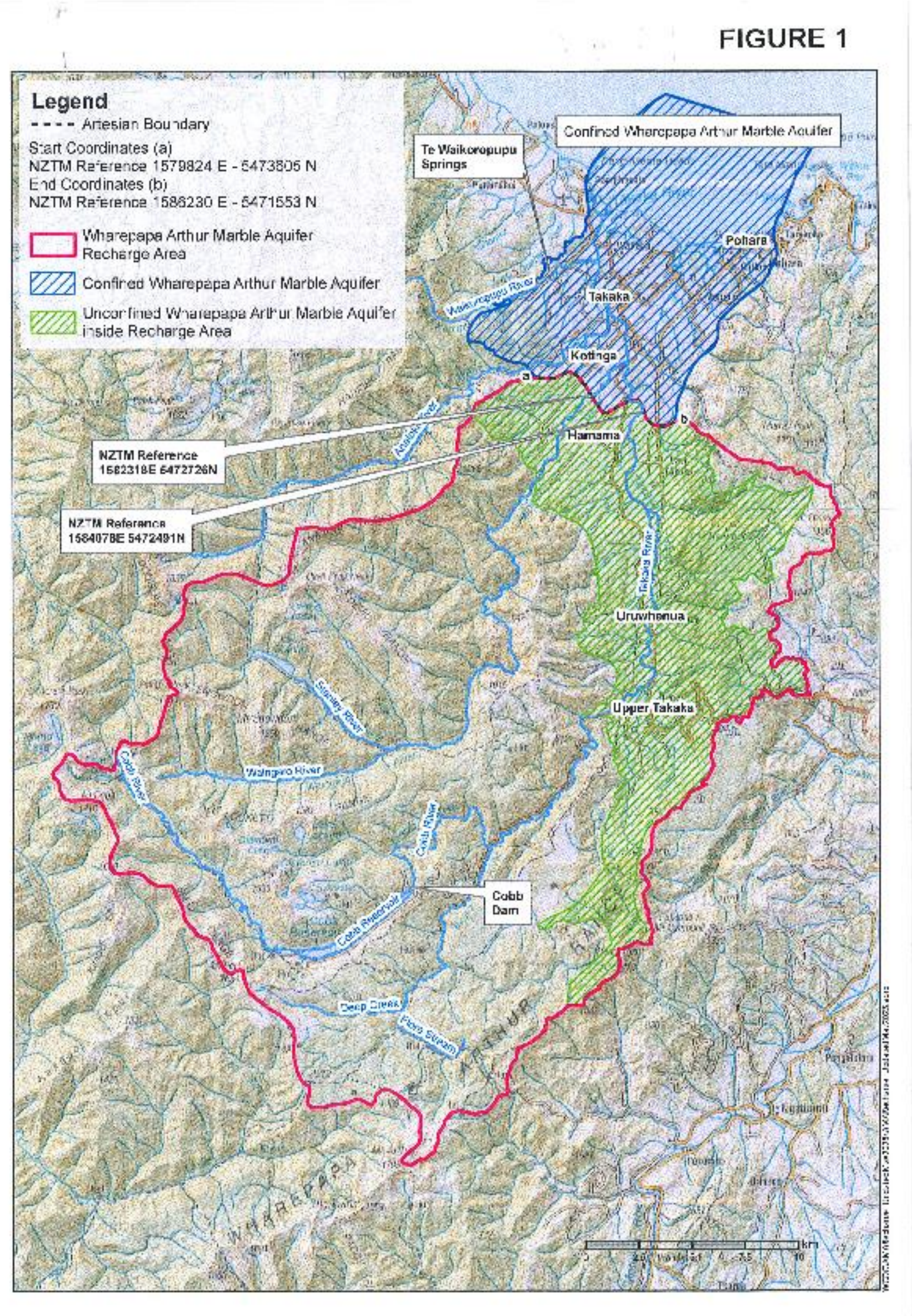


Figure 2

Te Waikoropupū Springs

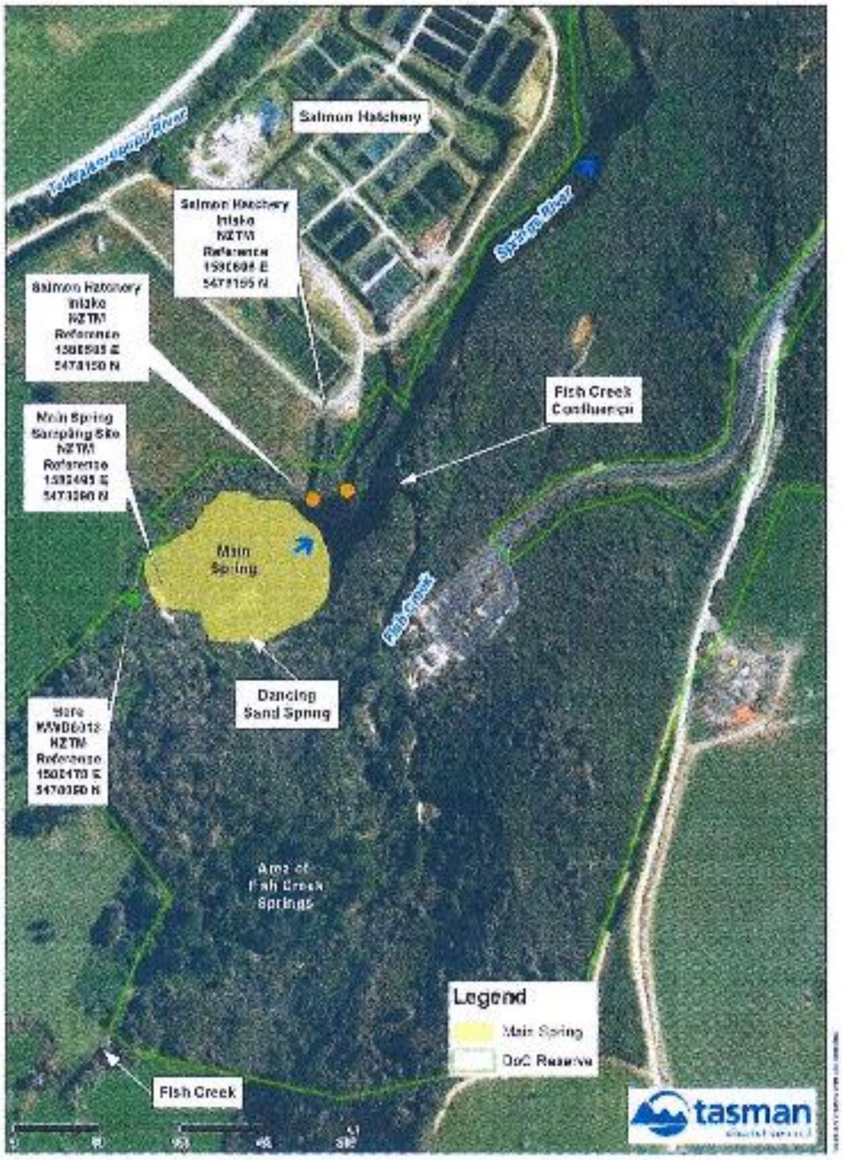


Figure 3

Contributing Groundwaters and Contributing Surface Waters

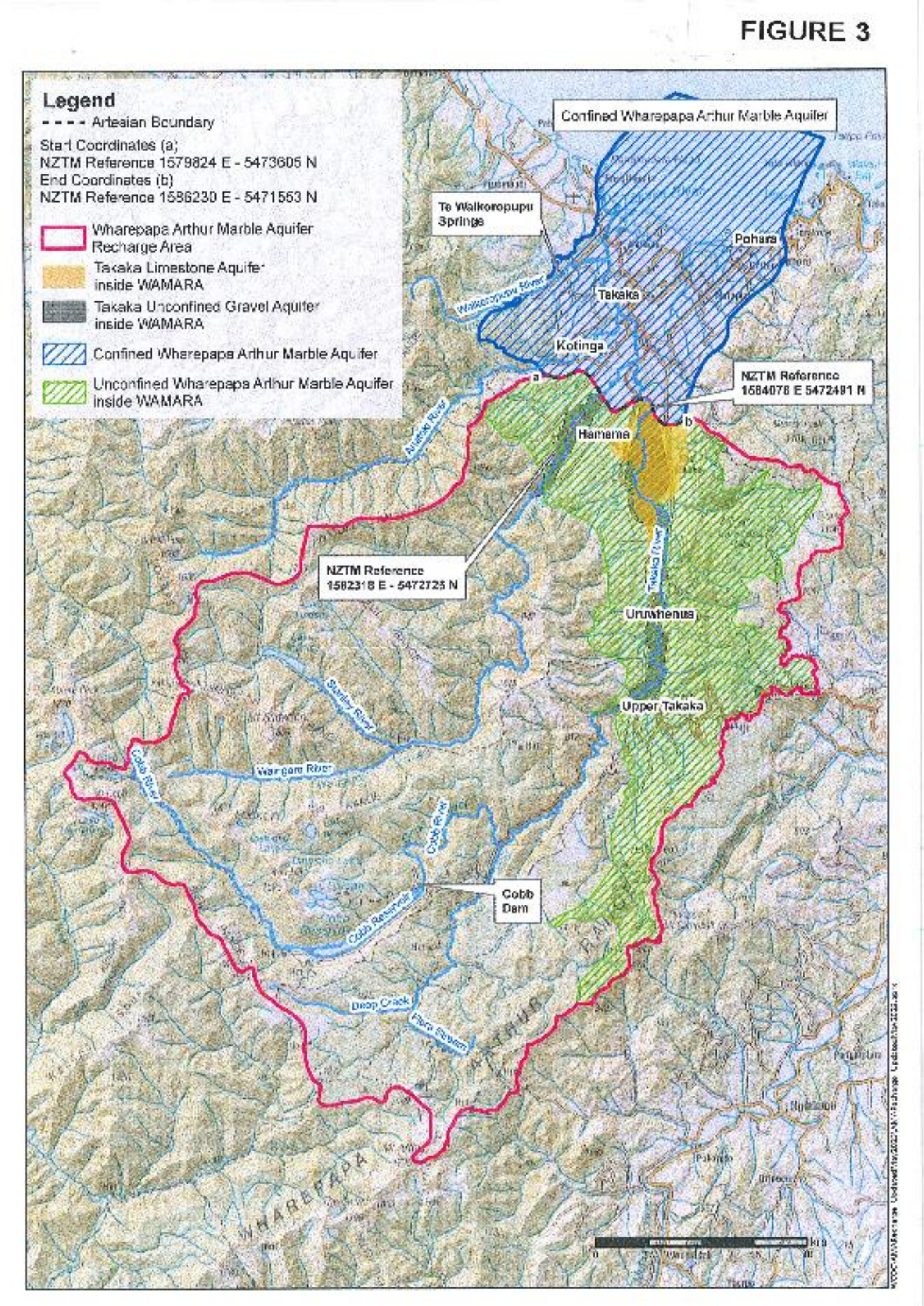
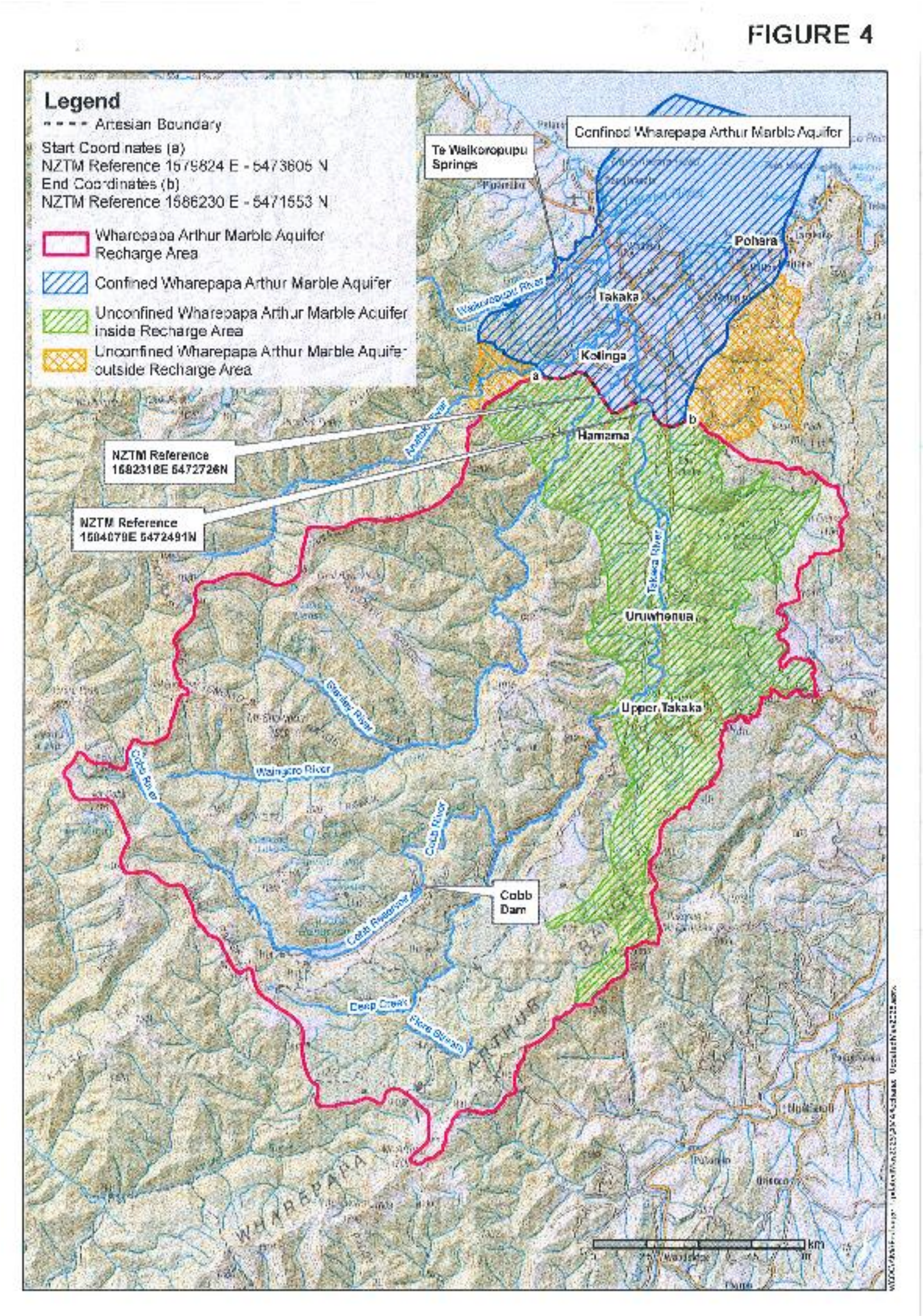


Figure 4

Wharepapa Arthur Marble Aquifer



ANNEXURE 2

List of witnesses and parties

Experts and other witnesses called by the applicants and supporting parties

Client or representative witnesses

Te Ahu Rei (applicants)

Andrew Yuill (applicants)

Leanne Manson (applicants)

Makere Chapman (applicants)

Kevin Moran (SOS)

Marion Sanson (SOS)

Andrew Lamason (DG) (evidence entered by consent)

Tikanga Māori and cultural health

Ms Margie Little (applicants)

Ms Kura Stafford (applicants)

Expert witnesses

Dr Graham Fenwick, aquatic and groundwater ecology (applicants, SOS)

Ms Kate McArthur, freshwater ecology (applicants, DG)

Professor Paul Wlliams, hydrology and groundwater systems (applicants, SOS)

Dr Donald Mead, NO_3-N and monitoring data interpretation (FOGB)

Ms Alison Dewes, farm systems (SOS)

Experts or other witnesses called by the Farming Interests

Client or representative witnesses

Cherrie Chubb

Corrigan Sowman

Expert witnesses

Ms Mirka Langford, scientists and farm systems

Dr Jacqueline Rowarth, soils, NO_3-N management and irrigation

Mr Andrew Fenemor, hydrology and water quality and policy

Mr Julian Weir, groundwater flow modelling

Mr Michael Copeland, economist (evidence entered by consent)

Experts or other witnesses called by TDC

Client or representative witnesses

Dennis Bush-King

Experts

Dr Roger Young, freshwater ecology

Ms Magali Moreau, groundwater geochemistry

Dr Chris Hickey, ecotoxicology

Mr Joseph Thomas, geohydrology

Dr Michael Stewart, groundwater and surface water hydrology and geohydrology

Planning experts in respect of which evidence was filed

In addition, briefs of evidence and JWS were filed for the following planning experts but at the direction of the Court these witnesses were not called: Mr Murray Brass (DG), Mr Gerard Willis (Farming Interests), Mr Matthew McCallum-

Clark (TDC).

Schedule – List of submitters

ENV-2020-CHC-19	The New Zealand King Salmon Company Limited
ENV-2020-CHC-20	Manawa Limited (formerly Trustpower Limited)
ENV-2020-CHC-22	A Reilly
ENV-2020-CHC-23	Upper Takaka Irrigators
ENV-2020-CHC-24	R & C Chubb
ENV-2020-CHC-26	David Scotland Limited
ENV-2020-CHC-27	Save Our Springs Aotearoa New Zealand Incorporated
ENV-2020-CHC-28	Ngāti Tama ki Te Waipounamu Trust & Andrew Yuill
ENV-2020-CHC-29	Tasman District Council

REPORT AND RECOMMENDATION TO THE MINISTER

for the making of a Water Conservation Order for Te Puna Waiora o Te Waikoropupū and Wharepapa Arthur Marble Aquifer

Part 2
Evidential findings and determinations on legal principles arising in the inquiry

Figure A

The Main Spring basin at Te Waikoropupū

Figure B

Dancing Sand Spring

Table of contents

Index to Figures referred to in Part 2

[249] Figures referred to in Part 2 (sections A – E) can be found as follows:

(a) **refer to Part 1 Annexure 1** for Figures 1 – 4, depicting Wharepapa Arthur Marble Aquifer Recharge Area (WAMARA) (Fig. 1), Te Waikoropupū Springs (Fig. 2), Contributing Groundwaters and Contributing Surface Waters (Fig. 3) and Wharepapa Arthur Marble Aquifer (Fig. 4);

(b) **refer to the cover page for this Part 2** for Figure A (the Main Spring basin at Te Waikoropupū) and Figure B (Dancing Sands Spring at Te Waikoropupū).

Some terms used in Part 2

[250] For convenience, in this Part 2, we use a range of acronyms that parties also used to refer to relevant parts of the catchment. In addition to those used in Part 1 of this Report, these include:

- **SOI** to refer to the Southern Oscillation Index in relation to rainfall and prevailing wind patterns;
- **TLA** to refer to the Tākaka Limestone Aquifer;
- **TUGA** to refer to the Tākaka Unconfined Gravel Aquifer;
- **WAMA** to refer to the Wharepapa Arthur Marble Aquifer.

Section A

The Tākaka River Catchment

A.1 Purpose of Section A

[251] Section A briefly describes land use activities that contribute NO_3-N to Te Waikoropupū Springs and provides background to the history of farming in the Tākaka River Catchment. It then provides an overview of the physical characteristics of the catchment. It describes the geology, ground and surface waters and the different sources that feed the Springs, annual rainfall, surface water quality and groundwater ecosystems.

[252] Section A also sets out our findings in relation to disputed boundaries.

A.2 General description

[253] Refer to Figure 1 of the recommended WCO in Annexure 1 for a map of the catchment.

[254] The catchment covers an area of 940 square kilometres (km^2) and is of rugged topography with steep ranges to the east, south and southwest with narrow valleys that broaden towards Tākaka. A significant amount of land (680 km^2 or 72%) in the upper catchments comprises the Kahurangi National Park and the Tākaka Hill Forest Park which are administered by the Department of Conservation[45] and largely covered in trees and/or regenerating bush.

[255] The area of the WAMARA, the catchment that recharges the groundwater system feeding Te Waikoropupū, is 714 km^2.[46] Around 90% of the treed areas referred to above drain to the Springs. Dr Stewart, a geohydrologist engaged by

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45 Thomas, EIC at [49].

46 JWS Nitrate dated 22 June 2022.

TDC, predicted those areas to be the main source of NO_3-N affecting Spring water quality. We received only limited evidence about past burning of the forest (namely that it occurred prior to the 1930s and by the 1970s, much of the Pikikirunga Range was reverting back to native scrub and bush).[47]

[256] Some parties and experts identified dairy farming in the Tākaka Valley Floor as the main contributing source of NO_3-N to Te Waikoropupū. We received conflicting evidence on areas of farmland. However, for the purposes of our recommendation, we have adopted an area of 65 ha, based on up-to-date information provided by TDC. Approximately two-thirds of this is in the Valley Floor and the rest in the Upper Tākaka and Waitui area, generally as shown on Figure E in section A.3 below.

[257] Mrs Chubb advised us that dairying has been a pioneering industry in Golden Bay since the first butter factory was established in Tākaka in 1894. She also advised that her family's farming connections in the Bay stretch back to the 1860s when three siblings settled at Uruwhenua.[48]

[258] Mr Sowman advised that his family has farmed in Uruwhenua since purchasing the original property of 50 ha in 1952 and that his grandmother's family, the Mansons, settled in Tākaka in the late 1800s.[49] Ms Langford is a senior resource scientist for land use and soils at TDC. However, she gave evidence as an independent expert called by the Farming Interests. She stated that all 15 farms remaining in the catchment are family farms that have been in the same family for two to six generations.[50]

[259] The town of Tākaka is outside the WAMARA. While its wastewater treatment plant is located inside the WAMARA and there are around 250 septic

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47 Sowman, EIC at [3.11].
48 Chubb, EIC at [3.2] and [3.1].
49 Sowman, EIC at [3.1].
50 Langford, EIC at [3.2].

tanks discharging nitrogen, the combined discharges contribute approximately 2% of the total NO_3-N load reaching Te Waikoropupū, as discussed in section B.

[260] Other than from treed and farming areas, we are satisfied on the basis of the land use evidence provided on behalf of TDC, that there are no other land uses within the WAMARA that contribute nitrogen in sufficient quantities to potentially adversely affect the values of Te Waikoropupū. We are also satisfied that rainfall in the catchment does not contain NO_3-N in quantities that could adversely affect those values.[51]

A.3 Geology

General overview

[261] We do not attempt to describe the complex geology of the WAMARA in any detail as that is not necessary for the purposes of our report. Instead, we include brief descriptions of aspects of most relevance to our recommended WCO. That is particularly the geologic units in each of the three water source areas that contribute flows to Te Waikoropupū: the Karst Uplands, Upper Tākaka and the Tākaka Valley Floor ('Valley Floor').

[262] The WAMA underlies these source areas and is the largest karst aquifer in New Zealand. To the south, it operates as an unconfined aquifer or recharge area for Te Waikoropupū, and to the north as a confined aquifer.[52]

[263] Figure C1 shows the geology of the catchment as a whole.[53] Figure C2 shows cross-sections in the locations shown on Figure C1. The lower cross-section in that figure, B, is in the unconfined part of the WAMA, where rain feeds

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51 Yuill, Transcript at p 179; Mead, Transcript at p 325.

52 Thomas, EIC, footnote 2: An Unconfined Aquifer is one where the permeable rock units are open to receive water from the surface i.e. in direct contact with the atmosphere. A Confined Aquifer is one where the permeable rock units are overlain by impermeable rock.

53 Thomas, EIC Figure 3.

either the Tākaka or Waingaro Rivers or the WAMA after passing through sands and gravels, before it becomes confined some distance to the north. The top cross-section, A, shows the geology directly under Te Waikoropupū, where impermeable Motupipi Coal Measures overlay marble and confine the WAMA, and where artesian pressure forces groundwater through a thin part of the coal measures to feed the Springs.

Figure C1

Map of geology of the Wharepapa Arthur Marble Aquifer

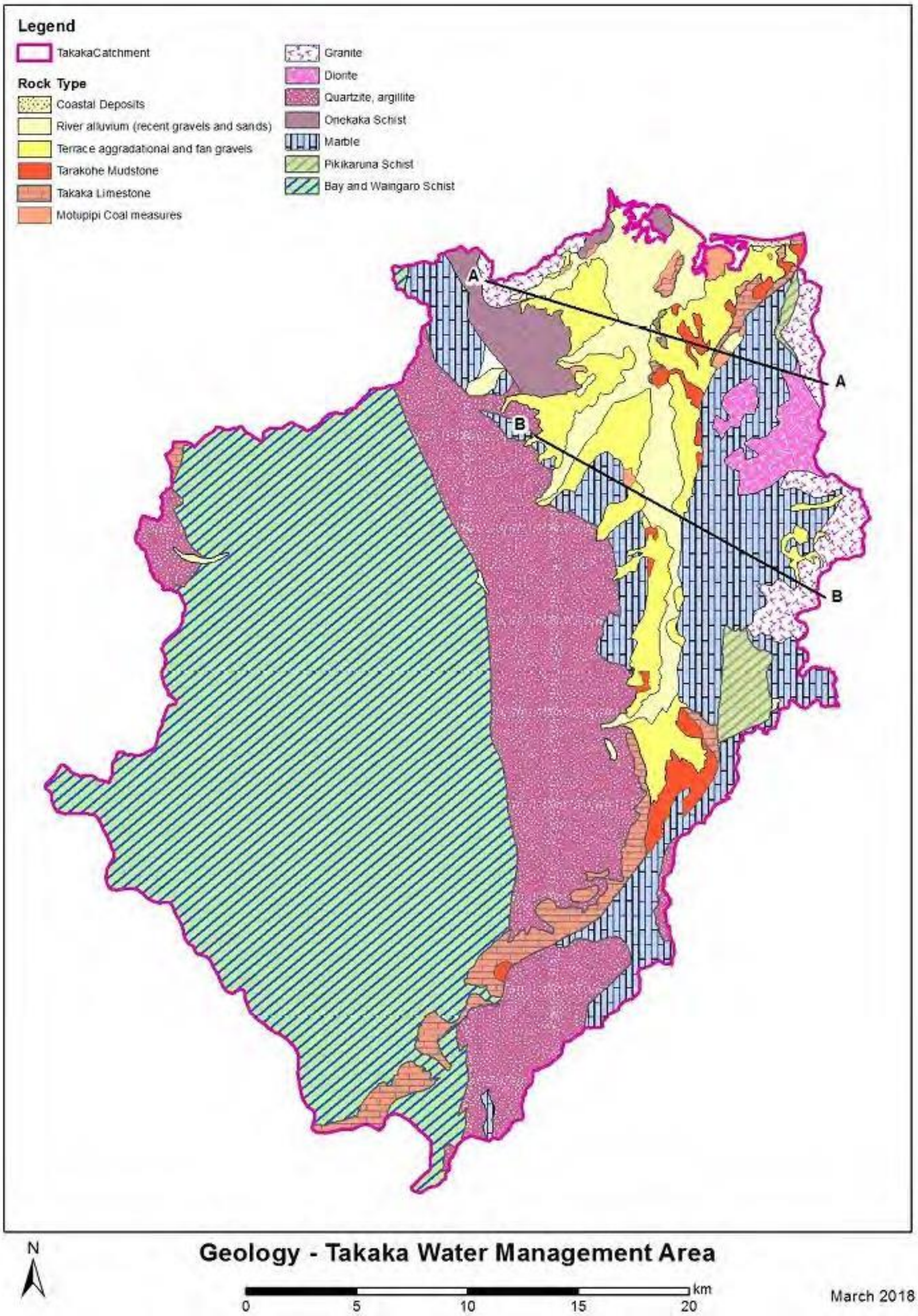
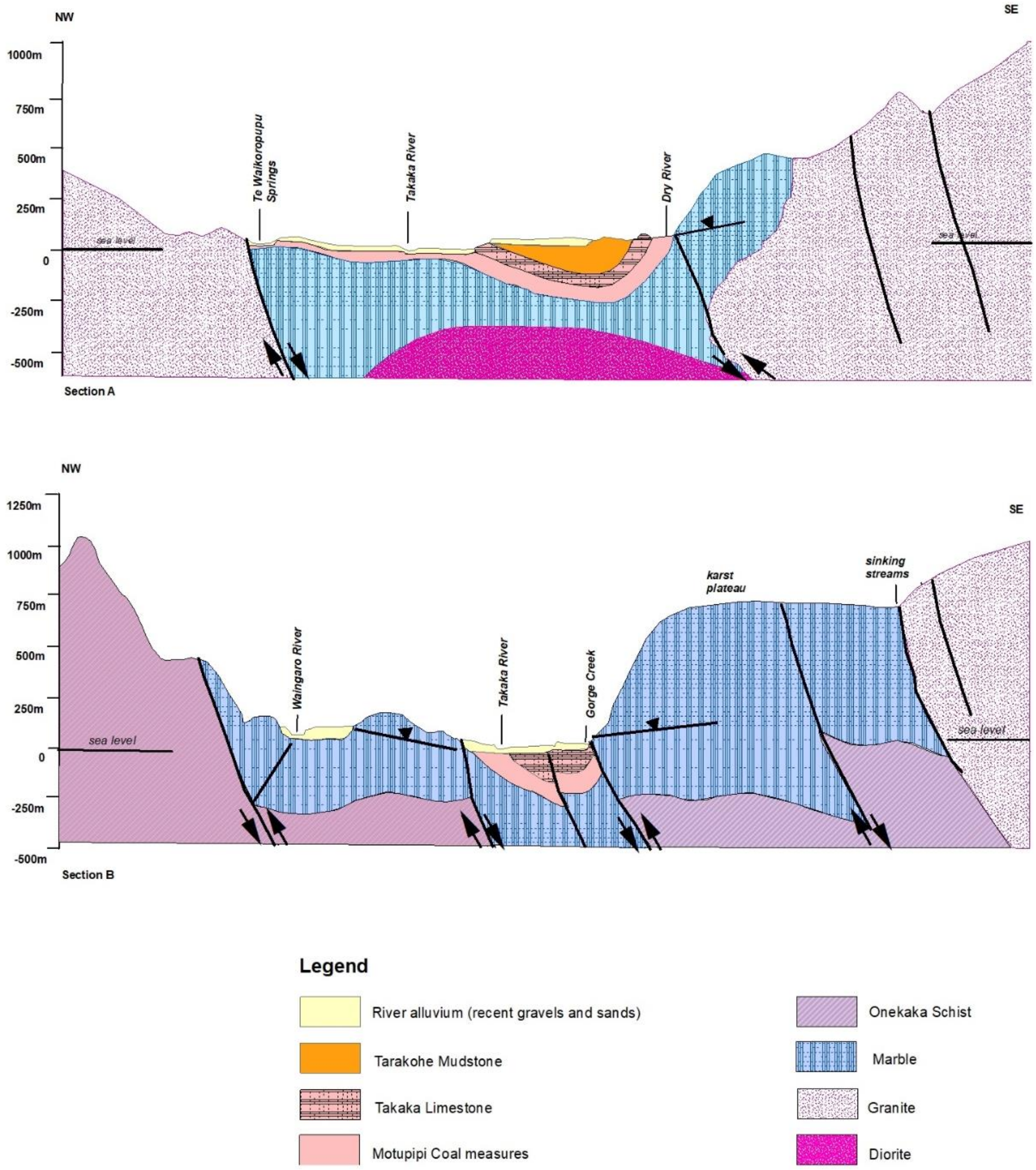


Figure C2

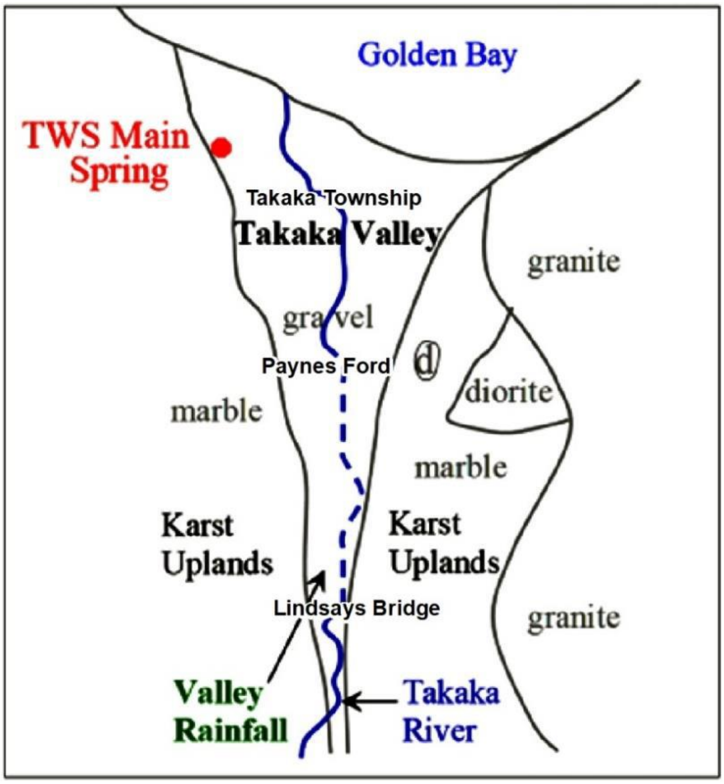
Cross-sections showing geology in the confined and unconfined parts of the Wharepapa Arthur Marble Aquifer



[264] Figure D[54] is a schematic showing the locations of the Karst Uplands on both sides of the Tākaka River. Figure E[55] shows the locations of Upper Tākaka and the Valley Floor (to the north of Upper Tākaka) as we refer to in this Part.

Figure D

Schematic map of the Tākaka Valley



54 Stewart, EIC, Figure 1.

55 Based on the JWS Modelling and Geohydrology and the JWS Nitrate, which were based on land use information provided by TDC in June 2022.

Figure E

Map showing Upper Tākaka and the Valley Floor to the north

Karst Uplands

[265] The term 'karst' refers to landscapes and associated hydrological systems developed in particularly soluble rocks such as limestone or, in its metamorphic form, marble. These rocks are composed chemically of calcium carbonate, which is readily dissolved in rainwater. The hallmark features of karst landscapes are sinkholes (dolines) at the surface, fluted rock outcrops, sinking streams, caves and large springs. The Arthur Marble varies from about 500 m to 1500 m in thickness, depending on location. It is often steeply dipping and is frequently faulted. In the Tākaka Valley it descends to well below sea level.[56]

56 Williams, EIC at [12] and [13].

Upper Tākaka

[266] The catchment of the Tākaka River (Upper Tākaka), before the river reaches Harwood, is on schist rock which is nearly impermeable. There is no significant groundwater contribution.[57] Surface water discharges to the Tākaka River system, from where large flows are lost into the Valley aquifer system downstream of Harwoods. That loss occurs in particular downstream of Lindsays Bridge.

Valley Floor

[267] Much of the Valley Floor is overlain by tens of metres of sands and gravels (up to 50 m thick).[58] Around Lindsays Bridge, the gravels are about 10 m thick. The gravels get thicker to the north (being 30 m to 40 m thick in the central part of Tākaka Township). Rain moves downwards through the gravels and in places flows through limestone before entering the WAMA.

A.4 Water resources feeding Te Waikoropupū

[268] Groundwater reaches Te Waikoropupū by way of a complex and incompletely understood combination of aquifers, rivers, streams and smaller springs that connect and interact. Professor Williams, who has particular expertise in karst geology, described the groundwater system as unusual in its complexity: the Springs being of large volume, artesian, tidal, having a sea water component, and a broad age spectrum. This is not known elsewhere in the Southern Hemisphere.[59]

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57 Stewart, Transcript at p 293.

58 Stewart and Thomas "A conceptual model of flow to the Waikoropupū Springs, NW Nelson, New Zealand, based on hydrometric and tracer (^{18}O, Cl, ^2H and CFC) evidence" (2008) Hydrology and Earth System Sciences 12, 1-19.

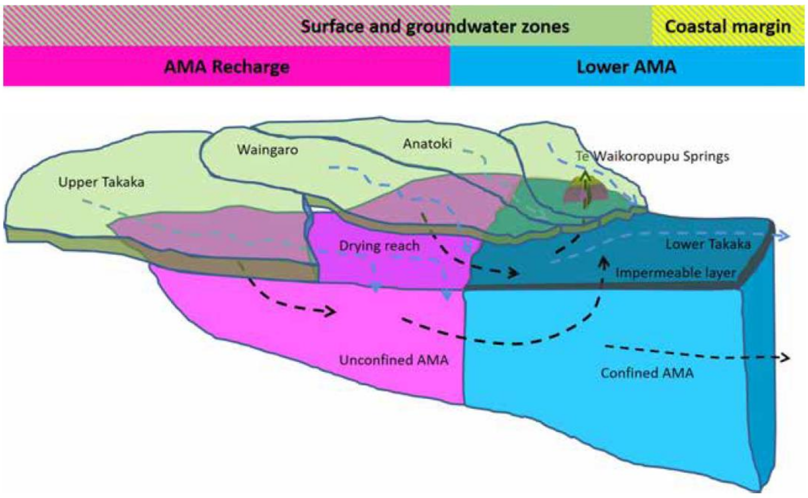
59 Williams, EIC at [9].

[269] As noted above, there are three main aquifers or groundwater bearing units in the catchment which are described as the WAMA, TLA and TUGA. The Tākaka River is the principal river draining the Tākaka Valley. It flows into Golden Bay and its major tributaries include the Cobb, Waingaro, Anatoki and Waikoropupū Rivers.[60] Again as noted above, the WAMARA is the recharge area for Te Waikoropupū.

[270] Figure F[61] is a schematic cross-section showing the broad inter-relationships between the different surface and groundwater resources.

Figure F

Schematic cross-section showing inter-relationships between the different water resources



A.5 Rainfall

[271] Rainfall was identified in the evidence as a major cause of leaching of NO_3-N from land uses. Given that and the explanation of its relationship with the SOI

60 Thomas, EIC at [34] and [48].

61 Figure 1 of the Tākaka Freshwater and Land Advisory Group Recommendations Report for freshwater management in the Tākaka Freshwater Management Unit, dated June 2019.

given by Dr Hickey,[62] we requested TDC to provide further information on rainfall records. Table 1 summarises the variability in rainfall at six monitoring sites in the WAMARA over the period 1989 to 2021. It shows the greatest percentage variability occurs at Upper Tākaka and Kotinga, just upstream and downstream of the main Valley Floor area used for farming.

Table 1
Variability and trends in annual rainfall in the WAMARA 1989 to 2021

Site	Location	Rainfall (mm)	
		Low	**High**
Hanging Rock	Upper Karst West	2,300	4,400
Little Devil	Upper Karst West	2,400	4,000
Happy Sams	Upper Karst West	2,300	4,300
Harwoods	Upper Tākaka	1,450	3,400
Kotinga	Valley Floor	1,300	3,000
Canaan	Upper Karst West	2,200	4,800

A.6 Surface water resources

Tākaka River

[272] As the main river in the catchment, the Tākaka River rises in Upper Tākaka, flows through the Valley Floor and discharges into Golden Bay. For context, we refer to Figure G from Mr Thomas' evidence showing the Tākaka River and main Valley rivers and tributaries.[63]

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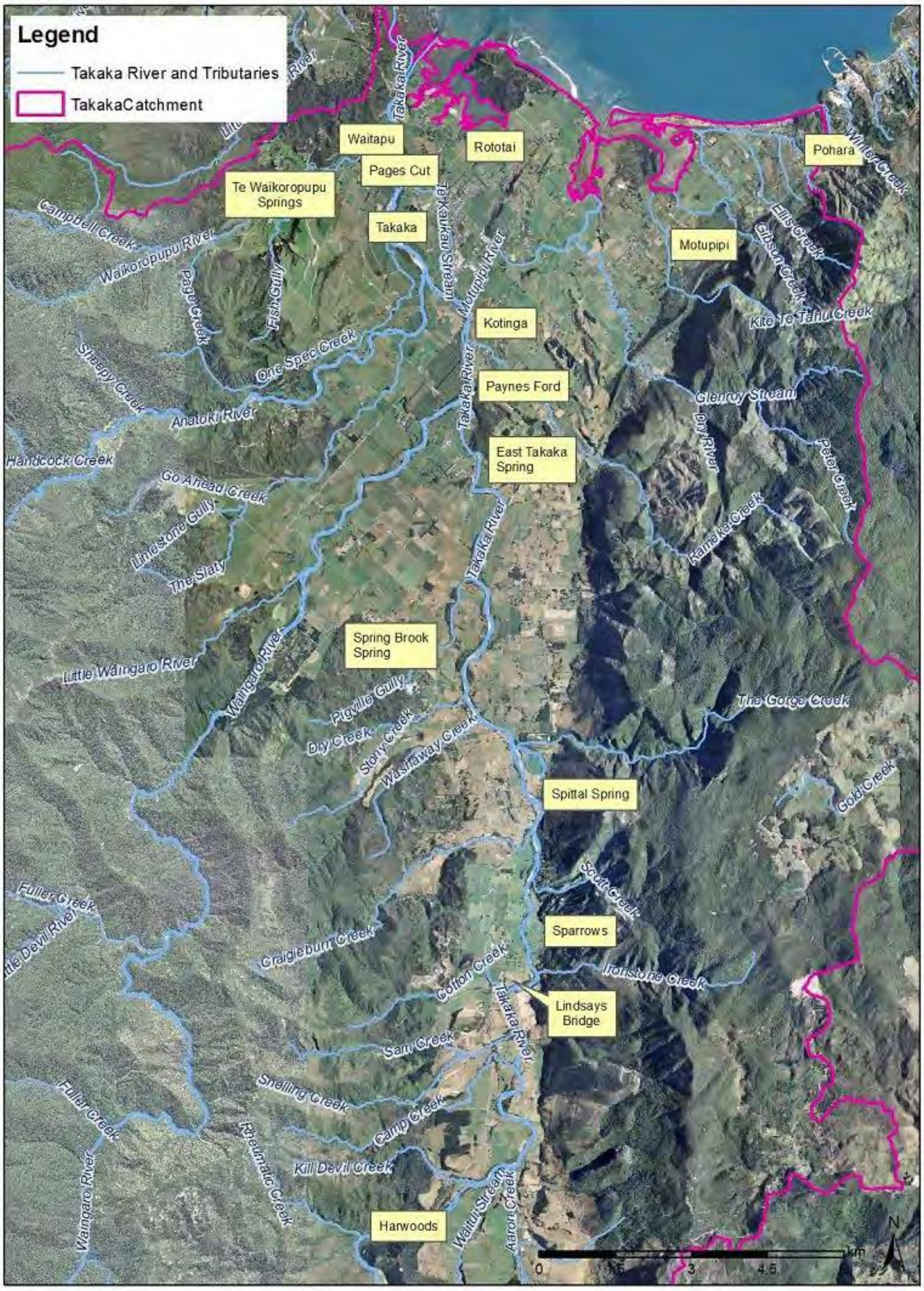
62 As described in section B of this Part 2.
63 Thomas, EIC Fig 2.

Figure G

Tākaka River and main valley rivers and tributaries



[273] Particularly important locations along the river and referred to in this report are:

(a) Harwoods – the most southerly monitoring location. It is unaffected to any significant extent by current anthropogenic discharges;

(b) Lindsays Bridge, below which the River regularly goes dry for an average of 100 days a year in summer;

(c) East Tākaka Springs, which is sourced from the limestone and supplements river flows. The River can dry out above the Springs. It is the most northerly monitoring location in the unconfined part of the WAMARA. Flows in the Tākaka River below the East Tākaka Springs do not contribute water to the AMA as it is confined;[64]

(d) Kotinga – a northerly monitoring point used by Dr Mead to demonstrate increased nitrogen concentrations in the River after it has passed through the Valley Floor.

[274] Indicatively, the Harwoods to Lindsays Bridge reach loses 750 l/s and the Lindsays Bridge to Spring Brook confluence reach loses 7600 l/s on average. Hence, the total recharge to the underlying aquifers is in the order of 8350 l/s.[65] The drying of the River migrates upstream from the area around where the East Tākaka Springs enters the River to just below the Ironstone Creek confluence at Sparrows (refer Figure G). The lower end of the River drying section can be anticipated to be dry when the flows at Harwoods (Figure G) drop below 7000 l/s, with the upper end being dry when flows drop below 3500 l/s.[66]

Waingaro River

[275] The Waingaro River flows out of the Western Karst Uplands. Parts of its mid-reaches north of Hamama are underlain by alluvial gravels which in turn overlay the unconfined WAMA. The mean and median flows in the River were

64 Thomas, EIC at [67].

65 Stewart and Thomas at section 4.1; Stewart, EIC Appendix 1 at 6.

66 Thomas, EIC at [64]-[66].

around 17,800 and 10,000 l/s between 1986 and 2013.[67] Mr Thomas stated that the River contributes some water to the WAMA recharge and that:[68]

> The flow losses to the TUGA during low flow measurements observed ranges between 500 – 1000 l/s for the river to its confluence with the Tākaka and between 300 – 600 l/s over the unconfined reach (where this water can also flow into the AMA (*WAMA*) from the TUGA).

[276] The Stewart and Thomas 2008 Report identified the Waingaro's contribution to the WAMARA to be about 2000 l/s for mean flow at Te Waikoropupū.

Cobb River

[277] The Cobb River flows out of the Western Karst Uplands and enters the Tākaka River upstream (south) of the Harwood monitoring station. It is dammed for hydroelectricity generation. The dam has an effect on river flow and recharge that is more obvious during the summer months when flows are lower. When the dam's peak discharge of about 7500 l/s is substantially reduced or shut down, water level and flow reduction is observed at the Springs.

Anatoki and Waikoropupū Rivers

[278] From a hydrological perspective, the surface water flows from the Anatoki River are not connected to Te Waikoropupū.[69] The Waikoropupū River catchment and its surface water from the various streams that feed it and the shallow groundwater in the Valley do not contribute to the WAMARA,[70] and hence are not connected to Te Waikoropupū.

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67 Water Resources of the Tākaka Management Area, J T Thomas and M M Harvey, July 2013.

68 Thomas, EIC at [71].

69 Thomas, EIC at [73].

70 Thomas, EIC at [75].

A.7 Surface water quality

[279] TDC has been undertaking surface water quality monitoring at a number of sites in the WAMARA for some years but provided no details in its evidence. Particularly relevant TDC and FOGB monitoring information to assist understanding of where NO_3-N is coming from was provided by Dr Mead, a hydrogeologist with experience of forestry, among other specialities. Although he is a member of FOGB, his candid approach to cross-examination and Court questioning satisfy us that he is nevertheless a reliable and independent expert.

[280] Dr Mead provided important data and analysis in supplementary evidence. This relates to total nitrogen in discharges from Upper Tākaka and increases in NO_3-N concentrations in the Tākaka River between Upper Tākaka and Kotinga. We summarise and evaluate this information in section B, where we bring together a range of different information relating to nitrogen.

[281] NO_3-N monitoring of surface waters has been undertaken at the following locations:

Site	Monitoring programme
Tākaka River at Harwood	TDC sampled this site until March 2016 and had it analysed for a wide range of nutrients, including the different forms of nitrogen. FOGB subsequently began sampling at this site in September 2018 but only had NO_3-N analysed.[71]
Lindsays Bridge	TDC began sampling at the site from mid-2016. It is located above where the Tākaka River often sinks into the AMA.
Waingaro River at Hanging Rock	TDC had stopped collecting samples in November 2004. FOGB began collecting monthly water samples from September 2018.
Tākaka River at Kotinga	Samples had been analysed for Total-N, NO_3-N and ammonium (NH_4-N) in 1986, from 10/10/2000 to 23/7/2013 in quarterly samples, and from then to December 2021 at monthly intervals. In addition, NO_3-N was also analysed in 1987, 1998 and from October 1999 monthly for twelve months.[72]
Ironstone Creek	Nine samples taken by FOGB between 1 November 2016 and 7 March 2022.
Gorge Creek	As Ironstone Creek.
Lower Rameka Creek	As Ironstone Creek.
Upper Rameka Creek	Six samples taken by FOGB between 5 November 2016 and 7 March 2022.

[282] Dr Mead stated that the Harwood and Hanging Rock sites do not have farming influences; Gorge Creek, which connects with Harwoods Hole, may be influenced by low intensity farming and Lower Rameka Creek at the Ford is strongly influenced by sheep and beef farming.[73] He stated that upstream of the

71 Mead, supplementary evidence dated 20 May 2022 at [7], with dates added as stated in EIC.

72 The data from June 2013 is part of NIWA's National River Water Quality Monitoring Programme which required monthly sampling on set days so that they cover a range of river conditions (James and McCallum, 2015). Before that date, the samples were collected, where possible, after three days of dry weather with the intention of getting 'base-flow' figures (James and McCallum, 2015). There were changes in methods of measuring nitrate and total nitrogen during the sampling period.

73 Mead, EIC at [14] and notes to Table 2.

Lindsays Bridge site there is some farming, but he does not consider its effects are as great as those further downstream at Kotinga.[74]

[283] The following Table 2 shows NO_3-N concentrations in rivers and streams not affected or only affected to a limited extent by farming.[75]

Table 2
Nitrate-nitrogen concentrations in rivers and streams not affected or only affected to a limited extent by farming, as described by Dr Mead

Site	Samples collected	Time period	Mean	Median	Range	Std. dev
Harwood, Tākaka R.*	39	25/9/18 – 21/2/22	<0.001	0.004	<0.003 – 0.029	0.0075
Hanging Rock, Waingaro R.*	40	25/9/18 – 21/2/22	0.012	0.008	<0.003 – 0.058	0.0116
Ironstone Creek**	9	1/11/16 – 7/3/22	0.029	0.03	0.007 – 0.09	0.0261
Gorge Creek**	9	1/11/16 – 7/3/22	0.085	0.06	0.041 – 0.18	0.0497
Upper Rameka Creek**	6	5/11/18 – 7/3/22	0.027	0.012	0.005 – 0.11	0.0408
Lower Rameka Creek**	9	1/11/16 – 7/3/22	0.482	0.53	0.10 – 0.65	0.1649

A.8 Groundwater resources and flows discharging to Te Waikoropupū

General overview

[284] The WAMA is the largest karst aquifer in New Zealand. As noted above, to the south, it operates as an unconfined aquifer or recharge area for Te

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74 Mead, supplementary evidence dated 20 May 2022 at [8].
75 Mead, EIC at Table 2.

Waikoropupū, and to the north as a confined aquifer.[76] The change occurs below the mid-reach of the Waingaro River, in the general locality shown on Figure 1 in Part 1, north of which impermeable Motupipi Coal Measures geology cap the marble.[77] We were told that the limits of the confined aquifer are not defined accurately, but that does not affect our findings.

[285] A hydrological model developed by Dr Stewart and Mr Thomas (Stewart and Thomas 2008) was commonly referred to in evidence. This is different to Dr Stewart's NO_3-N balance model, which we discuss in more detail in section B. Dr Stewart explained that there are two flow systems in the catchment, one deep and one shallow, and that the deep system is recharged from the Karst Uplands and the shallow system from the Upper Tākaka and Valley Floor.

[286] The deeply penetrating "old" water from the Karst Uplands has a mean age or travel time to Te Waikoropupū of 10.2 years and the much younger water from the other two sources has a mean age or travel time of 1.2 years. Figure H is Dr Stewart's conceptualisation of flows in the WAMA.[78] Of note, his conceptualisation shows all Karst Uplands flows recharging to the deep system, with no connection to the shallow system.

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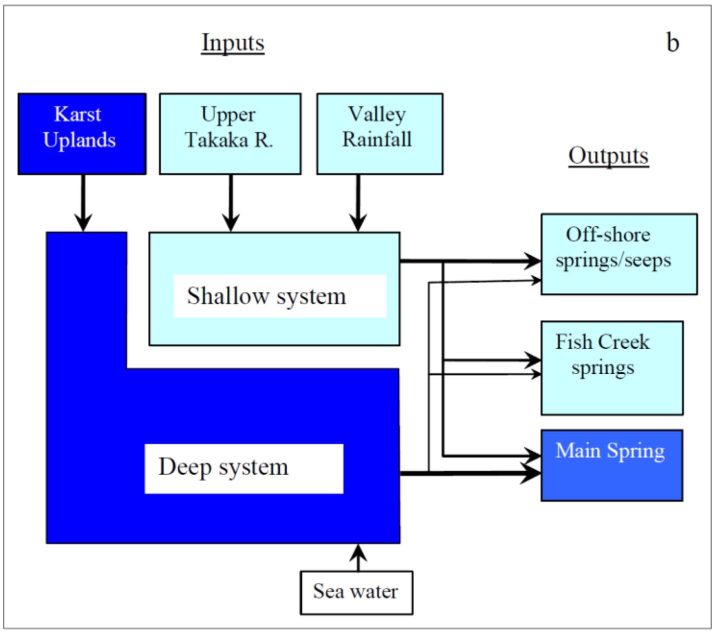
76 Thomas, EIC, footnote 2: An Unconfined Aquifer is one where the permeable rock units are open to receive water from the surface i.e. in direct contact with the atmosphere. A Confined Aquifer is one where the permeable rock units are overlain by impermeable rock.

77 Thomas, EIC at [72]; Fig 7.

78 Stewart, EIC at [19] and [34] and Figure 4.

Figure H

Conceptual model of flows in the Arthur Marble Aquifer



[287] Professor Williams disagreed with Dr Stewart on a number of issues, including that he considers there are connections to the shallow system. He developed his own model. Both models indicated that a different mix of water from the different sources reaches the Main Spring compared to Fish Creek Springs.

Water flows from the Karst Uplands

[288] Water flows from the Karst Uplands through a combination of pores, fissures (including joints) faults, bedding planes and caves. Their flow capacity is enhanced over time by rock dissolution as water moves through them. Most karst groundwater is stored in extensive interconnected fissure systems, but most water movement towards the Springs occurs in larger conduits (flooded caves) that pass through fissured rock and offer much less resistance to flow. Professor Williams

considers the WAMA is best conceptualized as an extensive fissure matrix pierced by occasional large conduit drains.[79]

[289] Professor Williams stated that "Because water movement through widened fissures and conduits is often fast and turbulent, groundwater flow through karst usually does not obey Darcy's Law, which assumes laminar flow. This adds another level of complexity to water management that is particular to karst".[80] Mr Weir and Mr Fenemor, who produced a third NO_3-N balance model limited to the Valley Floor,[81] consider "… it is certain that none of the models adequately represents the mixed linear-non-linear (Darcian-turbulent) nature of karst aquifer processes".[82]

[290] In response to questions from the Court during hot-tubbing, Professor Williams estimated that approximately 20% of the flow from the Karst Uplands discharges to the Valley Floor system "where it mingles with other groundwater in the valley". These flows would come from springs and manifestations in surface water sources such as Ironstone Creek and Rameka Creek shown on Figure G above. Professor Williams estimated this could occur in a matter of days to weeks.

[291] Professor Williams also estimated that the remaining 80% of the flow would go deeper, taking months to penetrate to the water table, after which it would take 10 years to get to Te Waikoropupū. We asked all other modelling and geohydrology experts for their views of whether they agreed with Professor Williams' explanation. Other than Dr Stewart finding himself at odds with the extent to which the 20% flows "… immediately to the valley floor shallow system", there was no disagreement.[83]

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79 Williams, EIC at [18]-[20] and [32].

80 Williams, EIC at [20].

81 Weir and Mr Fenemor addressed possible increases in nitrate concentrations in the valley floor as a result of possible increases in future water takes. They did not address groundwater flows from different sources.

82 Fenemor, JWS Modelling and Geohydrology in response to Question 17.

83 Transcript at pp 403 and 405.

Water movement through the Valley Floor

[292] We sought clarification from the geohydrology and modelling experts as to how flows from the Valley Floor reach Te Waikoropupū and the extent to which mixing occurs between flows from the Upper Tākaka Valley and Karst Uplands along the way.[84]

[293] Mr Thomas first confirmed that in places on the Valley Floor, the TUGA sits above the TLA and that aquifer sits above the WAMA, which is the only aquifer connected to the Springs.

[294] Professor Williams then explained his views on flows. He explained that when flows from Upper Tākaka disappear below the river-bed downstream of Lindsays Bridge, some travel along a gravelled former river channel and mix with flows in the Valley Floor and some goes directly into the marble. He then explained that, moving down the valley, flows from creeks and caves in the Karst Uplands on the eastern side of the valley start to mix with the flow in the Valley Floor, making up 20% of flows from the Karst Uplands. As also noted above, Dr Stewart considers all flows from the Karst Uplands go to the deep system.

[295] All modelling and geohydrology experts agreed that there is significant yet unquantifiable mixing going on in the Valley Floor area.[85]

[296] Groundwater travel times in the Valley Floor are important when considering the effects of NO_3-N leached from farming activities on Te Waikoropupū. To ensure we had correctly interpreted those travel times, we asked Dr Stewart if we could be looking "broadly speaking" at nine months from farms to the north of the Valley Floor and perhaps up to five years from farms further south.[86] Dr Stewart confirmed that range subject to a qualification that he

84 Transcript at pp 385-395.
85 Transcript at p 391.
86 Based on his predicted average travel time of 1.2 years.

considered travel times from the farms further south were more likely to be perhaps two to three years.[87]

[297] All other modelling and geohydrology experts were in general agreement with the Court's interpretation.[88]

Predicted mean groundwater flows entering the Wharepapa Arthur Marble Aquifer from different source areas

[298] Table 3 summarises flows from each of the three main source areas included in the most up-to-date modelling by Professor Williams and Dr Stewart (and Mr Thomas). We confirmed with the modellers that recharge volumes from each contributing area were based on area, rainfall less evapotranspiration and assumed infiltration rates and were not model predictions.[89] This is consistent with normally accepted practice.

Table 3
Predicted mean groundwater flows entering the Wharepapa Arthur Marble Aquifer from different source areas in litres per second

	Source area			Total predicted flow
	Upper Karst*	Tākaka River	Tākaka Valley Floor	
Professor Williams[90]	9,243	8,350	2,697	20,290
Dr Stewart[91]	9,200	8,350	2,200	19,750

* Includes flows from the Waingaro River

[299] The only significant difference between the predictions of Professor Williams and Dr Stewart occurs in relation to the Valley Floor. Professor Williams'

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87 Transcript at p 396.
88 Transcript from p 397.
89 Transcript at pp 681, 709 and 881.
90 Williams, supplementary evidence dated 26 June 2022 at Table 1.
91 Stewart, EIC at [22].

estimate was based on an updated Valley Floor area of 53.2 km^2 and an average annual rainfall of about 2,100 mm with actual evapotranspiration losses of around 600 mm.[92] Dr Stewart based his estimate on 50% of net precipitation of 950 mm/year on an area of 73 km^2.

[300] Professor Williams' estimate is based on the updated area provided by TDC in response to a request for further information by the Court. His allowance for annual rainfall is more closely aligned with Mr Thomas' estimate of annual rainfall of 2,000 mm at Tākaka Township than is Dr Stewart's allowance.[93] For those reasons, we consider Professor William's estimate is likely to be more accurate and accordingly, adopt it for the purposes of this report.

[301] On that basis, for the purposes of our inquiry, we adopted flows of 9200 l/s from the Karst Uplands, 8350 l/s from Upper Tākaka and 2700 l/s from the Valley Floor. We adopted an indicative mid-point total flow of 20,000 l/s from all sources combined.

Predicted mean groundwater flows entering the Main Spring and Fish Creek Spring from different source areas

[302] Tables 4, 5 and 6 summarise Professor Williams' and Dr Stewart's predicted groundwater flows entering the Main Spring and Fish Creek Springs and bypassing them, respectively.

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92 Williams, EIC at [47]; supplementary evidence dated 26 June 2022.

93 Thomas, EIC at [50].

Table 4
Predicted mean groundwater flows entering the Main Spring from different source areas in litres per second

	Source area			Total predicted flow
	Karst Uplands	Upper Tākaka	Tākaka Valley Floor	
Professor Williams[94]	6887	2021	982	9,890
Dr Stewart[95]	7,624	1,741	635	10,000

Table 5
Predicted mean groundwater flows entering Fish Creek Springs from different source areas in litres per second

	Source area			Total predicted flow
	Karst Uplands	Upper Tākaka	Tākaka Valley Floor	
Professor Williams[96]	1,909	1,257	337	3,303
Dr Stewart[97]	649	1,735	916	3,300

Table 6
Predicted mean groundwater flows from different source areas in litres per second by-passing both Springs and discharging to Golden Bay

	Source area			Total predicted flow
	Karst Uplands	Upper Tākaka	Tākaka Valley Floor	
Professor Williams[98]	465	5,072	1378	6,900
Dr Stewart[99]	926	4,875	649	6,450

94 Williams, supplementary evidence dated 26 June 2022 at Table 1.
95 Stewart, EIC at [27].
96 Williams, supplementary evidence dated 26 June 2022 at Table 1.
97 Stewart, EIC at [27].
98 Williams, supplementary evidence dated 26 June 2022 at Table 1.
99 Stewart, EIC at [27].

[303] Both model predictions of flows reaching the Main Spring from the Upper Karst area are broadly similar at around 70 to 75% of the total flow. This is consistent with what is to be expected by considering groundwater travel times and ages of waters reaching the Springs. We accept them as the basis for our evaluation.

[304] Professor Williams and Dr Stewart differed markedly in their predictions of flows from the Valley Floor and Karst Uplands. As for flows from the Valley Floor to the Main Springs, Professor Williams' prediction is 50% higher than Dr Stewart's. As for flows from the Karst Uplands to Fish Creek Springs, Professor Williams' prediction is three times higher than that of Dr Stewart. Conversely, Dr Stewart's prediction of flow from the Valley Floor to Fish Creek Springs is almost three times higher than that of Professor Williams. The Court had no robust way of checking or knowing which model, if either of them, is more reliable. The approach we used to overcome this conundrum is described in section B.

A.9 The groundwater ecosystem

[305] The groundwater ecosystem and its relationship with Te Waikoropupū form an important component of integrated catchment management and ki uta ki tai (a mātauranga Māori concept as referred to in the NPSFM). Dr Fenwick stated that the health of the groundwater ecosystem is linked to the ecological health and other values of Te Waikoropupū. In his opinion:[100]

> Te Waikoropupū is more than the springs, that its remarkably clear water and other values are linked to groundwater biodiversity and ecological processes within the aquifers that supply its water.

[306] He described the groundwater ecosystem, including biodiversity and their microbial and invertebrate components. They include diverse assemblages of small aquatic invertebrates (stygofauna) that are specifically adapted to live entirely

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100 Fenwick, EIC at [22], [25] and [37].

underground and provide natural remediation processes. These ecosystems are poorly understood and important aspects remain unresearched. Dr Fenwick identified NO_3-N from farming activities as a key contaminant in the system and emphasised the importance of dissolved oxygen and dissolved organic carbon in maintaining ecosystem health. We discuss these aspects in section B.

[307] Dr Fenwick made reference to a September 2021 ESR report commissioned by TDC on Groundwater Dependent Ecosystems ('GDE') in Tākaka.[101] This evidence was not available to the Tribunal. The report noted there is a lack of information on the GDE that occur in the WAMA and included a preliminary assessment of GDE, specifically stygofauna present in the aquifer, using data collected from three sampling rounds over three consecutive years.

[308] The report stated:

> No stygofauna were recovered from any wells/bores sampled during the first two sampling rounds (Autumn 2018 and Spring 2019). The recent sampling round (Spring 2020), however, recovered stygofauna, including those which may be endemic to the aquifer. Stygofauna were collected from 7 of 11 samples taken from wells/bores i.e. both from the gravel and marble aquifers. Macroinvertebrates, including stygofauna were also recovered from the springs fed from the karst/gravel aquifer systems. Total abundance and species richness were low, compared to ecosystems examined in other South Island locations e.g., Canterbury, Southland. The last season's results (2020) indicate an endemic ecosystem is present. At present it does not appear to be abundant, but more species could be discovered with more sampling.

[309] Dr Young confirmed there is a general lack of information on groundwater dependent ecosystems and that little is known about the presence and abundance of stygofauna in the aquifers connected to Te Waikoropupū.[102] Dr Hickey agreed

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101 A Bolton and L Weaver "Preliminary Assessment of Groundwater Dependent Ecosystems: Invertebrate Groundwater Fauna, Takaka, Golden Bay, Tasman" (2021) ESR Client Report No. CSC20026a; Envirolink Report Number: 2110-TSDC172-1.

102 Young, EIC at [134].

that the sensitivity of groundwater-dwelling species is largely unknown and that there are no specific guidelines available. He concluded that the lack of availability of stygofaunal data limits their suitability for guideline derivation. He considers that routine stygofaunal monitoring in New Zealand is still at the research stage and standard methods have not been sufficiently developed for application to routine monitoring.[103]

[310] Dr Hickey summarised the aquifer monitoring data for potential contaminants of concern as raised by Dr Fenwick. He included the measured dissolved oxygen concentrations and used surface water guidelines for nitrate, nitrite and ammoniacal forms of nitrogen. This was to provide an indicative measure of ecosystem protection for stygofauna which may inhabit these aquifers. As there are no stygofauna guidelines, he found it necessary to use the surface water guidelines, being the most sensitive available for his assessment. He considered this approach properly conservative and precautionary.[104]

[311] He concluded that:[105]

> … the DO concentration was aerobic on all occasions, but there were some sites/occasions when nitrate and nitrite concentrations exceeded water quality guidelines. For those sites/occasions there may be sub-lethal adverse effects occurring to sensitive stygofaunal species which might be present at those sites.
>
> Based on the existing water quality conditions in the Te Waikoropupū Springs aquifer, I do not consider that there are water quality factors which would significantly modify toxicity thresholds and enhance the likelihood of increased toxicity to the stygofaunal species. Rather, there are protective water quality conditions present (i.e., elevated hardness and chloride concentrations) which should reduce the likelihood of toxicity to sensitive stygofaunal species.
>
> The toxicity endpoints for the most sensitive species in the nitrate database used

103 Hickey, EIR at Table 1.
104 Hickey, EIR at [27]-[29].
105 Hickey, EIR at [108]-[110].

> for the guideline derivation are sub-lethal effects measuring growth and development.
>
> There is a safety factor of approximately 8x before reaching the threshold for survival reduction for these most sensitive species.
>
> This hardness-related toxicity reduction would be considered an additional margin of safety (about 13x) for species resident in Te Waikoropupū Springs and stygofauna resident in the Arthur Marble Aquifer groundwaters.

[312] Based on his analysis, Dr Hickey stated that site-specific thresholds and monitoring plans will need to be developed for the aquifer monitoring programme. In view of the complexity of the hydrological contributions of the upstream aquifers, he considers that a "one-size-fits-all" approach would not be appropriate for this aquifer.[106]

[313] Dr Mead acknowledged that he was not an expert in stygofauna but observed they have been around for a long time and they are presumably adapted to what the conditions were that they evolved with.[107]

Findings in relation to the groundwater ecosystem

[314] There was no difference of views from experts about the importance of stygofauna and the groundwater ecosystems in general. We find they are an integral and important part in protecting the water quality and values of Te Waikoropupū. We also accept that stygofauna are poorly understood and difficult to monitor effectively. Research on them in New Zealand is in its infancy. We further accept that there is currently no certainty as to the extent to which nitrogen species in particular may affect the ability of stygofauna and other elements of aquifer ecosystems to continue their protection function.

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106 Hickey, EIR at [33].

107 Transcript at p 959.

[315] The only evaluative water quality evidence, relating to toxicity, was provided by Dr Hickey, and this was not challenged. We received no evidence to demonstrate that the aquifer ecosystems are being adversely affected by current nitrogen concentrations to the extent that it is affecting water clarity at Te Waikoropupū, one of the matters raised as a concern. However, in view of the criticality of the ecosystems to protecting the values of Te Waikoropupū, we consider the precautionary principle should be adopted. As stated in section B, we recommend a median NO_3-N concentration limit for both the Main Spring and Fish Creek Springs of 0.41 mg/l.

[316] We acknowledge that this limit does not ensure Te Waikoropupū will be maintained in a state which will protect the values that all parties agree need to be protected. However, we find that it is the limit that is necessary, based on our evaluation of the evidence, and is consistent with baseline state in accordance with the NPSFM,[108] based on the best currently available information.

[317] In view of the major uncertainties as to when a water quality and ecology tipping point might be reached, the high variability in NO_3-N concentrations known to occur in the Springs and the potential for increased variability as a result of climate change, we find that any higher limit will place the undisputed outstanding values of Te Waikoropupū at an unacceptable level of risk.

A.10 Disputed catchment boundary around the Canaan Saddle[109]

[318] There is a dispute between Professor Williams and Mr Thomas as to the location of this part of the catchment boundary. The area in dispute is circled in the following Figure I, which is reproduced from the JWS mapping dated 27 April 2022 and labelled "This part is wrong".

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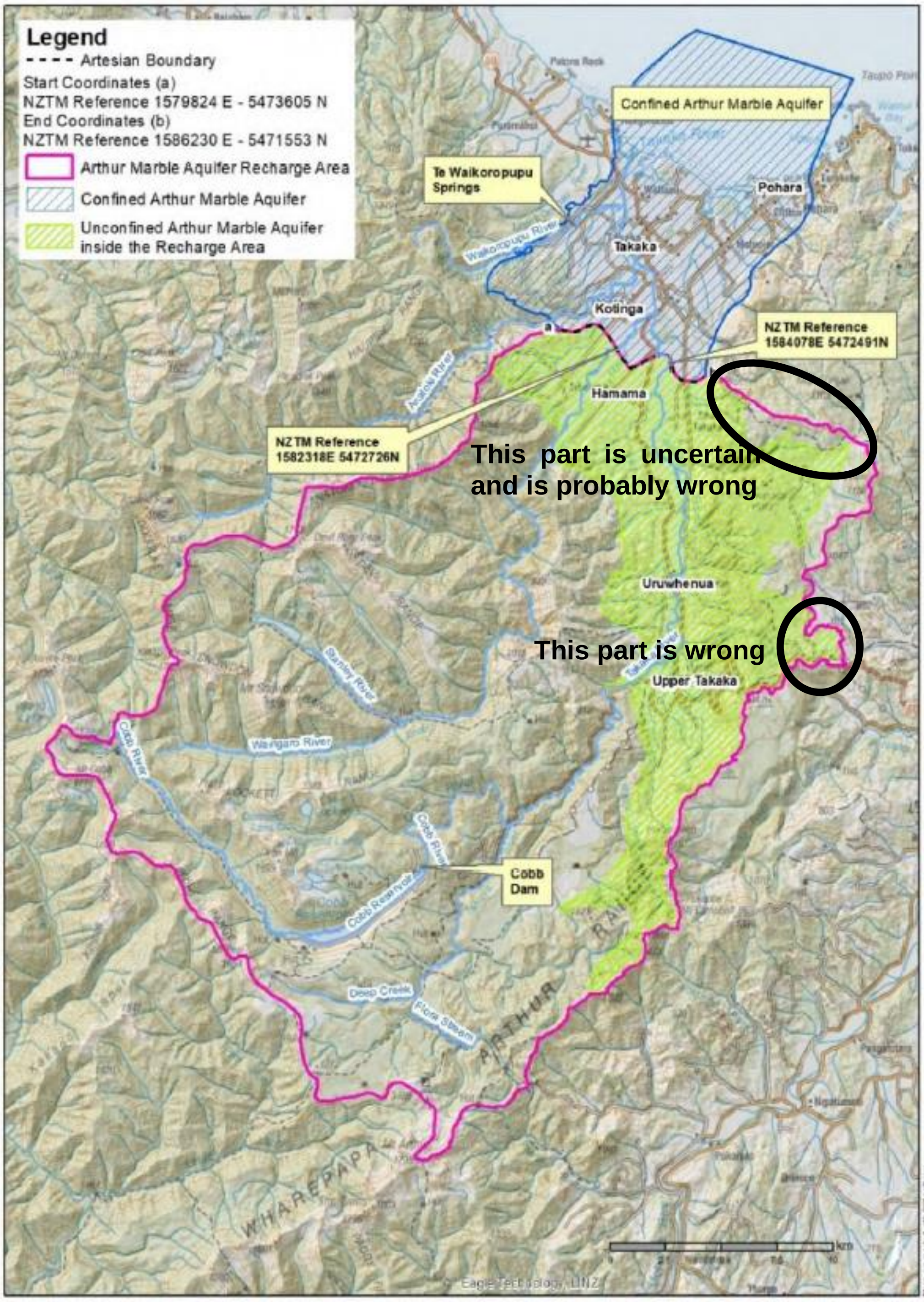
108 NPSFM, cl 1.4.

109 JWS Mapping unless stated otherwise.

Figure I

Disputed boundary areas



[319] The reasons for their different views are set out in the JWS. Mr Thomas based his boundary on the geographical/topographical separation high points between the catchments. Professor Williams used the same process by following

the high points of the topography. Additionally, he used further evidence from water tracing, which he has published several times. He considers the area in dispute is in the Riwaka, not the Tākaka River catchment.[110]

[320] Mr Thomas did not base his boundary on water tracing but noted that recharge water percolating into the karst can flow in several directions. He stated that:

> I have drawn my boundary as you come up to the top of Canaan and you go to the middle of the plateau. Professor Williams has drawn a line that is very straight if you look at figure, it's page [as transcribed] with the boundary, a very straight line on top of ridges.

[321] Mr Thomas pointed out that Professor Williams acknowledged that Tākaka River derived groundwaters join karst waters from Tākaka Hill (Canaan) prior to their mixed overflow at Spittal Spring.[111] In response to a Court question about NO_3-N sources affecting Spittal Spring, Mr Fenemor stated:[112]

> … if you take the catchment area as going up the hill which is regenerating scrub, previously grazed in places and over the top of the Canaan Road and into Gold Creek which is a pastoral area on the other side, actually outside the topographic catchment then .2 to .3 is a feasible concentration from land use up gradient of Spittal Spring.

[322] Our site visit helped our understanding of the matters in dispute between the experts. We acknowledge the difficulty in defining catchment boundaries in karst geology with certainty. We also acknowledge Professor Williams' particular expertise in such geology. Nevertheless, we consider it prudent to apply the precautionary principle. Our site visit reinforced to us anthropogenic land use activities in the disputed area could potentially be contributing to NO_3-N

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110 Transcript at p 805.
111 Transcript at p 806, referring to Williams rebuttal at [12].
112 Transcript at p 712.

concentrations monitored in the WAMARA. Therefore, we find that the boundary should remain as proposed by Mr Thomas for the purpose of the WCO.

[323] It will be for TDC to include locality-specific land use controls it considers appropriate, if any, in the TEP.

A.11 Uncertainty about the extent to which groundwater in the Wharepapa Arthur Marble Aquifer below hills in the north east (north of Rameka Creek) flow to Te Waikoropupū or to Golden Bay

[324] Professor Williams and Mr Thomas agree that:

> …. the direction of flow in the marble hills area to the north east (north of Rameka Creek) is subject to uncertainty because it is buried underground within Karst. The seawards eastern side of the Takaka catchment has marble, some of which may drain to TWS but most of which drains to the sea through the eastwards part of the AMA.

[325] The area in dispute is shown on Figure I marked "This part is uncertain and is probably wrong".

[326] Mr Thomas has shown the overall catchment boundary on Figures 7 and 8 of his evidence-in-chief. The experts agree that for practical purposes the boundary across Hamama between the Waingaro River and Tākaka River is as shown in Mr Thomas' Figures 7 and 8. However, Professor Williams considers the boundary line should be amended to distinguish between the Tākaka River boundary and the area that drains into the Springs.

[327] Mr Mather raised this issue when cross examining Mr Thomas, suggesting that the Court should take a precautionary approach and delineate the unconfined aquifer (as shown on Figure 6 in Mr Thomas' evidence-in-chief).[113] Mr Mather asked if a major new development was to occur in the area "… can you be

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[113] Transcript at p 830.

absolutely certain that this nitrogen would not be appearing at the Springs from this area?" Mr Thomas replied:

> … if you are aware how rough the country is on that flank Mr Mather, so that's all I can – it's very rough country in terms of steepness and the fact is that if you, if you follow the FLAG report, if you're worried about allocation this area in the FLAG report recommends that there's no abstraction, no new abstraction allowed in this area.

[328] Mr Mather also raised the issue when cross-examining Professor Williams.[114] Professor Williams referred to a paper by Leask cited in his evidence-in-chief.[115] He explained that the paper indicates the Brunner Coal Measures in this locality occupy a downfold that runs roughly from east Tākaka out along the line of the Tākaka River into the sea, more or less north-south, and the coal measures can be to 250 m below sea level. He stated that the coal measures provide a very sizable barrier to ground water movement which confines the WAMA water to its western flanks and sends it generally towards the Springs and towards the surface mouth of the Tākaka River.

[329] Based on Mr Thomas' response to Mr Mather, we do not consider this issue is likely to significantly increase risk to Te Waikoropupū or requires any change to the boundary as currently shown.

[330] However, it is a matter that TDC should consider and provide land use rules as appropriate in the TEP to ensure any development occurring in the additional area shown on Mr Thomas' Figure 6 does not result in adverse effects on Te Waikoropupū.

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114 Transcript at p 857.

115 W L Leask "Brunner Coal Measures at Golden Bay, Nelson: an Eocene fluvial-estuarine deposit" (1993) New Zealand J Geol & Geophys. 36(1):37-50.

Section B

Findings as to nitrogen in the Tākaka River Catchment

B.1 Background and purpose of section B

[331] Monitored nitrate-nitrogen (NO_3-N) concentrations reaching Te Waikoropupū Springs increased from 0.31 mg/l in the early 1970s to more than 0.52 mg/l in 2020, an increase of approximately 68% in 50 years. On the evidence, we find that this represents a serious threat to the undisputed outstanding values and characteristics of Te Waikoropupū and its associated water bodies.

[332] Despite concerns about these threats having been raised by the applicants in 2013, the reasons for the large increases were disputed and we were not in a position to determine them on the evidence as initially presented. There was no dispute that farming activities in the Valley Floor were contributing NO_3-N to Te Waikoropupū but there was major disagreement on the extent.

[333] TDC's case regarding NO_3-N in the catchment was almost exclusively reliant on a nitrogen balance model.[116] The model was unsupported by any catchment analysis of land uses, land-use change, associated NO_3-N loss rates or evaluation against monitoring records. The NO_3-N component of the model was unverified and had not been subject to independent peer review or any meaningful ground-truthing. The applicants' case was similarly based on a model with limited supporting information to enable us to assess its veracity.

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116 Bush-King accepted that characterisation, adding that "Joseph Thomas and Mike Stewart have been long involved in trying to research and understand the aquifer system in Tākaka and so they have been, you know, central advisors to the process, yes.", Transcript at p 733.

[334] TDC's model predicted that approximately 14% of NO_3-N reaching the Main Spring is from anthropogenic sources in the Valley Floor,[117] mainly farming, with approximately 80% from natural sources in the Karst Uplands. The applicants' model predicted almost the exact opposite: approximately 84% from anthropogenic sources in the Valley Floor and 15% from natural sources in the Karst Uplands.[118] TDC's model predicted that NO_3-N losses from both sources had increased over time, but the modeller, Dr Stewart, could not provide any explanation as to why predicted losses from natural sources increased by 28% over a period of 37 years.

[335] Modelling is a predictive tool and as such is not necessarily representative of real facts. For this reason, we must be satisfied that any model we are invited to rely upon is sufficiently fit for our purposes of making sound predictive evidential findings. The highly divergent predictions in two of the models presented to the Court plainly demonstrate that.

[336] The almost complete lack of any evidence on fundamental components of integrated catchment management meant we had no foundation material from which to evaluate the models and determine which, if either of them, could be relied on. Unless we could determine that, any recommendation we could make to the Minister on the appropriate limit for NO_3-N would have been fraught with uncertainty as to whether the limit was achievable and what the consequences would be for the farming community.

[337] To illustrate the points we have made concerning the source of NO_3-N, if TDC's model was correct and natural sources were increasing for no explained reason, those increases could continue to occur, meaning any limit recommended could be exceeded and there would be few, if any, options available to prevent

117 Stewart, EIC at Table 7. We note here that we refer to Dr Stewart's model as an addition by Dr Stewart of a nitrogen balance model to the 2008 Stewart and Thomas hydrological model.

118 Williams, EIC at [74].

that. In those circumstances, setting a limit would be futile.

[338] Furthermore, if TDC's model was correct and the NO_3-N limit we determined as necessary to preserve and protect Te Waikoropupū was lower than current concentrations, any reductions could only be achieved by reducing NO_3-N losses from farming activities. By way of example, if a 10% catchment-wide reduction in NO_3-N concentrations was to be required, and farming was contributing only 14% of the total catchment load as TDC's model predicted, average reductions across all farming activities would need to be around 70%, which would decimate the farming community.

[339] The absence of any WAMARA-wide analysis of nitrogen generation and transformation processes in the original evidence and no apparent understanding of the possible serious consequences of TDC's model predictions for both Te Waikoropupū and the farming community were of major concern to the Court. The paucity of fundamentally important information provided meant there was no reliable evidential basis for making a recommendation to the Minister.

[340] The purpose of section B is to summarise the process followed by the Court to understand where NO_3-N and other forms of nitrogen come from in the WAMARA, reasons why they have increased, how they change as they pass through the groundwater system and what that means for NO_3-N reaching Te Waikoropupū. We then consider the potential effects on Te Waikoropupū in section C.

[341] The information is technically complex and the process to obtain and evaluate it was time-consuming and expensive for all parties and the Court. In our view, this could and should have been avoided by a meaningful independent review and even the most basic of ground-truthing by TDC of its model.

B.2 The significance of different forms of nitrogen

[342] NO_3-N was the main focus of historical nitrogen monitoring in the Springs themselves and in the contributing ground and surface water resources. The evidence presented at the start of the hearing focussed almost entirely on NO_3-N, with very limited consideration of any other forms of nitrogen.

[343] Total nitrogen is the sum of all forms of nitrogen. These include inorganic nitrogen, which comprises NO_3-N, nitrite (NO_2-N) and ammonia (NH_3-N), and organic nitrogen. Nitrogen can exist in both soluble and particulate forms. The substantial majority of nitrogen reaching Te Waikoropupū is in the NO_3-N form.

[344] The form of nitrogen can change as a result of natural microbial processes as it passes through an environment. In a well-oxygenated environment, NO_3-N concentrations can increase due to the oxidation of other components of total nitrogen, particularly organic nitrogen. This process is known as nitrification.

[345] In an environment where oxygen is sufficiently deficient, either anoxic or anaerobic, NO_3-N concentrations can decrease. That is as its nitrogen and oxygen components are separated and either the nitrite, ammonia and/or nitrogen gas forms of nitrogen increase. This process is known as denitrification.

[346] Organic nitrogen is an important constituent of soil organic matter and plays a key role in soil nitrogen cycling and crop production. It can be increased by effective pasture management and reduced by poor management practices or by being washed out in heavy rainfall events or excessive irrigation. Organic nitrogen is also a major form of nitrogen produced in treed areas due to natural decomposition processes, but which can be converted to NO_3-N by nitrification as described above.

B.3 Changes in nitrogen form occurring in the WAMARA

[347] The Tribunal found "… the key Nitrogen related parameter is Nitrate Nitrogen", "The experts agreed that there is no need to measure total N" and "there is [nitrate] attenuation from the top to the bottom of the catchment."[119] This means that the Tribunal made its decision on the basis that NO_3-N concentrations are being reduced as they pass through the WAMARA, not increased. From answers experts gave to our questions on this, we respectfully find that the Tribunal erred on this matter. We find that indeed a high level of nitrification is occurring in the WAMARA and NO_3-N concentrations increase before reaching Te Waikoropupū.

[348] On our initial understanding from the Tribunal's finding that denitrification is occurring, we asked the modelling and geohydrology experts to advise the most likely mean and likely range of overall attenuation and/or denitrification that might occur in the WAMARA.[120] Their initial responses as recorded in the JWS were somewhat tortuous. To ensure we had correctly understood what they were saying, we stated by way of a subsequent Minute dated 22 June 2022:

> … The court understands the modelling and geohydrology experts to agree that:
>
> (a) the conversion of organic nitrogen to nitrate is very likely to be occurring in the aquifer system before it reaches Te Waikoropupū; and
>
> (b) no denitrification (conversion of nitrate to nitrite or nitrogen gas) is occurring.
>
> … Put another way, we understand the experts to be saying that the quantity of nitrate is likely to increase, not decrease, between where nitrate and other forms of nitrogen enter the aquifer system and Te Waikoropupū.

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119 Special Tribunal Report at [428], [243] and [259] respectively.

120 Minute dated 31 May 2022 at [74(g)].

[349] Dr Stewart confirmed our understanding was correct, as did others at different times, and no expert disputed that nitrification is occurring.[121] It is of note that Dr Stewart added the following sentence to his summary of evidence as a result of the questions included in our Minutes:

> Nitrification has been very little heard in New Zealand and I think that we have discovered that it will apply in many systems in New Zealand. However, the point is for Te Waikoropupū Springs.[122]

[350] He also cited the following passages from articles published in the international literature to support his statement:

> An analysis of N-species loading in recharge and discharge for the Barton Springs segment during 2008–10 indicates an overall mass balance in total N, but recharge contains higher concentrations of organic N and lower concentrations of NO_3 − than does discharge, consistent with nitrification of organic N within the aquifer and consumption of dissolved oxygen. This study demonstrates that subaqueous nitrification of organic N in the aquifer, as opposed to in soils, might be a previously unrecognized source of NO_3 to karst groundwater or other oxic groundwater systems. (Musgrove)[123]
>
> Main finding: Anthropogenic activities can change biogeochemical nitrogen dynamics of vulnerable karst aquifers, such that the groundwater overlain by an urban settlement has undergone denitrification, while suburban and pristine areas have been dominated by nitrification. (Yang)[124]

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121 Stewart, Transcript at p 285; Williams, Transcript at p 308.

122 Transcript at p 275.

123 M Musgrove, S P Opsahl, B J Mahler, C Herrington, T L Sample, J R Banta "Source, variability, and transformation of nitrate in a regional karst aquifer: Edwards aquifer, central Texas" (2016) Science of the Total Environment 568 (2016) 457-469.

124 Pingheng Yang, Yuyang Wang, Xinyu Wu, Longran Chang, Brian Ham, Lisheng Song, Chris Groves "Nitrate sources and biogeochemical processes in karst underground rivers impacted by different anthropogenic input characteristics" Environmental Pollution 265 (2020) 114835.

[351] In response to questions from Mr Thomsen, Dr Stewart stated that nitrification occurs in systems which contain DO greater than 5 mg/l.[125] DO levels within Te Waikoropupū Springs reflect the long residence time for water within the aquifer system and the breakdown of organic matter that occurs naturally within it as the DO is consumed.[126] The median of quarterly spot DO measurements recorded over the period from 2015 to 2021 was 6.2 mg/l (Moreau 2021). Other measurements at the Springs themselves, exceed Dr Stewart's inferred minimum.[127]

[352] As part of responses to our questioning of water quality, ecology and mātauranga Māori experts during hot-tubbing,[128] Dr Mead considered all nitrogen leached from farming operations would be in the NO_3-N form by the time it reaches Te Waikoropupū. The other experts were invited to advise if they disagreed with Dr Mead and no one did.

[353] Based on that evidence, we find that a high level of nitrification is occurring in the WAMARA, that NO_3-N levels will increase as groundwater travels down the catchment, and that NO_3-N cannot be considered a conservative indicator, as assumed in the Professor Williams and the Weir and Fenemor models presented in their evidence-in-chief. Revised model predictions were later provided to reflect the changed understanding.

B.4 Mechanisms by which nitrate-nitrogen enters natural water

[354] It is self-evident that the quantity of NO_3-N entering natural water cannot be greater than the quantity that is originally present in any land use type, including from any anthropogenic additions. This was of considerable significance to our evaluation of Dr Stewart's NO_3-N balance model prepared for TDC, which

125 Transcript at pp 291, 292.

126 Young, EIC at [155].

127 Young, EIC at [118]-[125].

128 A process where experts are empanelled together in open court and questioned through cross-examination and by the Court with all experts providing responses to the extent they consider appropriate.

predicted a quantity that was substantially greater than indicated by comprehensive evidence from other experts as being present in the first place.

[355] The potential for irrigation as part of farming activities to increase NO_3-N loss to natural water was addressed in some detail in evidence and in our evaluation and is discussed in sections B.8, B.12 and B.16 to B.18.

[356] Rainfall was identified in the evidence as a major cause of leaching of NO_3-N from land uses, including from both natural and anthropogenic sources.

[357] Dr Hickey considered that the SOI is relevant to the extent of leaching that occurs. He explained that the SOI is an indicator of climate that not only incorporates rainfall but also a measure of rainfall patterns like high intensity rainfall, antecedent rainfall, whether there is a wet season or whether there is a la niña or an el niño phase, which indicates if winds are predominantly westerlies or easterlies. The SOI also relates to cloud cover and evapotranspiration.

[358] Dr Hickey explained that the SOI is complementary to rainfall data and needs to be considered alongside it.[129] Following further questioning from the Court, he explained that rainfall on its own does not explain the increases in NO_3-N concentrations at Te Waikoropupū; it is necessary to look at aspects such as peak rainfall as well as they are "really important as drivers". He also stated that the SOI index goes in 10-year cycles and expressed the view that, as we are reaching the end of a cycle, a downward trend in NO_3-N concentrations should start to appear in the next year or two. The latest monitoring results suggest this trend has started.

[359] Other experts were asked if they had a different view and none did. However, when asked if he had a view on the correlation between SOI and NO_3-

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129 Transcript from p 476.

N load reaching Te Waikoropupū, Dr Mead replied he did not have a strong view and:[130]

> I think the SOI is to me is a rough way of getting information. If you want to understand what's going on in the Spring you need to have the rainfall data and the evapotranspiration data and other stuff to really work out what's going on. Why use a rough method like that and it presumes that there's a good correlation between for example rainfall and the SOI and in fact if you look at what Dr Hickey has produced I think his correlations are very, very poor. I don't, I wouldn't rely on that myself.

[360] Our interpretation of this evidence is that, while rainfall is a major driver of leaching, peak rainfall intensities and increased general "wetness" of the soils result in increased leaching compared to when the soils contain less water. The evidence as presented was insufficient to satisfy us that the SOI is, in and of itself, an indicator of changing NO_3-N concentrations and/or loads reaching Te Waikoropupū.

B.5 Relationships between rainfall and flows and nitrate-nitrogen concentrations and loads reaching Te Waikoropupū

[361] The focus of the evidence as initially provided to the Court was on NO_3-N concentrations with no significant consideration of loads. We consider that to be another significant omission. An understanding of loads is necessary to evaluate different sources of NO_3-N within the WAMARA and we considered both NO_3-N concentrations and loads in detail.

[362] The relationships between rainfall and flows and NO_3-N concentrations and loads reaching Te Waikoropupū are complex and affected by many variables but are highly relevant to the way in which and timeframes within which NO_3-N

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130 Transcript at pp 952 and 953.

reaches the Springs. By way of an overview to assist understanding of later sections of this section B, we summarise key elements of the mechanisms involved.

[363] When rain falls on the catchment, it results in a hydraulic response or piston effect in the aquifer which "pops out the water at the other end", being at Te Waikoropupū, and which happens quickly.[131] This effect was referred to in a generally similar way by a number of witnesses. Professor Williams stating that "when the Southern Oscillation Index goes up there's a pulse for the water at the Springs which is almost instantaneous". In questioning Professor Williams, Mrs Chubb asked if it is like having a long hose that is full of water and a person jumps on it at one end and the response can be observed at the other. Professor Williams confirmed that it is.[132]

[364] Dr Mead explained it is not always as simple as that, by reference to the Main Spring flow graph in his supplementary evidence dated 26 July 2022. He pointed out that from May 2013 to March 2015, the flow to the Main Spring dipped, but that coincided with a period of high rainfall. Between November 2015 and April 2017, the flow increased but coincided with a period of low rainfall. He pointed out that it is not a direct relationship and if you are coming out of a dry period you have to wet the soil before the effect of rainfall is felt at Te Waikoropupū.[133]

[365] Our interpretation of this evidence is firstly that, as is to be expected, rainfall increases the flow to Te Waikoropupū. Those increases are likely to occur relatively quickly if the soils are already wet before the rain occurs. On the other hand, there could be a lag up to possibly two years or more if the soils are dry. The timing is not critical to our recommendation but this evidence illustrates one of the many complexities and uncertainties that have to be considered when

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131 Weir, Transcript at p 682.
132 Transcript at pp 311 and 885.
133 Mead, Transcript at p 924.

seeking to understand the dynamics of nitrogen processes in the WAMARA and where the nitrogen is coming from.

[366] We record that the Court observed a discernible change in Te Waikoropupū on each of two site visits. On the second visit, a few weeks after a significant Nelson/Tasman rain event, the waters were significantly more vibrant and flourishing than on the occasion of the first visit.

[367] NO_3-N is not transmitted by the pressure pulse effect like water. Instead, it travels with the flow of the water in the aquifer, which generally speaking can take from more than a year to greater than 10 years. That means there is a very significant lag between when an increase or decrease in NO_3-N concentrations occurs as a result of land use changes and when the changed concentrations are seen at Te Waikoropupū.

[368] We explored the time of travel with the experts. There was general agreement that travel time in the Valley Floor was likely to be between one and five years. However, Professor Williams later explained that while conduit flows in the marble would reach the Springs in around 1.2 years, fissure flows take up to 10 years,[134] adding further to the complexities and uncertainties.

[369] The FOGB data shows that five step changes in NO_3-N concentrations at Te Waikoropupū occurred over the six years of record and within each step period the NO_3-N concentrations showed little change over time. The steps occurred in less than a month and lasted between 10 and 30 months.

[370] Consecutive median concentrations in each step at the Main Spring were 0.395, 0.44, 0.52, 0.48 and 0.50 mg/l. At Fish Creek Springs they were 0.36, 0.41, 0.51, 0.45 and 0.48 mg/l.[135] We received no evidence to explain the likely causes of the step changes. Based on other evidence however, they appear likely to relate

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134 Transcript at p 309.
135 Mead, EIC from [21] and Table 1.

to variable rainfall and different antecedent conditions in the catchment at the time rainfall occurred.

[371] In circumstances where there are no changes in concentration, the NO_3-N load will increase or decrease in proportion to any increase or decrease in flow. When increases in concentration occur at the same time, the load will increase proportionally to both the changes in flow and concentration. Dr Mead estimated that the NO_3-N load discharged from Te Waikoropupū increased from 174 tN/y in 2016 to 238 tN/y in the 10-month period to March 2022.[136] This represents an increase of 36% over a five to six-year period (or 80% compared to an estimated load of 132 tN/y in the early 1990s).

[372] Such increases must be viewed as extremely serious in terms of threats to the values of Te Waikoropupū. Those and previous increases are primarily responsible for our assessment that the Springs are no longer in their natural state in biophysical terms (although, for the reasons we have earlier traversed, we find them so in accordance with tikanga Māori as Te Puna Waiora).[137]

[373] When all the above complexities and uncertainties are taken into account, it is unlikely that a complete understanding of catchment dynamics will be possible in the foreseeable future, if ever. This means that currently it is not possible to be precise in our assessments. We adopted multiple lines of inquiry collaboratively with experts to inform findings which we consider are as robust and as accurate as it is possible on the basis of current knowledge.

[374] Despite this lack of certainty, it is indisputable that NO_3-N concentrations and loads have increased substantially and that rainfall, antecedent conditions and varying travel times through the karst geology in particular influence the extent,

136 Mead, EIC at [25].
137 We leave aside here our findings on their state in mātauranga Māori terms.

timing and variability of quantities reaching Te Waikoropupū, whatever the source of the NO_3-N.

[375] We are satisfied that the experts have provided as much information as they can on the naturally occurring variables. What needs to be determined is what are the reasons NO_3-N loads to Te Waikoropupū have increased by a factor that has approached two for a time over a period of 50 years, which we consider below.

B.6 Estimated nitrogen quantities leached from different land uses

[376] This is a fundamental starting point when considering nitrogen reaching Te Waikoropupū. In the absence of any evidence of substance that we could rely on, we directed TDC to provide maps and associated areas of different land uses in the WAMARA. We also directed experts[138] with an understanding of NO_3-N leaching from different land uses ('the nitrate experts') to conference and provide estimates of NO_3-N loss rates from different agricultural and horticultural land uses. We requested the experts to provide evidence on what changes in NO_3-N loss rates, if any, are to be expected from dairy farming on irrigated farms compared to those with no irrigation. We also requested that they advise us on NO_3-N loss estimates from forestry and native grassland/hill scrubland land uses (treed areas).

[377] The nitrate experts produced a JWS nitrate dated 22 June 2022, including agreed NO_3-N leaching rates and tonnes of nitrogen per year (tN/y) from treed areas, areas of gorse and broom and farm-related land uses. Their agreed values are reproduced in Table 7.

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138 Dewes, Langford, Mead and Rowarth.

Table 7
Estimated nitrate-nitrogen losses from different land uses based on the JWS nitrate

	Area (ha)	Indicative leaching rate (kg/ha/y)	Estimated NO_3-N loss (tN/y)	Estimated range of leaching rates (kgN/ha/y)	Estimated range of NO_3-N loss loads (tN/y)
Dairy farming – irrigated	858	94	81	65 to 123	56 to 105
Dairy farming – non-irrigated	1,574	48	75	45 to 60	71 to 94
Dairy support and drystock	4,000	25	99	19 to 37	75 to 147
Treed areas	61,814	0.08	5	0.01 to 3[139]	0.6 to 185
Gorse and broom	571	45	26	30 to 60	17 to 34

[378] The land use information provided by TDC indicated there are no horticultural land uses in the WAMARA.

[379] The experts confirmed the values in Table 7 refer to NO_3-N.

[380] The specified leaching rates and loads were agreed by all experts.[140] Other than for treed areas, we are satisfied that they represent the best available information for the purposes of our recommendation to the Minister. However, we record that a much more fine-grained approach is likely to be required for the purposes of the TEP now being prepared for notification.

B.7 Estimated nitrogen loads leached from treed areas on the Karst Uplands

[381] Dr Stewart's model predicted that around 120 tN/y in NO_3-N form reaches the Main Spring and Fish Creek Springs.[141] When nitrogen in-flows from the Karst

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139 From *Overseer* default.
140 Confirmed by Rowarth, Transcript at p 625 and Langford, Transcript at p 536.
141 Stewart, EIC at Table 7.

Uplands that by-pass the Springs and discharge to Golden Bay is added, the total annual load predicted by Dr Stewart could exceed 130 tN/y.

[382] However, we were told there is no definitive information on total nitrogen that is generated in the Karst Uplands.[142] As such, we had no "ground-truthing" evidence against which we could evaluate the veracity of Dr Stewart's NO_3-N balance modelling.

[383] To assist us to find the best available information, we considered the following potentially relevant matters when following multiple lines of inquiry:

(a) quantities and forms of nitrogen currently being generated by the trees themselves;
(b) residual quantities that could possibly be being released as a result of past burning of the indigenous vegetation;
(c) nitrogen produced from gorse and broom;
(d) estimates of total NO_3-N losses from treed areas, including gorse and broom;
(e) transformation from total nitrogen to NO_3-N by passage through the groundwater system;
(f) marble as a source of NO_3-N;
(g) monitoring data; and
(h) the predictions of Dr Stewart's NO_3-N balance model.

[384] We address each of these matters in turn below.

Loads and forms of nitrogen currently being generated by the trees themselves

[385] Based on the evidence of various experts, we found that the source of nitrogen in the Karst Uplands is leaf debris and other organic material washed from treed areas by rainfall and streams into soils, sink-holes in the marble,

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142 Transcript at p 408.

fissures, joints and caves in the karst. The organic material will include both soluble and particulate components.[143]

[386] The nitrate experts estimated an indicative leaching rate of 0.08 kgN/ha/y,[144] with a range of 0.01 to 3 kgN/ha/y. These estimates equate to a predicted NO_3-N load of 5 tN/y from the Karst Uplands, within a range of 0.6 to 185 tN/y. The upper end of the range is based on an *Overseer* default value.[145]

[387] The nitrate experts also estimated that gorse and broom in the catchment could leach an indicative additional quantity of 26 tN/y as NO_3-N, within a likely range of 17 to 34 tN/y. They noted there was limited published data on this source in the literature.

[388] In his supplementary evidence dated 29 June 2022, which followed the nitrate expert conference, Dr Hickey considered a paper by McGroddy[146] could be relevant. The study measured total nitrogen and NO_3-N in first order streams draining ninety-seven undisturbed indigenous forest environments in New Zealand (two of which were in the Tākaka Valley), from which leaching rate estimates were developed. Dr Hickey then stated:

> The leaching data for Takaka Valley has a range of 0.2-0.4 kg/ha, with a representative value of 0.3 kg/ha. Based on this representative leaching rate and an area of 61814 ha gives an indicative annual leaching rate of 18.5 T/yr.

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143 Stewart, Transcript at p 291; Williams, Transcript at p 406.

144 Based on the calculation of 1440 ha exotic plantation at 3 kg Nitrate leached/ha yielding 4320kg, and 60,374 ha of bush at 0.01 kg nitrate leached/ha yields total of 603.74 kg N or an average leaching of treed area of 0.079 kg Nitrate/ha.

145 JWS Nitrate.

146 M E McGroddy, W T Baisden, L O Hedin "Stoichiometry of hydrological C, N, and P losses across climate and geology: An environmental matrix approach across New Zealand primary forests" (2008) Global Biogeochemical Cycles 22: GB1026, doi:10.1029/2007GB003005.

[389] He considered the difference between the nitrate experts and the McGroddy estimates was likely to be that one refers to NO_3-N and the other to total nitrogen. He noted as follows:

> McGroddy et al do not provide analytical data for TN and nitrate-N for the individual streams. However, their summary table shows nitrogen content of stream water was found to be dominated by organic forms, with dissolved organic nitrogen (DON) contributing substantially more (81%) than nitrate-N (12%) or ammoniacal-N (4%).
>
> I would expect that this DON would be fully nitrified by microbial biofilms in the aquifer with the production of nitrate-N.

[390] Dr Young referred to the same paper in his supplementary evidence of the same date. He confirmed it is important to consider both NO_3-N and total nitrogen, that the predominant form of nitrogen being exported from more natural parts of the Tākaka Catchment is organic nitrogen and that conversion of organic nitrogen to nitrate is very likely to be occurring in the aquifer system.

[391] For reasons explained below, we directed Dr Hickey and Dr Mead to undertake further conferencing on nitrogen loads generated from Upper Tākaka. We asked them to consider also if the same basis of estimating nitrogen loads was relevant to estimating loads from the Karst Uplands. In a JWS dated 22 July 2022, they stated:

> (a) Both experts agree that the same monitoring data is relevant to other Karst Uplands areas for dissolved total nitrogen. We note that these water quality measurements do not include particulate nitrogen which may be entrained into the AMA.
>
> (b) Both experts agree that an indicative total nitrogen export coefficient for "treed area" should have been 0.3 kg N/ha/yr giving 18 t/yr of export from that land-use.
>
> (c) We consider the McGroddy et al (2008) paper an important paper as it demonstrates that the majority of nitrogen exported from undeveloped

> forested catchments is in the form of dissolved organic nitrogen (DON) with often minimal nitrate-N.

[392] In response to questions at the hearing, Dr Mead described the nitrogen cycle in forested areas. He referred us to a paper by Murray Davis entitled *Nitrogen Leaching losses from forests in New Zealand*.[147] Dr Mead stated this paper also gives a nitrogen leaching rate of 0.3 kg/ha/y. The paper explained:

> The nitrogen (N) cycle in temperate forests is characterised by an almost closed internal cycle between the vegetation and the pool of N in soil organic matter. Important processes are above and below ground litter production, decomposition, mineralisation (including nitrification), immobilisation, and plant uptake.

[393] We explored with different experts through the hearing the extent to which particulate nitrogen could increase NO_3-N reaching Te Waikoropupū. Dr Mead considered it was likely to be a "very, very tiny proportion".[148] Dr Young, whose doctorate was in organic matter transport and movement in rivers, considered, and we accept his evidence, that:

> … the key points to take out of it for this case is that the dissolved component which we're focused on will be the predominant source of organic matter but there will be a particulate component. It's hard to quantify that exactly but I think it might be another 10 or 20% on top of the dissolved component.

Residual quantities that could possibly be being released as a result of past burning of the indigenous vegetation

[394] We received evidence that logging occurred in the catchment prior to the 1900s[149] and that the forests of the Pikikirunga Range were burned in or before

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147 M Davis "Nitrogen Leaching losses from forests in New Zealand" (2014) New Zealand Journal of Forestry Science 2014, 44:2 http://www.nzjforestryscience.com/content/44/1/2.

148 Transcript at p 945.

149 Mead, Transcript at p 328.

the 1930's and that by the 1970s, much of the Range was reverting back to native bush and scrub.[150] Dr Young did not consider the effects of burning would be a significant driver of NO_3-N concentrations reaching Te Waikoropupū now.[151] Dr Mead considered that any nitrogen would have passed through within 10 years and any small amount coming through "… it's so small, it won't be great".[152]

Nitrogen produced from gorse and broom

[395] Having accepted the above evidence, the burning of the forests and subsequent regeneration provided an opportunity for gorse to become established in the catchment. The nitrate experts estimated this generates 26 tN/y but noted there is limited published data on NO_3-N generation rates from gorse, meaning the reliability of the estimate is uncertain.[153]

[396] The Court is familiar with a similar case where gorse was a contributing factor to NO_3-N leaching to a sensitive and highly valued water body.[154] In that case, a root zone leaching coefficient of 38 kgN/ha/y was adopted for mature gorse, broadly in line with the 45 kgN/ha/y used as the indicative leaching rate in the JWS nitrate and comfortably within the estimated range of 30 to 60 kgN/ha/y. A key consideration in the other case was the percentage cover of gorse within the area defined as gorse.

[397] Subsequent detailed examination of aerial imagery by the regional council in that case showed the coverage to be 41%, which reduced the estimated losses by an equivalent amount compared to initial estimates. The nitrate experts did not have time to undertake a similar examination as part of their JWS, meaning the estimate of 26 tN/y from the Karst Uplands could significantly over-estimate

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150 Sowman, EIC at [3.11].
151 Transcript at p 468.
152 Transcript at p 329.
153 JWS Nitrate at p 3.
154 Bay of Plenty Regional Council Plan Change 10, *Federated Farmers of New Zealand Inc v Bay of Plenty Regional Council* [2019] NZEnvC 136 and PC10 Catchment N Accounting, Module 4: Lake Rotorua Science Review, November 2018.

leaching from this source. We address this further in our overall evaluation and final section on sensitivity analysis and risk.

[398] The significance of this issue is that a gorse load of 26 tN/y could account for an increase in NO_3-N concentration of 0.07 mg/l at Te Waikoropupū.[155] Regeneration had started in the WAMARA by the 1970s,[156] so it appears plausible that increasing NO_3-N concentrations as a result of an increase in areas of gorse would have started around or just after that time, recognising the 10-year travel time from the Karst Uplands. This could have been a contributing source to increasing NO_3-N concentrations prior to the 1990's and possibly afterwards.

[399] No certainty can be placed on the actual NO_3-N contribution from gorse based on the very limited data currently available, but it is a source that needs careful consideration to inform the inclusion of appropriate provisions as part of the regional plan process.

Estimates of NO_3-N losses from the treed area, including gorse and broom

[400] Based on the above, and assuming total nitrogen is converted to NO_3-N, we estimated the mean NO_3-N load reaching Te Waikoropupū from the Karst Uplands in tN/y to be:

(a)	contribution from treed areas based on McGroddy	18
(b)	additional 20% from particulate matter	4
	Total from naturally regenerating areas only	**22**
(c)	contribution from gorse and broom as JWS nitrate	26
	Total indicative load	**48**

155 Based on a mean flow of 9,200 l/s from the Karst Uplands, which is equivalent to an annual flow of 290,000,000 m^3/y, and 75% of that flow feeding Te Waikoropupū.

156 Sowman, EIC at [3.11].

[401] We estimated a likely upper limit from this source as:

(a)	contribution from treed areas based on McGroddy upper limit of range of 0.4 kg/ha/y	24
(b)	additional 20% from particulate matter	5
	Total from naturally regenerating areas only	**29**
(c)	contribution from gorse and broom as JWS nitrate upper limit of range	34
	Total including from gorse and broom	**63**
(d)	add further 20% contingency	<u>13</u>
	Total indicative upper limit of load	**76**

[402] Based on the total indicative load and a mean flow of 9200 l/s from the Karst Uplands, which is equivalent to an annual flow of 290,000,000 m^3/y, the mean NO_3-N concentration would be 0.165 mg/l. The likely upper limit concentration would be 0.26 mg/l.

[403] Ms McArthur independently considered what the concentration might be based on total nitrogen monitoring data for Harwoods and Lindsays Bridge, estimating values of 0.11 and 0.26 mg/l. In response to a question from the Court ("So broadly speaking we're not that far apart given the uncertainties we're dealing with here?") Ms McArthur replied: "No, I had some confidence looking at our numbers we're pretty close using a different method to get there".[157]

Transformation from total nitrogen to nitrate by passage through the groundwater system

[404] Dr Young considered organic matter decomposition in the aquifer as a source of NO_3-N. He used as his starting point the known reduction of 4.5 mg/l in dissolved oxygen concentration that occurs in water during its passage through

157 Transcript at p 1074.

the aquifer, from around 10.5 mg/l down to 6.0 mg/l. Knowing the stoichiometric relationship between dissolved oxygen uptake and carbon breakdown, he calculated that 1.7 mg/l of carbon is broken down as the water passes through the aquifer. Using a range of dissolved organic carbon (DOC) to dissolved organic nitrogen (DON) ratios of 5 to 30, based on typical ratios in river water, he calculated 0.07 to 0.4 mg/l of NO_3-N would be released as water passes through the aquifer.[158]

[405] When we asked Dr Young for his views on our estimated concentration, which at that time was 0.14 mg/l, he replied it sounded "about right".[159]

Marble as a source of nitrate

[406] Dr Young considered marble as a possible source of NO_3-N in the WAMARA. He stated that some marble has a relatively high nitrogen content, but measurements of nine pieces of marble collected from the Tākaka area indicated a relatively low proportion of nitrogen in Tākaka marble. He considered marble is likely to be only a very minor (about 2%) contributor to NO_3-N concentrations in the Springs.[160]

Monitoring data

[407] Dr Mead stated that FOGB water samples from the Eastern Creeks show that low amounts of NO_3-N are coming from the Karst Uplands; with medians generally less than 0.015 mg/l.[161] A number of witnesses considered that Spittal Spring flows represent those from the Karst Uplands, having NO_3-N concentrations of between 0.21 and 0.28.[162] We find that is unlikely to be the case,

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158 Young, EIR at [21]-[25].
159 Transcript at p 1020.
160 Young, EIR at [26].
161 Mead, EIC at Table 2 and synopsis of evidence dated 23 May 2022 at [12c].
162 Thomas, EIC at Figure 20.

being persuaded by answers given to our questions by Professor Williams. We are mindful of his specialist knowledge of karst systems.[163]

[408] Spring Brook Springs flows have monitored NO_3-N concentrations of between 0.46 and 0.56. Dr Stewart stated that Spring Brook comprises a stream as well as seepages, whose flows have not been measured independently of the stream, meaning the source of the elevated NO_3-N has not been determined.[164]

[409] Mr Thomas placed emphasis on another location with higher concentrations (bore 24034) which Dr Hickey considers could also be affected by anthropogenic activities. After being asked three times by the Court, Mr Thomas agreed that it is fair to say that the upper limit of NO_3-N from the Karst Uplands, generally, is 0.2 to 0.3 mg/l or less.

[410] We find that the available monitoring data demonstrates that the NO_3-N concentration of 0.46 mg/l[165] from the Karst Uplands predicted by Dr Stewart's model does not reflect what is observed in the catchment by a significant margin.

Dr Stewart's model

[411] Dr Mead expressed serious concerns about Dr Stewart's nitrogen balance model because it is based partly on chloride concentrations in the Main Spring.[166] Professor Williams considers the model concept is untenable because it separates shallow from deep systems and permits no mixing until just before the Springs (which he says is unobserved in karst systems). He raised other concerns and considers the model is misleading as it is based on misunderstanding of the influence of the geology as well as of the karst groundwater dynamics.[167]

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163 Transcript at p 855.
164 Stewart, EIC at [24].
165 Stewart, EIC at Table 4.
166 Mead, synopsis of evidence dated 23 May 2022 at [12d].
167 JWS Modelling and Geohydrology in response to Question 39.

[412] As part of our evaluation of the differing views between Professor Williams and Dr Stewart, we considered their experience in matters of particular relevance to the case. Professor Williams is Emeritus Professor in the School of Environment, University of Auckland. His speciality is karst hydrogeology and geomorphology. He co-authored a research text on that subject that for 30 years has been the main international reference on karst.[168]

[413] Dr Stewart is a geochemist specialising in the use of chemical (including isotopes) and water flow information to understand sources, flow paths and storages of water and chemicals underground. He acknowledged that he has no specific experience in karst systems or karst hydrogeology.[169]

[414] Based on their respective expertise, we prefer and rely on Professor Williams' explanations of karst systems.

[415] When Dr Young was asked about uncertainties in Dr Stewart's NO_3-N balance model under cross-examination, he replied:[170]

> … we'd all been scratching our heads when Dr Stewart's model, the apparently high concentrations of nitrogen or nitrate that appeared to be coming from what he described as the Karst Uplands and so, we were all thinking well that doesn't, doesn't, as far as the sniff test goes that doesn't smell right, so what, how could that, is there any mechanism that could describe that?

[416] The Court sought clarifications about several matters concerning the model in various minutes[171] and in questioning of Dr Stewart at the hearing. The Court wanted to understand why the model predicted that natural sources were the reason for large increases in NO_3-N over a 37-year period, and whether Dr Stewart expected they would continue to increase. We also asked for details of any model

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168 Williams, EIC at [2](h); Karst Hydrogeology and Geomorphology, Derek Ford, Paul D Williams, Wiley (editions 1989, 2007).

169 Transcript at p 897.

170 Transcript at p 1007.

171 Minutes dated 19 May and 22 June 2022.

verification, validation and ground-truthing undertaken and about what monitoring or evaluative data or other foundation information supported the model. No satisfactory answers were given in response to any of our requests.

[417] Dr Stewart's inability to respond with any meaningful answers to our questions left us seriously questioning the model's veracity. As we have noted, we have no evidence that the model is supported by reliable data including from any catchment monitoring. Our reservations about that were also informed by the clear lack of confidence that Dr Mead, Professor Williams and Dr Young conveyed about the model's predictions. Moreover, a first principles assessment of land uses and nitrogen leaching they generate shows conclusively that the model predictions bear no resemblance to reality.

[418] We appreciate that the WCO process, as in this case, is initiated by citizen-application. Even so, it fundamentally concerns the powers as to water management that are exercised by the relevant local authority under s30(1)(e) and (f), RMA. Bearing in mind the RMA's associated duties and responsibilities for catchment management, we were both surprised and highly concerned about what TDC's evidence revealed as a deficiency in their management approach. It necessitated the Court taking a significantly more inquisitorial approach than would typically be taken. In addition to the significant resourcing consequences for the Court, we are mindful that it also imposed unreasonable burdens of time and cost on other parties. Ultimately it is a significant factor in our finding that it is necessary for any WCO to include somewhat more prescriptive restrictions on TDC's s30(1)(e) and (f) powers than is typical.

Findings in relation to estimates of nitrogen losses from the Karst Uplands

[419] On the best available information for the purposes of our recommendation to the Minister, we find that the mean NO_3-N load generated in the Karst Uplands is 48 tN/y, with a likely upper limit of 76 tN/y. We explained the basis of our estimates to all relevant experts and they all confirmed they are of about the right

order. In view of the complexities, uncertainties and limited locality specific evidence, we do not consider any greater precision is possible at the present time.

[420] When contributions from gorse are excluded, the contributions from the treed areas reduce to an indicative load of 22 tN/y and an upper limit of 35 tN/y.

[421] We found no evidence to support the proposition that NO_3-N leaching from the Karst Uplands has increased over the last 30 or so years, as predicted by Dr Stewart's model, other than as a result of variable climatic conditions which resulted in periodic increases and decreases.

B.8 Estimated nitrogen loads leached from farming activities in the Valley Floor

[422] All experts who participated in nitrate expert conferencing at which nitrate leaching rates were agreed, had experience (often extensive) in using *Overseer* to predict NO_3-N leaching rates in relation to farming activities. The JWS records that they had access to an *Overseer* file for one farm with multiple blocks across the WAMARA. Ms Dewes stated during hot-tubbing that she had been given access to another *Overseer* file earlier that day.

[423] We questioned the experts on various aspects of the use of *Overseer* during hot-tubbing. Its uncertainties for reliably predicting leaching rates are well known and were acknowledged by all experts. However, we agree with Dr Mead that "… whether you'd say fortunately or unfortunately … it's the best tool we've got at this stage". Ms Langford expressed a similar view. Put simply, there is no other evidence on NO_3-N leaching rates from farming before us and we must use the estimates in the JWS as the best available information and our starting point.

[424] In her evidence-in-chief, Ms Dewes cited the *Overseer* whole model review report.[172] The Court is familiar with the report and the following excerpts need consideration because of the issue that has arisen about NO_3-N being only one component of total nitrogen:

> Overseer reputedly estimates total nitrogen (i.e., all nitrogen forms exported from farm). However, it has been difficult to find any specific reference to totals, with most of the literature reporting on root zone losses of nitrate … Further, the terms nitrate and nitrogen and N appear to be used interchangeably in much of the documentation, making it difficult to decipher what Overseer is estimating. (page 51)
>
> Overseer does not appear to account for surface losses of nitrogen and, therefore, may significantly underestimate total nitrogen loss from the farm. (page 75)

[425] Figure 5.6 of the report suggests that NO_3-N and nitrite (NO_2-N) make up around two thirds of the total nitrogen discharged in the Tasman District. However, when we questioned water quality and ecology experts during hot-tubbing, Dr Mead offered his opinion that all nitrogen would be in the nitrate form by the time it reaches Te Waikoropupū. When invited to comment, no other expert disagreed with Dr Mead about that.

[426] The Court is familiar with *Overseer* predictions from a number of previous cases. We are satisfied that the indicative leaching rate estimates of 48 and 25 kgN/ha/y for non-irrigated dairy and dairy support and drystock respectively are within expected ranges and we accept them as our starting point. We also accept the experts' estimates of ranges of leaching rates that could occur, being 45 to 60 kgN/ha/y for non-irrigated dairy and 19 to 37 kgN/ha/y for dairy support and drystock. They are within the expected ranges of uncertainty based on our

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172 Overseer whole-model review, Assessment of the model approach, MPI Technical Paper no: 2021/12, dated July 2021.

experience of other cases and they were estimated by the experts to reflect their understanding of local circumstances in the WAMARA.

[427] We are aware of and accept the need for caution when interpreting *Overseer* predictions. To enable us to take a risk-based approach, we evaluated the following four NO_3-N load options from the Valley Floor:

Option 1 Lowest leaching rates in Table 7 above for all farming activities

Option 2 Indicative leaching rates in Table 7 for all farming activities and assuming irrigation does not increase leaching compared to non-irrigated farms

Option 3 Indicative leaching rates in Table 7 for all farming activities, including increased leaching from irrigated farms

Option 4 Highest leaching rates in Table 7 for all farming activities.

[428] We included Option 4 as indicative of possible leaching rates in extreme climatic conditions to allow comparisons with the worst-case naturally sourced load estimated from the Karst Uplands.

[429] The resulting loads for each option are shown in Table 8.

Table 8
Estimates of nitrogen leaching loads in tonnes per year for Options 1 to 4

Load source	Option 1	Option 2	Option 3	Option 4
Non-irrigated dairy	71	75	75	94
Irrigated dairy	56	41	81	105
Dairy support and drystock	75	99	99	147
Total estimated NO_3-N load	**202**	**215**	**255**	**346**

Findings in relation to estimates of nitrogen losses from the Valley Floor

[430] For the purpose of our evaluation, we adopted a likely minimum load of 200 tN/y, an indicative load of 220 to 250 tN/y and a worst-case load of 350 tN/y from farming activities in the Valley Floor.

B.9 Estimated nitrogen loads leached from Upper Tākaka

[431] Dr Stewart predicted NO_3-N discharges from Upper Tākaka of 16.4 tN/y.[173] Professor Williams estimated less than 6 tN/y from this source.[174]

[432] In a supplementary statement of evidence dated 20 May 2022, Dr Mead drew the Court's attention to TDC monitoring data that had not been presented in evidence, but which he considered was relevant to understanding nitrogen loads from Upper Tākaka.

[433] Dr Hickey referred to this data in response to questions from Mr Thomsen. While noting he had only had a very limited time to consider the information, he indicated that the total nitrogen yield could be 0.9 kgN/ha/y (or three times the average yield indicated in the McGroddy paper).[175] This could have been significant and for that reason, we directed further conferencing between Dr Hickey and Dr Mead to assist us in understanding how much nitrogen can be expected to enter groundwater from this source. At conferencing, they agreed that:

> Using medians provides an estimate of 12.7 t/yr. An upper bound on this is 35 t/y from the maximum based on the Lindsays' Bridge data (Table 2). We do not consider that the upper bound is likely as once the AMA is filled after the summer dry period then most of the excess will flow down the river.

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173 Stewart, EIC at Table 7.

174 Williams, supplementary evidence at Table 2.

175 Transcript at p 441.

Findings in relation to estimates of nitrogen losses from Upper Tākaka

[434] Based on the above, we have adopted an indicative total nitrogen load from the Upper Tākaka of 15 tN/y, being a rounding up from the experts' estimate of 12.7 t/y with a worst-case load of 20 tN/y. Based on the evidence it would be in the NO_3-N form by the time it reaches Te Waikoropupū.

[435] The load from this source represents approximately 5% of indicative NO_3-N loads generated in the catchment. Based on modelled flows by Dr Stewart and Professor Williams respectively, between a third and half the load is discharged to Golden Bay by way of the Tākaka River,[176] meaning the contribution to Te Waikoropupū from the Upper Tākaka is in the order of 2 to 3% of the total load. There are no land use options available to reduce the contribution.

B.10 Estimated nitrogen loads discharged from the Tākaka wastewater treatment plant and septic tanks in the WAMARA

[436] In response to a request from the Court, TDC provided estimates of loads discharged from the treatment plant and septic tanks in the WAMARA by memorandum dated 27 June 2022. Dr Rowarth identified that the memorandum underestimated the load discharged from septic tanks, and that the correct estimate is around 3 tN/y (not 1.22 tN/y as estimated by TDC).[177]

[437] Following our review of TDC's estimate, we agree with Dr Rowarth and consider that, when the load from the treatment plant is added, the estimated load from wastewater sources in the WAMARA should be in the order of 4 tN/y, or likely less than 1 or 2% of the total load reaching Te Waikoropupū. Dr Rowarth agreed this was not material compared to other sources.

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176 Stewart, EIC and Williams, EIC.

177 Transcript at pp 639 and 640.

[438] We agree with Mrs Chubb that even though the load is small as a percentage of the total load in the catchment, it will be important that all dischargers "do their bit" to reduce the load.[178] This will be a matter for TDC to address as part of the TEP process.

B.11 Monitored nitrate-nitrogen loads reaching Te Waikoropupū

[439] NO_3-N loads vary from year to year and the evidence included a range of estimated loads and associated increases over time, which we summarise below.

[440] Table 9 summarises indicative changes in NO_3-N load that have occurred since the early 1990s through to the present, as a basis for comparison with estimated increases from changes in land use over the same period. The data was provided by TDC in July 2022 in response to a request from the Court.[179]

Table 9
Nitrate-nitrogen loads discharged to the Main Spring and Fish Creek Springs in the early 1990s and 2022 (tN/y)

	1993		2016		2021	
	Conc (mg/l)	**Load (tN/y)**	**Conc (mg/l)**	**Load (tN/y)**	**Conc (mg/l)**	**Load (tN/y)**
Main Spring	0.35	110	0.40	135	0.48	164
Fish Creek Spring	0.20	23	0.36	40	0.47	62
Total		133		175		206

178 Transcript at p 784.

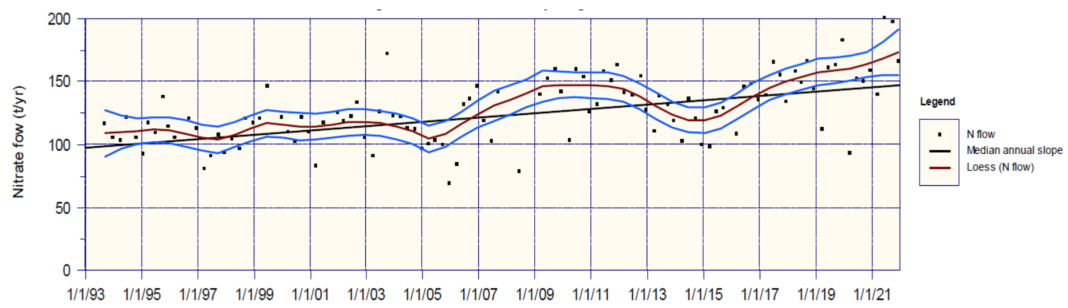
179 TDC noted that the Fish Creek Spring nitrate concentration in 1993 was estimated from a single sample collected in 1994. Coarse nitrate loads were calculated based on annual average flow and annual median nitrate concentrations. Ideally, they considered loads should be calculated at a much finer time scale and/or using any established relationships between flow and nutrient concentrations.

[441] This indicates an increase in NO_3-N load of around 40 tN/y between 1993 and 2016, and 70 tN/y between 1993 and 2021.

[442] Figure J shows the mean NO_3-N load to the Main Spring based on monitored NO_3-N concentrations and daily flows from 1993 to 2021.[180] Monitoring of Fish Creek Springs was not undertaken during the early part of this period.

Figure J

Nitrate-nitrogen loads at the Main Spring for the 1993 to 2021 period (combined dataset)



[443] Figures K, L and M present the results of the increased frequency of monitoring by FOGB from the start of 2016. Figures K and L show NO_3-N loads based on monitored NO_3-N concentrations and daily flows. Figure M indicates that NO_3-N loads varied in a broadly similar pattern for both the Main Spring and Fish Creek Springs.[181] This most likely reflects variations in rainfall and other climatic influences. It appears loads are highest in November/December and lowest in winter, no doubt reflecting lag times.

180 Reproduced from "Analysis of the TDC/GNS and FOGB data sets and monthly rainfall", D J Mead 26 July 2022.

181 Figures 2 and 3 from "Analysis of the TDC/GNS and FOGB data sets and monthly rainfall", D J Mead 26 July 2022 and Figure 4 from JWS Ecology and Mātauranga Māori dated 22 July 2022 at Appendix 1, amended Figure 5.

Figure K

Nitrate-nitrogen loads at the Main Spring for the 2016 to 2022 period

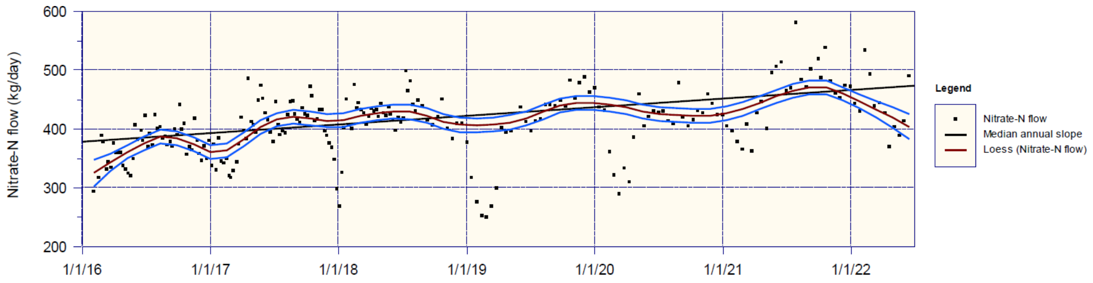


Figure L

Nitrate-nitrogen load at Fish Creek Springs cluster 2016 to 2022

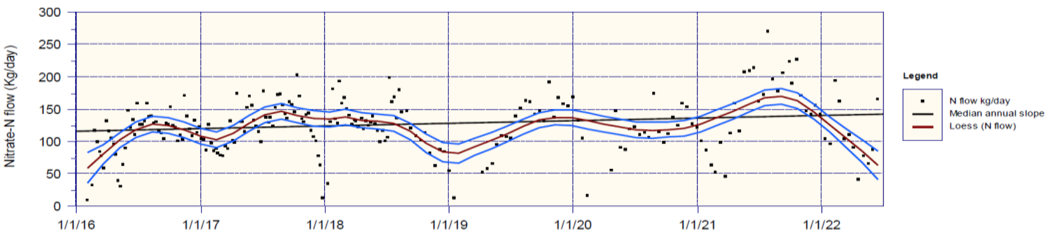
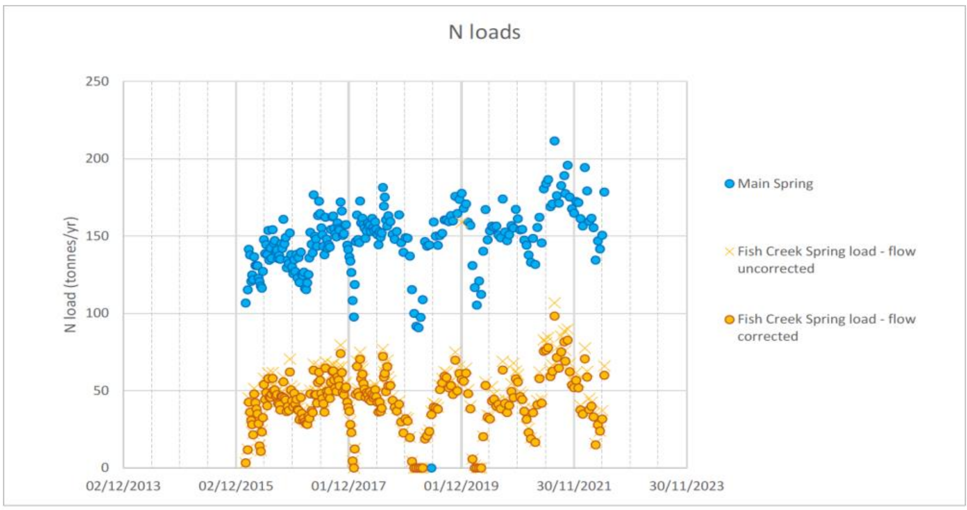


Figure M

Nitrate-nitrogen loads at the Main Spring and Fish Creek Springs (FOGB Site) 2016 to 2022



[444] Figure K shows that the NO_3-N load to the Main Spring increased from 390 kg/d in mid-2016 to 470 kg/d in mid-2021, an increase of 30 tN/y or 20%. Figure L shows that the load to Fish Creek Springs increased from around 120 kg/d to around 145 kg/d over the same period, an increase of around 9 tN/y or 20%, indicatively the same percentage increase as at the Main Spring. Table 7 appears to indicate that the increase in load to Fish Creek Springs from the early 1990s to 2022 was three times greater than that to the Main Spring. However, we place greater weight on the FOGB data because of its more certain confidence levels.

[445] Ms McArthur's analysis of the data showed that between 2016 and 2021, the estimated NO_3-N load leaving Te Waikoropupū increased by 40 tN/y.[182] This is consistent with the 39 tN/y derived above. Dr Mead estimated that the median NO_3-N load to both Springs increased from 174 tN/y in 2016 to 238 tN/y in the 10 months to March 2022,[183] an increase of 64 tN/y or around 35%. This is not difficult to see from the combined load data in Figure M.

[446] While there are differences in the above estimates of NO_3-N load increases, no doubt partly due to different start and finish dates, there can be no doubt that a very substantial increase in NO_3-N load has occurred in the period since comprehensive monitoring was started by FOGB in 2015/6. There is clear evidence that the load has exceeded 200 tN/y at times; an increase in the order of 70 tN/y from early 1990 loads.

[447] Figure M indicates the combined load exceeded 250 tN/y for a period towards the end of 2021. This compares to an estimated load of 130 tN/y in the early 1970s or an almost doubling in the intervening 50 years. Under these circumstances, there can be no argument that Te Waikoropupū can be considered

182 McArthur, EIC at Table 2.
183 Mead, EIC at [25].

to remain in its natural state in terms of NO_3-N. It clearly does not and its health is at significant risk as a result.

B.12 Reasons for the increases in nitrate-nitrogen that have occurred over time

[448] As already noted, we received conflicting opinions as to the reasons for increasing NO_3-N concentrations but no robust evaluative evidence from any expert to support their opinions. The submissions and/or evidence of the applicants, FOGB and SOS was that farming intensification is the primary cause. TDC's case was that natural sources were the primary contributor of NO_3-N to Te Waikoropupū and were an almost equivalent contributor to the increases as farming activities.[184] Farming Interests acknowledged farming is a contributor and presented evidence of improved farming practices they consider are likely to have reduced rather than increased NO_3-N losses over the last 30 or so years.

[449] The effects of irrigation on leaching rates from dairy farms was a matter of significant dispute at the hearing and one we explored in some detail with witnesses, particularly the nitrate experts during hot-tubbing. We also considered it essential to understand the reasons for the increases in NO_3-N concentrations and loads to ensure that any limits we recommend to the Minister are capable of being implemented through TDC's processes in preparation of its notification of the TEP, particularly in view of the large natural variations that occur in the WAMARA.

[450] We summarise this part of our inquiry under a number of separate topic headings below. We addressed NO_3-N leaching from the Karst Uplands in section B.7 and found no evidence to support the proposition that NO_3-N leaching from that source has increased over the last 30 or so years, other than as a result of climatic conditions from time to time.

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184 Based on Stewart, EIC at Tables 4 and 6.

[451] The first six sections below summarise the evidence we received in relation to farming activities (from the collective we have referred to as the Farming Interests). A collective case was presented to the Tribunal by a group of submitters called Upper Takaka Irrigators ('UTI'). This group comprised three farming families in the Uruwhenua and Upper Tākaka areas of the WAMARA, the Sowmans, the Rossers and the Harwoods.

[452] Mr Sowman led the submission of UTI in the WCO process. In evidence to the Court, he advised that UTI now provides a voice for the majority of dairy farmers in the WAMARA through a Catchment Group called FAMA (an acronym for Farmers on the Arthur Marble Aquifer).[185] Mrs Chubb farms in Hamama. Before the Court, she gave evidence on behalf of her husband and herself, UTI and FAMA. Mr Savage, who owns a farm in the Tākaka Valley also gave evidence.[186]

[453] Ms Langford is a senior resource scientist for land use and soils at TDC. Called as an expert by the Farming Interests, she gave evidence drawing on her detailed knowledge of farming in the WAMARA. This included working for nine years as Fonterra's Sustainable Dairy Advisor and prior to that as a nutrient management consultant for a fertiliser company in the Buller and Tasman Regions.

B.13 History of farming in the WAMARA

[454] Mrs Chubb advised us that dairying has been a pioneering industry in Golden Bay since the first butter factory was established in Tākaka in 1894. Her family's farming connections in the Bay stretch back to the 1860s when three siblings settled at Uruwhenua.[187]

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185 Sowman, EIC at [2.3].

186 As noted, we refer to these various submitters collectively as the Farming Interests.

187 Chubb, EIC at [3.2]-[3.1].

[455] Mr Sowman's family has farmed in Uruwhenua since purchasing the original property of 50 ha in 1952. His grandmother's family, the Mansons, settled in Tākaka in the late 1800s.[188] The property Mr Savage farms has been in his family since 1936.[189] Ms Langford stated that all 15 farms remaining in the catchment are family farms that have been in the same family for two to six generations.[190]

B.14 Changes that have occurred in farming practices over time

[456] Mr Sowman described the many sustainable farm practice improvements made on his family farm over the last 14 seasons. Those improvements included:

(a) reducing nitrogen use from 210 to 115 kgN/ha;

(b) investing in soil moisture monitoring sensors and new irrigation infrastructure that allows lower application rates to match soil moisture deficit;

(c) upgrading the dairy effluent system to provide 30 days' storage, separation and composting of the solid component and irrigation of the effluent when soil moisture is in deficit;

(d) removing cows prior to the start of Autumn rains, with 85% of cows removed from the milking platform; and

(e) fencing off all flowing streams and planting 7,000 native trees.

[457] In response to a question from the Court, Mr Sowman estimated nitrogen losses from the farm have reduced by around 45%. He acknowledged that:

> These practices are not necessarily common of all other dairy farmers within the AMARA, however there are many fast followers all making changes as their confidence in management practices and technology solutions improves and their individual financial situations allow.

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188 Sowman, EIC at [3.1].

189 Savage, EIC at [1.3].

190 Langford, EIC at [3.2].

[458] Mr Savage described upgrading of the irrigation system on his family farm in 2012, which included a water efficient centre pivot, low application rate k-line sprinklers, variable control pumps and soil moisture telemetry. Improved irrigation and effluent irrigation efficiency resulted in an estimated 17% reduction in NO_3-N leaching.

[459] Mr Sowman and Mrs Chubb described the following improvements that have occurred in the wider farming area from the early 1990s and 2000s:[191]

(a) in the late 1970s to 1990s there were 20 dairy sheds within the WAMARA, today there are 13;[192]

(b) many of the sheds were located adjacent to natural waterways, with some having a sump to collect the wastes and others discharging straight to water;

(c) stock crossed many waterways, including the Tākaka River and regularly flowing tributaries, where water is lost direct to the AMA;

(d) the spraying of whey onto pasture in the WAMARA was stopped abruptly after a fire all but destroyed the Tākaka Dairy Factory.

[460] Ms Langford stated that:

(a) all dairy farms in the WAMARA have a Farm Environment Plan;

(b) the cost of fertiliser is prohibitive to over application. Nitrate fertiliser use in the WAMARA ranges from 22 to 181 kg N/ha/year, which means all farms are below the newly regulated limit of 190 kg N/ha/year;

(c) all 15 farms have runoff blocks and are wintering some of their herds on those runoff blocks;

(d) all 15 farms have deferred irrigation effluent systems. This means

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191 Sowman, EIC at [3.12]; Chubb, EIC at [3.4].

192 We note that Ms Langford stated there are currently 15 farms in the WAMARA, as recorded in paragraph [10]. We do not consider the difference to be material to our decision.

that farms can store effluent and defer irrigation to land until soil moisture conditions are suitable;

(e) all Water Accord defined water ways[193] have been stock excluded since 2013. At that time, around 40% of the minor non-accord waterways in the WAMARA were stock excluded and now this is expected to be higher;

(f) data collected from the farmers shows that since 2015 there has been a consistent planting effort of around 2000 plants a year along waterways;

(g) dairying in the WAMARA falls in the mid-range of Dairy New Zealand's classification of dairy production systems and intensity and there is no evidence of intensification.

[461] Ms Langford provided a table of TDC data that showed the number of cows in the WAMARA increased from 5510 in 2005/6 to an average of 6130 between 2006/7 and 2019/20, an increase of 11%, after which it reduced by around 5%.[194] Mr Sowman relied on the local Rural Service Centre vet practice records of leptospirosis vaccinations, which confirmed there was a 10% increase in cow numbers from 2011 to 2016, followed by a 5% decrease by 2021. He stated:

> This reflected the farm management system improvements occurring on farms through irrigation (newer more productive pasture species being established, better in-calf rates, higher responses to fertiliser), and the trend to higher uses of purchased supplements that typified the system changes across the New Zealand dairy industry after record milk prices in 2007 and 2008. They also reflect two farms that adopted part herd or full herd once a day milking where stocking rates

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193 The Dairying and Clean Streams Accord is an agreement between Fonterra, the Ministry of Agriculture and Forestry, the Ministry for the Environment, and Local Government New Zealand (on behalf of regional councils). Signed in May 2003, the Accord provides a framework for these organisations to work together. The Accord's aim is to contribute toward clean, healthy freshwater resources including streams, rivers, lakes, groundwater, and wetlands in dairying areas. It is an important voluntary environmental initiative alongside other projects and strategies that support and improve the dairy industry's social, economic and environmental performance.

194 Langford, rebuttal at Appendix A.

> are typically lifted to offset the lower milk production of the animals. In these situations, the farm systems are no more intense *per se* (as Ms Langford also notes in her evidence), it is simply that the same amount of feed is passed through a larger number of animals who each have a lower biological feed demand.

[462] Ms Langford described environmental performance requirements that must be met before Fonterra will accept milk.[195] From our review of the requirements they were all directed towards ensuring more sustainable farming practices and reductions in effects in the environment, including from NO_3-N leaching.

[463] Mr Bush-King reported on related matters concerning TDC's farm monitoring programme as follows:[196]

> … the Council annually monitors all farms to check compliance with the permitted activity rules for dairy effluent discharge (Rule 36.1.2.3). Using Ministry for the Environment guidelines, full compliance has been achieved in nine out of 16 seasons with one, or at most 2 farms, having low risk non-compliance in 5 seasons, and on two occasions, a moderate risk noncompliance.

B.15 Effects of seasonal climate variability in the WAMARA

[464] We received evidence on the effects of seasonal climate variability in the WAMARA. Mr Savage stated that:[197]

> The seasons in the Takaka valley are highly variable. When the season's rainfall departs from the average season, then the impacts become severe and place a high level of stress and pressure on the farms, livestock, productivity and profitability. … The Takaka valley experiences some very extreme weather. Especially high rainfall events (300 mm+), heat (soil temperatures 25 degrees plus) and high evapotranspiration (where the moisture is taken from soil) weather. In extreme seasons, our irrigation systems cannot cope, and high pasture growth rates can still

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195 Langford, EIC at [2] and JWS Nitrate.

196 Bush-King, EIC at [60].

197 Savage, EIC at [2.4].

> suffer despite the irrigation.

[465] Both Mr Sowman and Mrs Chubb provided evidence of climate variability in the WAMARA based on farm monitoring records.[198] Mrs Chubb stated "I can assure the Court that in my first-hand experience of farming in the Tākaka Valley for the past 20 years that our weather is highly variable".[199]

[466] Ms Langford stated:[200]

> The problem in the WAMARA is not the amount of annual rain, but the variability in rainfall pattern and intensity.

[467] We also note Ms Dewes' opinion that:[201]

> Farming can be profitable, productive and resilient without significant additional inputs of water and imported nutrients. This is especially so when there is high rainfall such as in the Takaka Valley.

[468] However, we found the evidence of the Farming Interests' witnesses to be consistent, highly credible and based on directly relevant local knowledge, while Ms Dewes provided no Tākaka Valley-specific climate evidence to support her views. We have no hesitation in accepting the Farming Interests' evidence on the significance of climate variability in the WAMARA.

B.16 The evidence on the effects of irrigation on leaching rates

[469] Ms Langford advised that all 15 farms in the WAMARA practice deferred irrigation of dairy effluent, which means the effluent is applied at times of soil moisture deficit. She also stated that irrigation (authorised by freshwater take

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198 Sowman, rebuttal evidence at Appendix 1; Mrs Chubb, rebuttal evidence at [2.2] and Appendix 1.

199 Chubb, rebuttal dated 29 April 2022 at [2.2].

200 Langford, EIC at [3.21].

201 Dewes, EIC at [22].

resource consents) is used by WAMARA farmers to overcome seasonal soil moisture deficits and that she has observed a change in the type of irrigation over the 15 years she has worked with the farmers from less precise and higher rate irrigation to more precise low-rate systems.[202]

[470] Dr Rowarth confirmed that irrigation is required to overcome increasing periods of drought and referred to a period in 2020 when soil moisture deficit would have occurred from September to April with the exclusion of November. She stated that irrigation allows the build-up of soil organic matter, which holds water and nutrients and allows more plant growth and, therefore, enables a higher intensity of land use. She explained that, if plants do not grow during drought conditions, the nutrients can be lost to the environment when the drought breaks. By contrast, if plants can be kept growing in drought conditions through irrigation, that results in a decrease in nitrogen leaching to ground rather than an increase.[203]

[471] Ms Dewes and Dr Mead agreed that if the water is applied just to replenish the soil moisture deficit, then you would not get flushing through during that period. However, Ms Dewes considered that it would keep the soil at a level of saturation that meant the NO_3-N would be pushed through, either during high summer rainfall or at the start of winter rains.[204] Ms Langford also considered that an irrigated farm has higher soil moisture content, meaning that when it does rain, drainage will occur faster.[205]

[472] Based on this evidence, we are satisfied that deficit irrigation as currently practiced in the WAMARA is unlikely to cause significant, if any, increased NO_3-N loss at the time of or immediately following irrigation. However, the increased

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202 Langford, summary statement at [2.11].
203 Rowarth, EIC at [3] and Appendix A.
204 Transcript at pp 341 and 342.
205 Langford, summary statement at [3.10].

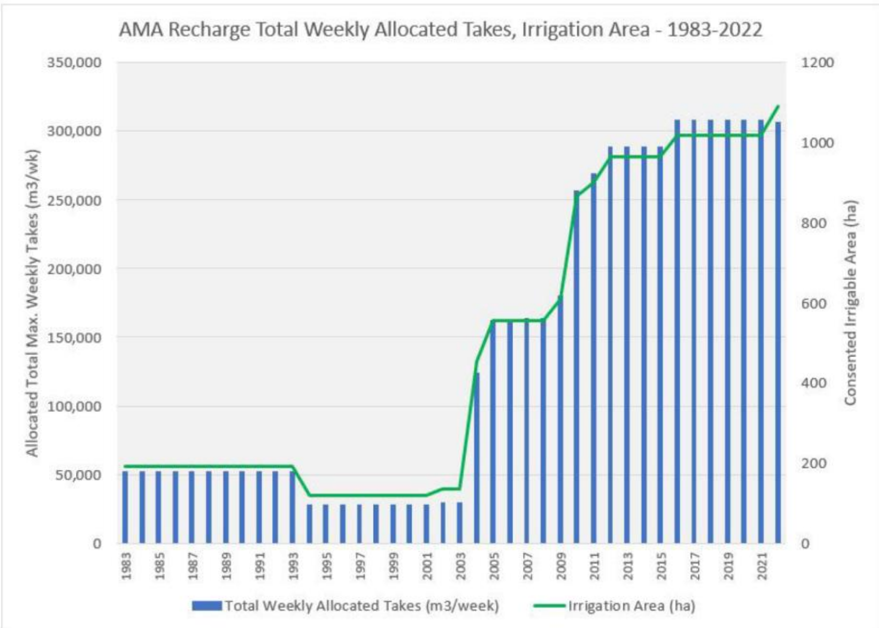
nitrogen held in the soil in whatever form increases the overall quantity of nitrogen potentially available to be flushed out during heavy rainfall.

B.17 Increased water use for irrigation and associated increases in the area irrigated

[473] Following on from the nitrate expert conference, TDC provided the allocated water quantities and irrigation areas from 1983 to 2022 as depicted in Figure N based on TDC records.[206]

Figure N

Allocated water quantities and irrigation areas from 1983 to 2022



[474] This shows that the irrigated area increased from less than 150 ha in 2003 to more than 500 ha in 2005, more than 800 ha in 2010, more than 950 ha in 2012 and more than 1000 ha in 2016.[207] Overall, the area irrigated increased by a factor

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206 TDC memorandum dated 27 June 2022, Court Exhibit JT1.

207 Sowman, EIR at 3.4 stated that the increase in 2016 was not additional, but replaced "an old irrigation consent dating back to … 1984 when the Savage and Wood families first applied for and received consent to irrigate at Hamama."

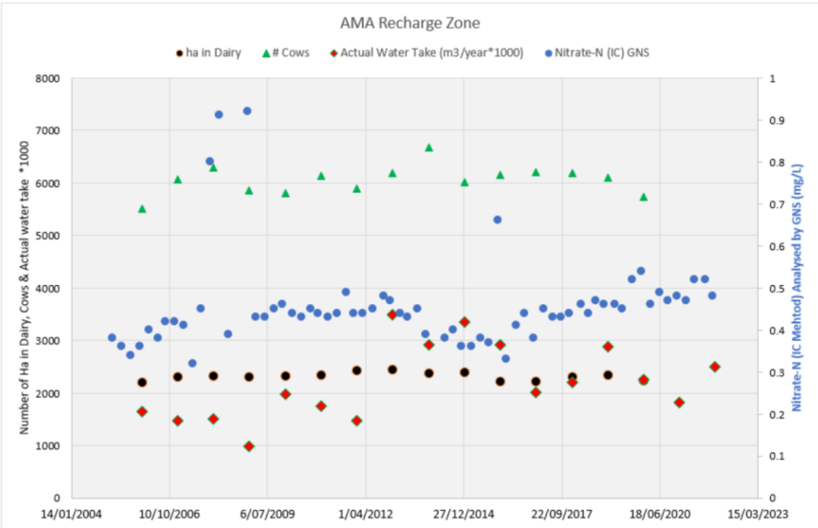
of seven times and the gradual increase coincides closely with the period between 2005 and 2015 when NO_3-N loads reaching Te Waikoropupū increased, with a continuing increase through to 2020.

B.18 Relationships between the area in dairy, the number of cows, actual water take and nitrate-nitrogen concentrations at Te Waikoropupū

[475] Figure O was produced by the nitrate experts in their JWS.

Figure O

Factors that may affect Nitrate-Nitrogen losses from farming activities



[476] The figure confirms there was an approximate doubling in actual water taken for irrigation after 2012, compared to before, which aligns with the date in Figure N at which the consented irrigated area increased by approximately 50%. Water taken decreased from 2017. Based on the evidence of the Farming Interests, irrigation is only used when necessary to maintain soil moisture content, so variations in water taken from year to year will be the result of different climatic conditions.

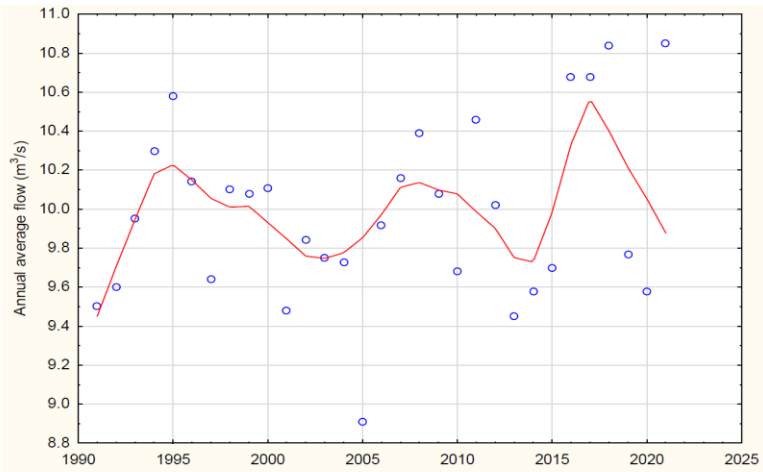
B.19 Changes in flows and nitrate-nitrogen loads and concentrations reaching the Main Spring based on monitoring records

[477] We requested further information on rainfall trends[208] and trends in flows and loads to Te Waikoropupū over time. In response, Dr Mead provided Figure J above, which showing an analysis of NO_3-N loads discharged from the Main Spring from 1993 to 2021.[209] TDC provided a graph of mean annual flows from the Main Spring, which is reproduced as Figure P.

[478] In the JWS on ecology and mātauranga Māori, the experts had previously advised that based on statistical testing, there are strong seasonal effects on discharge (water flows) at both Springs, so NO_3-N mass loads also show strong seasonal effects for the Main Spring and Fish Creek Springs.[210]

Figure P

Mean annual flows at Te Waikoropupū Main Spring 1991 to 2021



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208 Transcript at p 363.

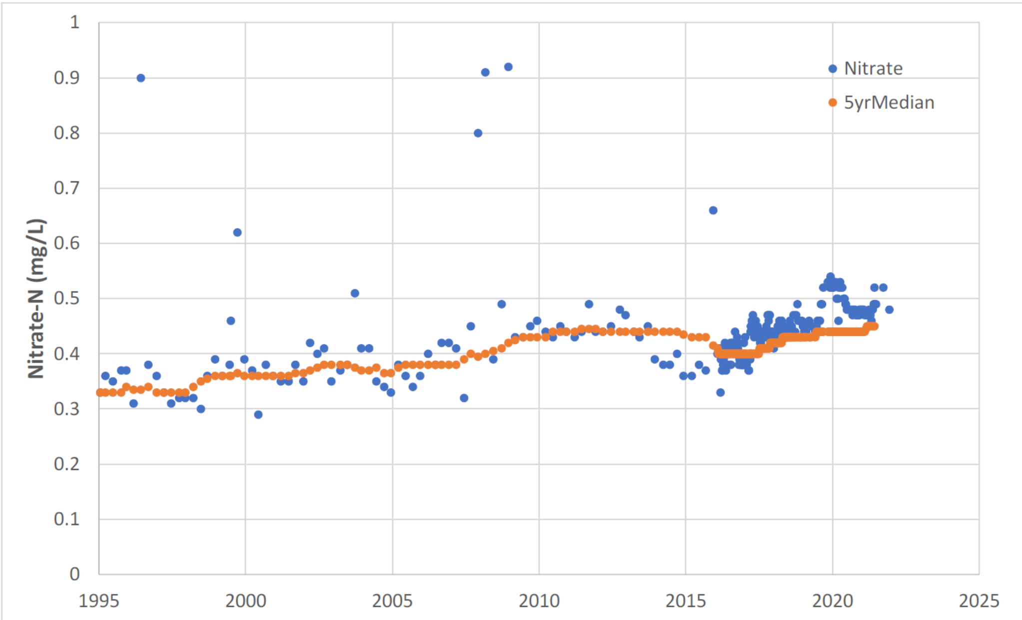
209 Analysis of the TDC/GNS and FOGB data sets and monthly rainfall, D J Mead 26 July 2022.

210 JWS Ecology and Mātauranga Māori.

[479] Figure Q shows the variability in the five-year rolling median NO_3-N concentration at the Main Spring.[211]

Figure Q

Five-year rolling median nitrate-nitrogen concentrations at the Main Spring 1995 to 2022



[480] Figures J, P and Q indicate that in relation to the Main Spring:

(a) the 5-year median NO_3-N concentration increased from 1998 and dipped slightly between 2003 and 2005. No evidence was presented on land use changes leading up to this period, so it is not possible to analyse possible causes of the increased concentrations. There may be a link to the increased flows and NO_3-N loads from around 1998 to 2003. It could also reflect some increase resulting from any increases in the extent of gorse and broom in the Karst Uplands;

(b) in the period up until about 2005, the annual NO_3-N load varied between indicatively 100 and 115 tN/y, which can reasonably be

211 Reproduced from JWS Ecology and Mātauranga Māori at Appendix 2.

expected to reflect natural variations in climate over that period;

(c) the load increased from around 100 tN/y in 2005 to indicatively 145 tN/y from 2009 to 2012, which appears to follow a period of increasing flows three or so years earlier. It then reduced to around 115 tN/y in 2015, which appears to follow a period of decreasing flows three or so years earlier;

(d) the cycle then repeated itself with the load increasing to more than 160 tN/y in 2020 before starting to reduce.[212]

[481] To provide an initial opportunity for the relevant experts to assist us in understanding if the above evaluation could be correct, we worked through Dr Mead's graph on which Figure J is based and explained our preliminary interpretation of what it appeared to be showing with each of them. We acknowledge that Figure J was new evidence and none of the experts had the opportunity to consider what it might be showing in any detail before Court questioning. Their responses were as follows:

(a) Dr Rowarth could not see any obvious flaws;[213]

(b) when Ms Dewes was asked if she thought the interpretation was just plausible or probable or possible, she replied "I … would say probable, plausible and probable";[214]

(c) when Mr Thomas was asked if he had a view on whether it was possible that increased irrigation could be where the additional nitrogen has come from, he replied that "You are right Commissioner, it is about 2003 to 2005 that the irrigation picks up in the Upper Tākaka valley, so I would concur with you …";[215]

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212 While the graph indicates a continuing increasing trend after 2020, that is a reflection of a smaller number of points analysed at both extremes, leading to reduced confidence. A review of the most recent data shows the actual trend has levelled off and appears to be reducing again.

213 Transcript at p 641.

214 Transcript at p 668.

215 Transcript at p 838.

(d) Professor Williams stated "Well it's, without actually working through the numbers it looks on the face of it as if that's a plausible explanation of where most of this nitrate is coming from, because I don't know where else it could come from";[216]

(e) Dr Mead stated "The cause, the only cause that I can think of, of the increase in load is an increase in intensity of farming and that is partly due to irrigation, …".[217]

[482] After completing our overall and more detailed evaluation of the evidence, we interpret the monitoring results as indicating that there were two contributing factors to changing NO_3-N loads to the Main Spring. The first is a repeating increasing followed by a decreasing trend over about ten-year periods that reflects the increases and decreases in flow. The second is an additional increase in load of around 30 tN/y from 2000 to 2010, reducing to an increase of around 15 tN/y in 2015. This was followed by a further increase to around 2020, by which time the total increase compared to 2000 levels was between 40 and 50 tN/y. The larger increases follow periods of higher flows to Te Waikoropupū and the smaller ones follow periods of lower flows.

B.20 Changes in flows and nitrate-nitrogen loads reaching Fish Creek Springs based on monitoring records

[483] Monitoring records for Fish Creek Springs do not allow an equivalent graphic illustration of relationships between flows and loads to be shown. However, Figure L in section B.11 summarises NO_3-N loads at multiple sites within the Fish Creek Springs cluster for the 2016 to 2022 time period. Dr Mead's analysis showed a virtually certain increasing trend in nitrogen discharged from

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216 Transcript at p 889.
217 Transcript at p 953.

Fish Creek Springs.[218] Based on Figure L we estimated an overall increase in NO_3-N load of 9 tN/y over the six-year period.

B.21 Findings in relation to increased nitrate-nitrogen loads reaching Te Waikoropupū

[484] As set out in section B.11, the broad scale of increases in the NO_3-N load that has occurred over the last 30 or so years is around 40 tN/y to 2016 and around 70 tN/y in 2021. Figure M indicates that the load exceeded 250 tN/y for a period towards the end of 2021, or an increase of more than 100 tN/y compared to the load in the early 1990s.

[485] As set out in section B.19, the NO_3-N load to the Main Spring increased from indicatively 100 tN/y in 2005 by around 30 tN/y in 2010, reducing to an increase of around 15 tN/y in 2015, followed by an increase of between 40 and 50 tN/y in and around 2020, compared to pre-2005 levels. When the additional load to Fish Creek Springs is added, the total increase in load reaching Te Waikoropupū since 2005 is in the order of 20 tN/y in low Spring flow periods and 50 to 60 tN/y in high Spring flow periods.

[486] Professor Williams predicted that approximately half the flow from the Valley Floor bypasses Te Waikoropupū and flows into Golden Bay. Dr Stewart predicted that 30% of the flow bypasses the Springs. Based on Professor Williams' predictions, the total increase in NO_3-N leached from Valley Floor land uses to deliver increases of 20 and 50 to 60 tN/y NO_3-N to Te Waikoropupū would be 40 and 100 to 120 tN/y respectively. Based on Dr Stewart's predictions the total increase in NO_3-N leached from the Valley Floor would be around 30 tN/y in lower flow periods and 70 to 85 tN/y in higher flow periods.

[487] Other than the potential for increased loads from increased areas of gorse in the Karst Uplands, the only changes that have occurred in the WAMARA

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[218] Mead, Analysis of long-term TDC data, 26 July 2022.

between the early 1990s and 2020 were an approximate seven-fold increase in irrigated area and a more than 10% increase in cow numbers. Both occurred from or about 2005, the date from which increases in NO_3-N concentrations and loads started to be seen at Te Waikoropupū. They increased in two main steps with crests in 2010 and 2020 and a trough in 2015.

[488] It can be seen from Table 7 that the agreed expert evidence is that irrigating 858 ha of dairy farms compared to not irrigating it increases NO_3-N leached by an indicative 46 kg/ha or a total increase in load of approximately 40 tN/y. Cow numbers increased by around 10% from 2006. While that does not necessarily mean a proportional increase in NO_3-N losses because of improved animal genetics, some increase might be expected. The estimated overall increase in NO_3-N leached falls within the range estimated above based on loads reaching Te Waikoropupū. We discuss this further in as part of our overall evaluation and final section on sensitivity analysis and risk.

B.22 Changes in nitrogen concentrations in the Tākaka River between Upper Tākaka and Kotinga

[489] In accordance with the NPSFM concept of ki uta ki tai, we considered the extent to which surface water quality monitoring assisted in understanding possible sources of increasing NO_3-N in the WAMARA. Between Upper Tākaka and Kotinga, the Tākaka River flows through the main farming area in the Valley Floor, where the potential effects of NO_3-N leaching can be expected to be most pronounced.

[490] Dr Mead stated there is strong evidence that NO_3-N concentrations at Kotinga increased significantly between 1986 and 2021, but the trend was less evident over the last few years.[219] He expanded on this in a supplementary statement of evidence dated 30 May 2022, following a request for further

219 Mead, EIC at [34].

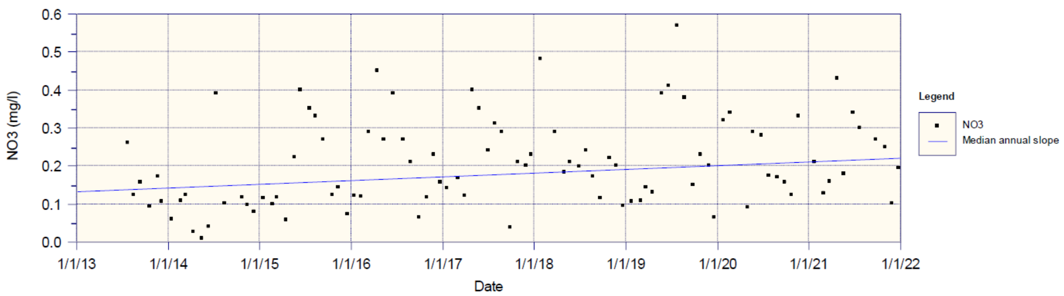
supporting information from the Court, noting that total dissolved nitrogen in March 1986 was 0.19 mg/l and in 2021 it had a median value of 0.27 mg/l.[220] This represents an increase of approximately 40%.

[491] Dr Mead explained that a range of sampling frequencies, a change in laboratories in 2012 and changes in the methods of NO_3-N and total nitrogen analysis at or about the same time complicated analysis of the data. As a result, he performed three sets of analyses. NO_3-N was analysed from 1986 to 2021 ignoring the sampling issues. This was based on 163 data points and showed a "virtually certain" annual increase of 1.71% in NO_3-N over the period. For the period April 1998 to February 2012, total nitrogen was stable and NO_3-N increased by 5.2% a year.

[492] Figure R is a graph provided by Dr Mead showing how NO_3-N concentrations increased between 2013 and 2022. Monthly samples were tested at the same laboratory for the whole period which, in our view, produces a reliable data set.

Figure R

Nitrate-nitrogen in the Tākaka River at Kotinga from 2013 to 2022 (mg/l)



[493] Based on monthly data after June 2013, there was a clear seasonal pattern as shown in Figures S and T and Table 10, which compares NO_3-N collected

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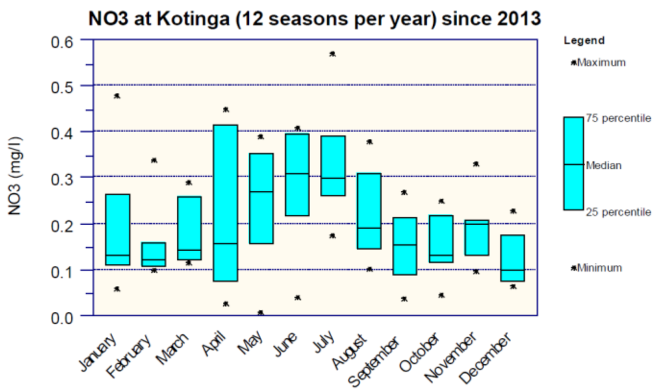
220 Dr Mead observed that at Kotinga there is flow from the Tākaka River for most of the year, despite it sinking into the AMA and running dry upstream.

monthly (usually) at Harwood, Lindsays Bridge and Kotinga on the Tākaka River and at Hanging Rock on the Waingaro River, between September 2018 and February 2022.[221]

[494] The figures and table clearly demonstrate the seasonal variations in NO_3-N leaching and the relationship between rainfall and leaching. This evidence is consistent with seasonal variations for farming activities where leaching is affected by winter rainfall. There was a "virtually certain" seasonal trend of 5.6% increase in NO_3-N and total nitrogen increased at 4.3% a year.

Figure S

Seasonal variations in nitrate-nitrogen concentrations at Kotinga, indicating the effects of rainfall



221 Mead, EIC at Table 3.

Figure T

Monthly rainfall and nitrate-nitrogen in the Tākaka River at Kotinga

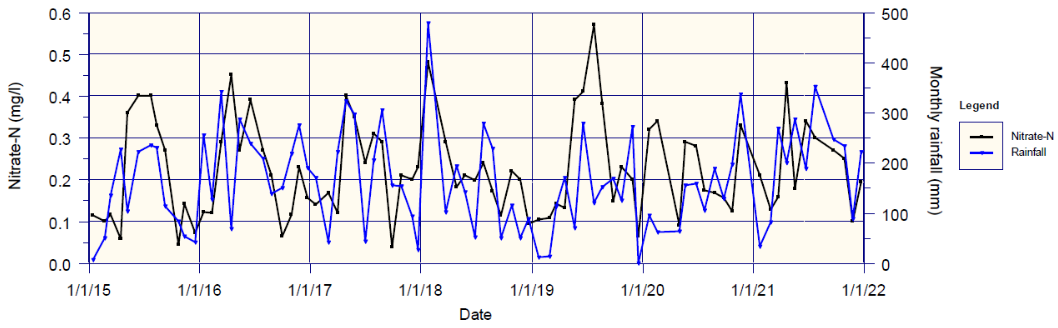


Table 10
Nitrate-nitrogen concentrations at Harwood, Lindsays Bridge, Kotinga and Hanging Rock between September 2018 and February 2022

Site	Samples used	Season test	Median Nitrate-N (mg/l)				Range in Nitrate-N (mg/l)				Kendall seasonal trend Test
	Number	***P***	**Spring**	**Summer**	**Autumn**	**Winter**	**Spring**	**Summer**	**Autumn**	**Winter**	
Hanging Rock, Waingaro R.	40	<0.000	0.006	0.001	0.017	0.017	<0.003 – 0.020	<0.003 – 0.010	0.008 – 0.058	0.010 – 0.035	Trend unlikely
Harwood, Tākaka R.	39*	<0.000	0.0015	0.003	0.005	0.011	<0.003 – 0.005	<0.003 – 0.008	<0.003 – 0.025	0.005 – 0.029	Trend unlikely
**Lindsays Bridge, Tākaka R. ** **	50	0.002	0.042	0.0.020	0.049	0.117	0.008 – 0.147	0.003 – 0.106	0.009 – 0.184	0.068 – 0.300	18%/yr. Highly likely
**Kotinga, Tākaka R. ** **	37	0.054	0.200	0.129	0.169	0.320	0.101 – 0.330	0.065 – 0.340	0.091 – 0.430	0.169 – 0.570	5%/yr. As likely as not

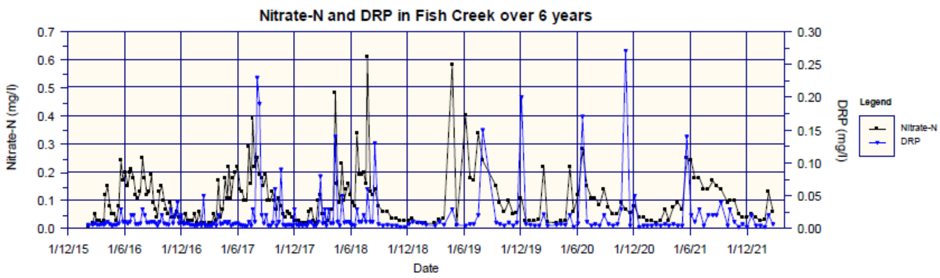
[495] While NO_3-N concentrations measured in the Tākaka River at Kotinga would not directly affect Te Waikoropupū, it is clear to the Court that, if changed land uses in the Valley were increasing NO_3-N concentrations in the adjacent surface waters, they would also be contributing increasing concentrations to the aquifer. Figure R shows an increasing trend in NO_3-N concentrations in the Tākaka River from 2013. Figure J shows NO_3-N loads at Te Waikoropupū increasing from 2015, which is likely to reflect lag times. This further supports the proposition advanced by a number of parties that land uses in the Valley Floor are

the primary cause of increasing NO_3-N concentrations and loads reaching Te Waikoropupū.

[496] Dr Mead also stated that NO_3-N concentrations in Fish Creek above the Fish Creek Springs had a very strong seasonal component being highest in winter and lowest in summer, as shown on Figure U.[222]

Figure U

Nitrate-Nitrogen and Dissolved Reactive Phosphorus concentrations in Fish Creek 2015 to 2021



[497] With regard to Fish Creek, Dr Mead stated that:[223]

(a) a seasonal component is obvious for both nutrients and that the very high spikes (i.e., NO_3-N ≥0.25 mg/l or DRP ≥0.1 mg/l) are associated with high rainfalls in the previous week – the median rainfalls were 44 and 41 mm for these NO_3-N and DRP peaks, respectively;

(b) NO_3-N over the six-year period showed a very strong seasonal component. In winter the median NO_3-N concentration was 0.18 mg/l while in summer it was as low as 0.03 mg/l. Values ranged from 0.005 to 0.61 mg/l NO_3-N and were highly correlated with the previous week's rainfall.

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222 Mead, EIC Figure 2.

223 Mead, EIC at [42] and [43].

[498] This evidence is a further indication that the farming activities contribute to increasing NO_3-N concentrations in the WAMARA.

B.23 Groundwater monitoring in the Valley Floor

[499] TDC provided no critical evaluation of the results of its groundwater monitoring programme in the Valley floor area, which would normally be expected to provide an indication of the effects of land uses in the area. Accordingly, once again in accordance with the NPSFM concept of ki uta ki tai, we considered the extent to which such monitoring assisted in understanding possible sources of increasing NO_3-N in the WAMARA. We have already discussed the results of groundwater monitoring in the Karst Uplands and this section considers possible effects of farming activities.

[500] TDC has been monitoring groundwater quality in the Tākaka Gravel Aquifer from 2000 and a bore within the Tākaka Limestone Aquifer three monthly from 1990. No results were presented of this monitoring. Since 2018, TDC has been monitoring six bores and two springs annually. To complement the three-monthly monitoring, TDC carried out synoptic (snapshot) surveys involving several bores/wells in the catchment in 2006 and 2016. Most of the bores sampled are in the TUGA, both over the unconfined and confined WAMA. There are only a limited number of bores both in the TLA and the WAMA, primarily due to the cost and risk of drilling to depth to access water in these geologies.[224]

[501] Four years of annual monitoring has been undertaken in winter in 2018 and in spring in other years[225] at the bore locations shown on Figure V, reproduced from Figure 19 of Mr Thomas' evidence-in-chief. The results are summarised in Table 11.

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224 Thomas, EIC at [108] and [109].

225 Thomas, Transcript at p 841.

Figure V

Annual groundwater monitoring sites – Tākaka Recharge Area

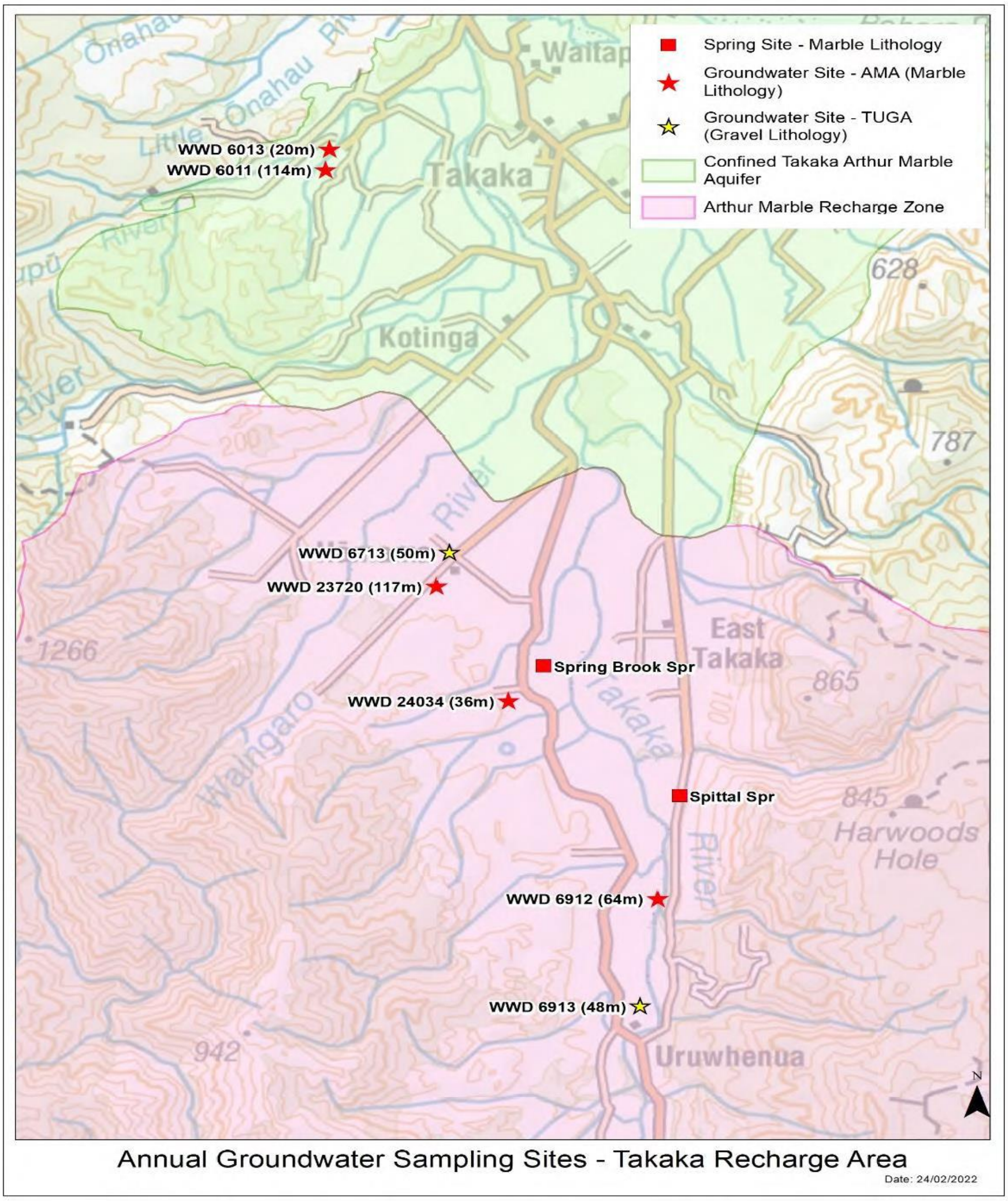

Table 11

Results of annual Nitrate-nitrogen groundwater monitoring

	Spring Sites – Marble Lithology		Groundwater Sites – AMA (Marble Lithology)					Groundwater Sites – TUGA (Gravel Lithology)	
	Spittal Spring	Spittal Brook Spring	WWD 6013 (20m)	WWD 6011 (114m)	WWD 23720 (117m)	WWD 24034 (36m)	WWD 6912 (64m)	WWD 6713 (50m)	WWD 6913 (48m)
2018	0.21	n/a	0.45	0.26	1.01	0.71	0.018	2.9	0.58
2019	0.25	0.5	0.49	0.25	0.88	1.36	0.27	4.3	1.08
2020	0.28	0.46	0.45	0.24	0.97	1.90	0.38	5.0	0.87
2021	0.23	0.56	0.51	0.31	2.20	2.50	0.25	4.1	0.49

[502] The results of the synoptic monitoring of bores throughout the catchment are summarised in Table 12. The surveys were undertaken in summer.[226]

Table 12
Results of synoptic Nitrate-nitrogen groundwater monitoring in the WAMARA in 2006 and 2016

	Nitrate-nitrogen concentrations (mg/l)						No of bores
	Mean		Minimum		Maximum		
	2006	2016	2006	2016	2006	2016	
Takaka Unconfined Gravel Aquifer	2.38	1.74	0.32	0.45	4.2	3.1	9
Takaka Limestone Aquifer	0.62	0.64	0.56	0.58	0.68	0.7	3
Wharepapa Arthur Marble Aquifer	0.54	0.72	0.36	0.44	0.75	0.95	4

[503] To assist our understanding of what the groundwater monitoring programme is telling us, we considered the particular circumstances of each bore or group of bores. We did so with the assistance of responses to questions we put

226 Thomas, Transcript at p 841.

to Mr Thomas. We note first that most bores were not constructed in accordance with then current standards for water quality monitoring bores.

[504] Depending on the depth and location of each individual bore in the TUGA and TLA, NO_3-N concentrations will be influenced by seasonal effects, particularly the amount and intensity of rain over the preceding period, and the extent of mixing that occurs with inflows from Upper Tākaka and the Karst Uplands. Both are likely to vary significantly, making meaningful analysis difficult if not impractical.

[505] For that reason, the results of synoptic monitoring did not assist our understanding of what is occurring in the WAMA, the aquifer of primary interest. At best, the results provided a one in ten-year snapshot of NO_3-N concentrations in two contributing aquifers, with no confidence that the results were representative. Accordingly, we placed no weight on the results of the synoptic surveys. It is unclear to us what the purpose of that monitoring is.

[506] We considered each of the bores drilled into the WAMA on their merits, based on the evidence, as described below, starting at the north of the WAMARA.

[507] Bore WWD 6013 is located within the Te Waikoropupū Reserve boundaries with a depth of 20 m. Being located in the immediate vicinity of the Main Spring, monitoring results reflect concentrations in the Main Spring. It is difficult to imagine how that would not be the case.

[508] Bore WWD 6011 is in the same general locality with a depth of 114 m. Annual NO_3-N concentrations are generally half those in Bore 6013. This information did not assist us to understand what is happening in the upstream aquifer, which is necessary for effective management of recharge flows to Te Waikoropupū.

[509] Bore WWD 23720 is the most westerly in the WAMA with a depth of 117 m. It is located in the middle of an irrigated area. Mr Thomas was unable to

answer a question about whether the monitored concentrations could have been diluted by losses from the Waingaro River.[227] The first three annual results recorded NO_3-N concentrations averaging around 1 mg/l and in 2021, the concentration was 2.2 mg/l. This could reflect the high rainfall in 2021, but that was not apparent in other bores.

[510] In the unconfined part of the WAMA, Bore WWD 23720 is the closest to Te Waikoropupū, with NO_3-N concentrations in the order of two to four times those in the Springs. Other than farming, there is no other land use that could be generating NO_3-N in those concentrations, based on the evidence. Dilution with waters having lower NO_3-N concentrations must be occurring before or at the Springs, potentially as a result of losses from the Waingaro River into the aquifers.

[511] Mr Thomas stated that Bore WWD 24034 is not in the Valley Floor, but around 20 m above it, and part of quarry operations. While he considers it could be an indicator of NO_3-N concentrations in marble, possibly between 1 and 2 mg/l, possibly getting up to 2.5 mg/l, being above the Valley Floor, it cannot be an indicator of the effects of farming on the WAMA. Mr Thomas was unable to identify any reason for the high concentration but, as noted earlier, Dr Hickey helpfully advised that in his experience:[228]

> … quarries use explosives and virtually all explosives contain nitrate in some form they actually have the potential to increase nitrate concentrations in local vicinities. So I'm not in this circumstance familiar with that quarry but it is something to flag that may result in those elevated concentrations.

[512] Bore WWD 6912 is the most southerly bore with a depth of 64 m. It is located around mid-point of the dairy farming area along the Valley Floor and in close proximity to the Tākaka River. NO_3-N concentrations averaged 0.3 mg/l for the last three years, approximately two thirds those at Te Waikoropupū.

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227 Transcript at p 843.
228 Transcript at p 964.

However, Mr Thomas considers the results could be diluted by water lost from the Tākaka River, being so close,[229] making it difficult to put much reliance on what the results represent.

[513] We find that monitoring data from Bores WWD 23720 and WWD 6912 supports a reasonable inference that farming is contributing NO_3-N to Te Waikoropupū, but uncertainties exist as to what exactly the information shows. It is difficult to draw any firm conclusions about the extent or the value gained from monitoring at other current locations. That is particularly because there are uncertainties about what value is gained by monitoring bores so close to the Spring, or monitoring Bore WWD 24034, which does not collect groundwater affected by farming activities and may represent the effects of anthropogenic activities at the quarry rather than natural sources. However, there could be merit in investigating the cause of the high NO_3-N concentrations in the vicinity of the quarry.

[514] In our view, the purpose of both the groundwater and surface water monitoring programmes should be to provide early warning of up-catchment changes in water quality that could adversely affect the values of Te Waikoropupū. It is unclear to the Court whether either programme does that at present, nor whether and to what extent TDC uses the monitoring data it collects.

[515] Both programmes require review to take account of the evidence put before the Court, particularly the importance of total nitrogen and dissolved organic carbon. Mrs Chubb's question about whether a new monitoring site on the Tākaka River just south of the boundary between the unconfined and confined parts of the WAMA requires further consideration, acknowledging that drying out of the river raises matters of practicality.

[516] We strongly recommend that both programmes be the subject of independent peer review by one or more suitably qualified and experienced

229 Transcript at p 843.

experts, preferably at least one with no previous involvement in the WAMARA, including for the purposes of consideration of the matters raised above and in relation to the groundwater programme:

(a) the limitations imposed by the practical difficulties and cost of drilling into the Wharepapa Arthur Marble and difficulties in determining bore locations that are representative of flows and contaminant levels reaching Te Waikoropupū Springs;
(b) the need to understand and document the hydrological settings of and any natural variabilities and uncertainties associated with any monitoring locations;
(c) the extent to which monitoring results will contribute to the effective management of the Springs; and
(d) the need for practicability and reasonableness of expectations in what monitoring programmes can achieve, recognising benefits, costs and other demands on TDC resources.

B.24 Proportion of loads to the Main Spring and Fish Creek Springs from different sources

[517] As noted in section B.1, predictions as to the contributing sources of NO_3-N loadings in the Springs were substantially different in two of the models. Specifically, Professor Williams' model predicted that approximately 84% of NO_3-N entering the Main Spring comes from the Valley Floor and 15% from the Karst Uplands.[230] Dr Stewart's model predicted almost the exact opposite, with 14% coming from the Valley Floor and 80% from the Karst Uplands.[231]

[518] This is a critically important issue for the reasons set out in section B.1.

230 Williams, EIC at [74].
231 Stewart, EIC at Table 7.

[519] We have already indicated that a first principles assessment of land uses and NO_3-N leaching they generate shows conclusively that the Stewart and Thomas nutrient balance model predictions bear no resemblance to reality. While Professor Williams' model predictions more realistically reflect what the evidence shows is occurring in the WAMARA, we identified concerns about hydrological aspects of the model above, and the complexities and uncertainties of the case are such that a particularly careful evaluation is necessary.

[520] We found in sections B.9 and B.10 that the contribution of NO_3-N to Te Waikoropupū from the Upper Tākaka and wastewater sources are in the order of 2% of the total load each, or 8 tN/y total. For the purposes of our evaluation, we have assumed that 6 tN/y will reach the Main Spring and 2 tN/y will reach Fish Creek Springs.

[521] The only other NO_3-N reaching Te Waikoropupū comes from either the Karst Uplands or from the Valley Floor. We found that the indicative load from the Karst Uplands is 48 tN/y with a worst-case load of 76 tN/y.

[522] The Stewart and Thomas and Professor Williams' hydrological model predictions of flows reaching the Main Spring from the Karst Uplands are broadly similar at around 70 to 75% of the total flow.[232] We undertook a simple check of the predictions by considering groundwater travel times and ages of waters reaching the Main Spring, which showed close correlation to the above percentages. As a result, we find that 75% of the flow from the Karst Uplands reaches the Main Spring.

232 Refer Table 4 in section A.8.

[523] The other 25% of the flow from the Karst Uplands will be split between Fish Creek Springs and direct to Golden Bay. The predicted proportions going to each are different in the two models. As the indicative load to be divided between the two outlets is 12 tN/y and the worst-case load is 19 tN/y, we took the pragmatic approach of assuming half goes to each outlet.

[524] From the analysis, we then deducted the estimated loads from the Karst Uplands, Upper Tākaka and wastewater sources from the total estimated NO_3-N loads reaching the Main Spring and Fish Creek Springs to derive estimated loads from the Valley Floor, as shown in Table 13.

Table 13
Derivation of estimated nitrate-nitrogen loads reaching the Main Spring and Fish Creek Springs from the Valley Floor in tN/y and proportions of total load as percentages

		Main Spring		Fish Creek Springs		Total to both Springs	
		Average	Worst case	Average	Worst case	Average	Worst case
1	Estimated total load to Springs[233]	142	175	42	75	184	250
2	Estimated load from Karst Uplands	36	57	6	10	42	67
3	Estimated load from Upper Tākaka and wastewater sources[234]	6	7	2	3	8	10
4	Estimated combined load from Karst Uplands, Upper Tākaka and wastewater sources (2 + 3)	42	64	8	13	50	77
5	Estimated residual load from Valley Floor (1 – 4)	100	111	34	62	134	173
6	Estimated proportion of load from Karst Uplands (2/1)	25%		14%		23%	
7	Estimated proportion of load from Valley Floor (5/1)	70%		81%		73%	

[525] By way of comparison, as noted above, Professor Williams' model predicted approximately 84% of NO_3-N entering the Main Spring comes from the Valley Floor and 15% from the Karst Uplands. He predicted 93% of NO_3-N entering Fish Creek Springs comes from the Valley Floor and 6% from the Karst Uplands. If losses from gorse and broom are excluded from the estimates in Table

233 Mean loads from Table 9 and worst-case loads from Figure M for the period around the end of 2021.

234 Wastewater unlikely to change, only minor increase likely from Upper Tākaka.

13, the percentage load reaching the Main Spring from the Karst Uplands and the Valley Floor is broadly similar to those predicted by Professor Williams' model.

[526] While acknowledging the general agreement between Professor Williams' model predictions and our estimates derived from various expert evidence and assessments of monitoring results, the nitrogen balance model has not been independently verified and we received no information to enable us to assess its veracity other than the above comparisons. There is still uncertainty as to how much of the flow from the Valley Floor and Upper Tākaka bypasses the Springs and goes direct to Golden Bay.

[527] We recognise the major complexities, uncertainties and unknowns associated with the WAMARA, as we have discussed. Nevertheless, we are satisfied that we can make the necessary predictive findings on this matter for the purposes of our recommendation to the Minister.

[528] Based on all the evidence, we find that the proportions of NO_3-N load to Te Waikoropupū coming from the Valley Floor are likely to be around 75% of the total load and within the range of 70 to 85%. Approximately 20% comes from the Karst Uplands, including from gorse and broom, with the remaining 5% approximately coming from Upper Tākaka and wastewater sources.

B.25 Nitrate-nitrogen load to come

[529] We received various opinions as to the extent to which NO_3-N loads already in the aquifers could result in further increases in concentrations and loads reaching Te Waikoropupū, although it was unclear to us that any of them were based on a robust evaluation of local circumstances. Our own assessment is that there has been no increase in irrigated area or increase in cow numbers within the last six to seven years. We are satisfied that any changes in farm management practices that have occurred over that period are likely to have reduced NO_3-N loss rates rather than increased them. We received no evidence to suggest that

changes in land uses over the period will result in further increases in NO_3-N concentrations and loads compared to those observed to date.

[530] The relevant experts agreed that the travel time for the majority of NO_3-N from when it leaves the farm to when it reaches Te Waikoropupū is between about one and five years or less. Under this combination of circumstances, there is no evidential basis to expect any further increases in NO_3-N concentrations beyond those already observed at the Springs provided:

(a) any future land use changes ensure there is no net increase in nitrogen discharged to land or water; and
(b) changing climatic conditions do not result in significantly increased leaching rates.

B.26 Overall evaluation

[531] During the course of our questioning of the nitrate experts, we raised our concern that some parties appeared to presume that dairy farming is the cause of all the problems. We then made clear that we were not yet prepared to draw any such inference.[235] Aside from our responsibility to make our findings on the evidence, we are also required to have regard to the needs of primary and secondary industry, and of the community.[236] Therefore, a necessary aspect of our inquiry has been to direct attention to the several ways in which evidence initially submitted to the Court was deficient, and to direct that experts undertake rounds of expert conferencing to address these deficiencies. That was in order to ensure the Court could be in a position to make necessary findings on a sufficiently robust evidential base and by a process that fairly considered the interests of all parties.

[532] To ensure there is no misunderstanding, it was clear to us that the three farming witnesses who gave evidence before us take very seriously their

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235 Transcript at p 351, in the second week of the hearing.
236 Section 212(a), RMA.

responsibilities to manage their activities sustainably and have put considerable effort into caring for their land and reducing their environmental footprints. In our evaluation, it was also necessary to take into account evidence relating to changes in nitrate concentrations and loads reaching Te Waikoropupū and compare them to when increased irrigation started. These are catchment management issues that are the responsibility of TDC, not the farming community, and an Environment Court inquiry should not have been the first time such an evaluation was undertaken.

[533] There is no evidence to suggest that farming has been undertaken in breach of resource consent conditions or that farmers have turned a blind eye to the effects of their activities. We consider unequivocally that the converse is true in the case of the three witnesses before us.

[534] It is clear from Mrs Chubb's evidence that there has been adverse public reaction against farming activities that has been hurtful and stressful and which, in our view, is unfair, inappropriate and unjustified. The solution lies in working together rather than seeking to apportion blame to a long-established part of the community that is operating within the rules historically set for it.

[535] The much more substantial evidence arising through our inquiry and the best information now available lead us to find overall that:

(a) farming activities in the Valley Floor contribute approximately 75% of all NO_3-N reaching Te Waikoropupū, or approximately three times more than all other sources combined;[237]

(b) from 2005 onwards there has been a generally increasing trend in NO_3-N concentrations and loads reaching Te Waikoropupū, with reductions at times that reflect varying climatic conditions in the WAMARA and water flows measured at Te Waikoropupū;[238]

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237 Refer [528].

238 Refer section B.19.

(c) since 2005, there has been an increase in NO_3-N loads leached from the Valley Floor of around 30 tN/y in lower flow periods and possibly 70 to 85 tN/y in higher flow periods;[239]

(d) the only changes in land uses that have occurred in the WAMARA between the early 1990s and 2020 were a more than a seven-fold increase in irrigated area of dairy farms between 2003 and 2016 and a more than 10% increase in cow numbers in or after 2005;[240]

(e) there have been no other land use changes in the WAMARA that are likely to have contributed to increasing NO_3-N concentrations and loads reaching Te Waikoropupū, most certainly not at the levels monitored;

(f) there is no evidential basis to support TDC's proposition that natural sources are the main contributor to NO_3-N concentrations and loads reaching Te Waikoropupū or that they have increased over the last 30 or so years. To the contrary, the evidence shows that is not the case;

(g) increases in NO_3-N concentrations monitored in the Tākaka River in the Valley Floor from 2013 are consistent with increases monitored at Te Waikoropupū when lag times are taken into account, adding weight to the evidence of the effects of farming activities on water resources in the WAMARA;

(h) FOGB monitoring of Fish Creek adds further evidence that farming activities contribute to increasing NO_3-N concentrations in the WAMARA;

(i) based on the agreed evidence of the nitrate experts, irrigating an increased area of 858 ha of dairy farms compared to not irrigating it increases NO_3-N leached by approximately 40 tN/y, without considering the effects of increased cow numbers or variability due to rainfall. This is broadly consistent with the mean of increases in

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239 Refer [480] and following, and [528].

240 Refer [473] and [474].

loads observed at Te Waikoropupū under low and high flow periods.[241]

[536] Despite the best efforts of members of the farming community giving evidence before us, it is clear from our comprehensive evaluation of multiple lines of inquiry that increases in NO_3-N concentrations and loads reaching Te Waikoropupū have resulted from the increased use of irrigation and, to an extent, increased cow numbers from 2005 onwards.

B.27 Sensitivity analysis and risk

[537] The primary need to consider sensitivity and risk relates to the relative loads of NO_3-N generated in the Karst Uplands and Valley Floor as this is likely to affect future land use rules made under the TEP. The loads generated in Upper Tākaka and by wastewater facilities are too small to have any significant effect on Te Waikoropupū.

[538] If gorse and broom are excluded from consideration, the worst-case predicted load generated within the Karst Uplands would be 33 tN/y compared to 22 tN/y under more normal conditions, as set out in section B.7. The worst-case increase in NO_3-N load to Te Waikoropupū would be 11 tN/y, as a small portion would flow direct to Golden Bay.

[539] This variability is small compared to the variability in loads from the Valley Floor summarised in section B.21, indicating low sensitivity to variations in predicted loads from the Karst Uplands.

[540] An important issue is how much NO_3-N is being generated by gorse. If it is 26 tN/y as per the nitrate experts' indicative estimate and it is practicable to reduce that by 30% as a result of future land use rules, indicatively, around 40% of the required NO_3-N reduction required at Te Waikoropupū could be achieved. If

241 Refer section B.21.

the actual load generated by gorse is in fact around 10 tN/y and it is practicable to reduce that by 30% as a result of future land use rules, only around 15% of the required NO_3-N reduction required at Te Waikoropupū could be achieved.

[541] That is not a matter that can be addressed through the WCO but independent of what the contribution of gorse is, farming activities will continue to be the biggest contributor of NO_3-N reaching Te Waikoropupū. As no reductions in loads from natural sources will be possible through the TEP, controls on farming activities will have to make up the difference. If controls on gorse are ineffective, the only way to meet the load reduction target, will be for farming activities to reduce their contribution further.

[542] It will be for TDC to determine what reductions must be achieved by those activities through the TEP process with community input.

Section C

Findings as to tikanga Māori significance matters and ecology and water quality

C.1 Purposes of section C

[543] The key purposes of this section C are to set out our evaluative findings on evidence as to:

(a) the significance of Te Puna o Te Waikoropupū Springs (Te Waikoropupū) and Te Taiao (the environment) within which it sits to Manawhenua; and

(b) why the values of Te Waikoropupū are under threat and what restrictions are necessary to preserve and protect them.

[544] We have been guided by the NPSFM as to the importance of holistic or integrated management of Te Taiao in accordance ki uta ki tai, which recognises the interconnectedness of the whole environment from the mountains to the sea. The NPSFM includes objectives and policies that we must have regard to in addition to those considered by the Special Tribunal.[242]

[545] Our findings address Te Taiao through both mātauranga Māori and western science lenses. We draw from our findings in sections A and B. We consider evidence giving important background from a mātauranga Māori perspective to the taking of additional water from contributing sources to Te Waikoropupū in section D.

[546] The importance of Te Waikoropupū to Manawhenua is set out in the application for a WCO dated April 2017, which stated that the sole objective was:

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242 The NPSFM 2020 took effect after the Special Tribunal's Recommendation decision was issued.

> … to protect a culturally significant *Wāhi tapū* (sacred place) and outstanding natural freshwater and aquifer system of national significance to the descendants of Ngāti Tama and the communities of New Zealand.

[547] To ensure our recommendation on the WCO is based on the best available information and satisfies the requirements of ss 6(e), 7(a) and 8, RMA, we address the evidence of Manawhenua witnesses in some detail. After briefly describing the Springs and their physical setting, we describe their significance in accordance with tikanga Māori in section C.3, followed by their history in section C.4.

[548] In subsequent sections, we set out findings on the ecological values and features and water quality of Te Waikoropupū, with considerable emphasis on NO_3-N. We also address the other three water quality parameters of particular importance identified by the water quality and ecology experts – dissolved reactive phosphorus (DRP), dissolved oxygen (DO) and water clarity. In each case we set out our findings in relation to limits necessary to preserve and protect Waikoropupū.

C.2 General description of Te Waikoropupū and its setting

[549] Te Waikoropupū Springs are the largest in New Zealand with waters among the clearest in the world.[243] They include the Main Spring, Dancing Sand Springs and Fish Creek Springs. They were designated formally as a wāhi tapu by the New Zealand Historic Places Trust Pouhere Taonga in 2005.

[550] The Springs are located near Tākaka, towards the northern end of the Tākaka River catchment, as shown on Figure 1 in Part 1. A general layout of the Springs is shown on Figure 2 in Part 1. Figures A and B on the inside cover of

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243 Common Bundle at 80: Ecosystem health of Te Waikoropupū, Cawthron Report 2949 dated March 2017 at section 1.

Part 2 show photographs of the Main Spring and Dancing Sands Springs respectively.[244]

[551] The full areal extent of Fish Creek Springs has not been defined. Professor Williams stated that the area across which upwelling occurs from these Springs varies noticeably with discharge, sometimes extending beyond the Department of Conservation reserve boundary. He acknowledged that during average to low flow conditions, discharges occur within the boundary but during high flows small upwellings of water under pressure emerge through the grass on adjacent farmland to the south of the reserve boundary.[245]

[552] The applicants requested that the WCO include a plan of Te Waikoropupū that encompasses the full extent of Fish Creek Springs (in essence to be protected by the WCO's associated controls). No survey plan was provided to define the full extent and we had no evidence indicating the views of the landowners onto whose properties the Springs extend. We were not informed as to whether and to what extent this may require associated changes to the Department of Conservation reserve boundaries. Plainly such matters go beyond the scope of a WCO inquiry to address.

[553] In addition to those uncertainties, it is important to avoid undue delay in making this report. Therefore, we find that we should not incorporate the requested modification. However, we observe that the RMA allows for technical amendments to a WCO in due course. The recommended WCO includes a specific clause acknowledging this potential.

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244 Figure 4, in Young et al, 2017.
245 Williams, EIC at [25] and rebuttal at [11].

C.3 Significance of Te Waikoropupū in accordance with Tikanga Māori

[554] We accept Ms Little's explanation of the significance of Te Waikoropupū to Ngāti Tama as follows:[246]

> Te Puna Waiora o Te Waikoropupū refers to pupū (bubbling waters). Ngāti Tama ki Te Tauihu have continuously upheld kaitiakitanga in Mohua since 1820. Since our occupation of Mohua, Te, Waikoropupū Springs has been central to the lives of Ngāti Tama ki Te Tauihu whānau. It is the intrinsic values of Te Puna Waiora o Te Waikoropupū, its purity and pristine wai that whānau go to in times of need and spiritual fulfilment. This is a testament to the wairua surrounding Te Puna Waiora o Te Waikoropupū as it bubbles up from the underground Wharepapa, Arthur Marble aquifer. The purity of the wai is unequalled as a wāhi tapu and taonga tuku iho. …
>
> In the past Te Puna Waiora o Te Waikoropupū was used for the birth of the Ariki tamariki and for blessings of whānau and taonga when leaving Mohua. The Pounamu (Greenstone) Trails passed through Te Puna Waiora o Te Waikoropupū and it is said that whoever controlled Mohua also controlled Te Puna Waiora o Te Waikoropupū. The spiritual realm is reflected in the legend of Huriawa the kaitiaki taniwha who was called forth to reside and clear the caves and caverns of the underground realm. She is the keeper, kaitiaki and the giver of purity and pristine water – Ngā waiora o Huriawa. …
>
> We see Te Puna Waiora o Te Waikoropupū, as part of the wider system of the Tākaka River catchment; everything from the underground source to the sea, all the small tributaries and all the springs that bubble up into the ocean. Because the physical and the spiritual are inseparable, the health of the whole system reflects the well- being of our community. Water has different qualities and Te Puna Waiora o Te Waikoropupū Springs falls into the category of wai ora – water of life. Wai Ora is the purest form of freshwater. It gives and sustains life, can rejuvenate damaged mauri and counteract evil. The waters of Te Puna Waiora o Te Waikoropupū were used by tūpuna for cleansing and spiritual healing. We view the springs and the tracks leading to them as marae. There is respect and ceremony around visiting Te Puna Waiora o Te Waikoropupū. It is part of our tradition that

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246 Little, EIC at [15], [17] and [40].

> we take forward into the future to maintain the continuity of life

[555] We accept Ms Manson's evidence describing the cultural significance of Te Waikoropupū to Ngāti Tama. She explained that Ngāti Tama's mana and occupancy of te whenua o Te Tauihu o Te Waipounamu has been continuously maintained by Manawhenua through keeping the homes fires burning (Te Ahikaa roa o Tama) and upholding the role of kaitiaki throughout the rohe (tribal area), since pre-1840.[247] In particular, she said:

> Ngāti Tama ki Te Tauihu descend from Māori chiefs, who, through raupatū (conquest) and intermarriage, assumed the role of kaitiaki, or guardians of the rohe (area); a responsibility, which was subsequently passed down by way of tikanga (protocols) and whakapapa (genealogy). As kaitiaki, Ngāti Tama continue to carry out their responsibilities and obligations to uphold the cultural, spiritual and environmental integrity of all taonga (sacred treasures) and wāhi tapu (sacred places) in the rohe for past, present and future generations and whanau. Te Waikoropupū Springs is of immense spiritual importance to Ngāti Tama ki Te Tauihu. Ngāti Tama whānau have maintained ahi kā roa (a continuous relationship) with Te Waikoropupū and the taonga tuku iho (natural treasures) within the Tākaka Catchment since the early 1800s. Whānau have come to Te Waikoropupū for cleansing and healing for generations – following the footsteps of their tūpuna (ancestors). Te Waikoropupū is one of the most sacred places in Mohua.

[556] We accept Mr Rei's explanation of the Mana Kaitiaki or kaitiakitanga role of Manawhenua.[248] He informed us as follows:

> The tikanga of kaitiakitanga is essentially the responsibility aspect of mana. It recognises the responsibility of iwi and hapu to protect and look after the whenua, moana and taonga within their rohe. It also reflects the fact that iwi and hapu do not see themselves as simply owning or exploiting the whenua, wai or moana, but recognises iwi and hapu authority, but equally important, a responsibility to protect

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247 Manson, EIC at [9].

248 Rei, EIC at [30] and [31].

> the mauri and tapu of those taonga.
>
> Kaitiakitanga is an ongoing responsibility. The mana, or connection between iwi and hapū and their rohe is active and ongoing, and is based on fulfilling responsibilities to protect the mauri and tapu of the site, resource or taonga.

[557] The cultural significance of Te Waikoropupū as a sacred taonga and waahi tapu that has been treasured by Ngāti Tama over successive generations and which they now seek to protect through this WCO for future generations, is described in the following whakatauki:[249]

> Te Puna Waiora o Te Waikoropupū
> Ra runga atu ana o Parapara
> To apu o Huriawa kia toremutu ia te ripo o Waikoropupū e
> Pupu ake ki te rae o Onetāhua.
>
> The passageways of Huriawa follow over Parapara as she dives down deep to Waikoropupū, that bubbles up at the tip of Onetāhua.

[558] The Manawhenua Mātauranga Report for the Tākaka Catchments[250] describes the cultural significance of the Tākaka catchments and associated expectations for the management of ngā taonga (treasured resources). It states:

> Manawhenua articulate their whanaungatanga (relationships) to Te Ao Wairua (spirit world) and ngā taonga (treasured treasures) through whakapapa (ancestral descent). It is through whakapapa that manawhenua express moemoeā (aspirations) for taking care of natural resources.
>
> Whakapapa links the Supreme Being IO, the creator of all things with the natural world. IO created the realm of being (from the void) and in doing so formed the spiritual framework for the cosmic process to unfold. Energy, awareness, wisdom and the 'breath of life' came together to lift the veil of darkness; shape, form, time and space was created. Rangi-nui (the Sky Father) and Papatūānuku (Earth

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249 Manson, EIC at [7].
250 Prepared by Ngāti Tama, Ngāti Rārua and Te Ātiawa for TDC, June 2019.

Mother) emerged clinging to each other. From these parents descended ngā atua kaitiaki, the spiritual guardians, who breathed life into all taonga (treasured resources). Rangi-nui and Papatūānuku form the physical and spiritual realm within which ngā atua exist (see illustration on page eleven).

For manawhenua, the ultimate reality is wairua or spirit. Therefore, everything in life is sustained, replenished and regenerated by its hau or mauri, 'the breath of life'. People are part of the cosmic process and the natural order of things; there is no sharp distinction between the natural world, culture and society. All manawhenua customs, values and attitudes are derived from the indigenous body of knowledge, which seeks to explain the origin of the universe.

It is through whakapapa that manawhenua define their collective identity, mana and belonging to each other and to the universe. All elements of nature and the cosmos are ngā tūpuna (ancestors) of those living today. Whanaungatanga (kinship) is derived from whakapapa and sets out hapū and whānau responsibilities. Because of whanaunga (relatedness), all elements in the natural world are treated with the utmost respect, an honour given to esteemed ancestors. Wai is imbued with a mana of its own; to be treated like a very old kaumātua (a respected elder); a representative of the spirits and times past.

Pūrākau (stories) are an integral part of the body of knowledge held by manawhenua; deliberate constructs used by tūpuna to make sense of the world – to understand the relationship between the Creator, the universe and people. Cultural patterns developed around this perceived reality.

Central principles underpinning catchment management are Ki uta ki tai – the flow of wai from the ngā maunga (mountains) to ngā moana (sea), and Te Mana o te Wai – the first right to wai is to wai itself; a principle which is intertwined with Te Mana o te Whenua (the mana of the land). In order to safeguard the hauora (health) of the Tākaka catchments, all relationships with ngā taonga (treasured resources) in the rohe (area) must be managed in an integrated way.

Manawhenua moemoeā (aspire) for the mātauranga (knowledge) in this report to be used to achieve positive and meaningful cultural and environmental outcomes. To this end, it is important that this report is read in its entirety and that manawhenua participate in decision-making relating to the management of catchment hauora (health) in Mohua.

[559] We accept the explanation given by Ms Chapman[251] of the iwi relationship, historical associations, and cultural significance associated with Te Waikoropupū. In particular, she explained the spiritual connection of Ngāti Tama ki te Tauihu with Te Waikoropupū, as told through the tradition of Huriawa.

[560] She stated that to Ngāti Tama iwi, Te Waikoropupū is the playground of the kaitiaki taniwha, Huriawa. Huriawa is a tupuna and kaitiaki taniwha who works her way through the lands of Mohua. It has been said that Huriawa would bless newborns here on their journey into the world; this is the physical element, the Taha Tinana.

[561] Her conclusions were that:[252]

> Māori understand the importance of eco-systems and biodiversity as all being integrated and connected. If one part of the eco-system is harmed then this will ultimately affect all aspects of that chain, humans included. This integrated thinking includes all generations past and future. Sustaining waterways' mauri and wairua is of prime importance as kaitiaki for future generations and is reflected in the environment's health
>
> These korero are all part of the history and cultural connection of manawhenua iwi with Te Waikoropupū. This Water Conservation Order is so important because it will maintain the Mana of those waters; Te Waikoropupū is so sacred and protecting the mauri and protecting the tapu through this order is critical to also respecting and protecting these stories connected with Te Waikoropupū. This holds great esteem in the Māori world, in terms of tikanga.
>
> Taonga tuku iho are treasures handed down by the ancestors and it is up to us to protect these for our mokopuna. It is our responsibility to hand these taonga tuku iho on to our children …

251 Chapman, EIC.
252 Chapman, EIC at [30]-[32].

[562] Manawhenua seek a partnership with TDC in the management and protection of Te Waikoropupū. According to Ms Stafford, the benefits of a partnership relationship would include:[253]

(a) the strengthening of Ngāti Tama's relationship with Te Waikoropupū Springs and water bodies;
(b) the ongoing protection of the mauri, wairua and wai ora status of Te Waikoropupū Springs according to Ngāti Tama tikanga;
(c) the inclusion of Ngāti Tama values and Mātauranga in decision making frameworks, policies, plans and proposals.

[563] The Court's recommended WCO makes express provision for partnership as between TDC and Manawhenua in the care of Te Waikoropupū. That is informed by the Court's acceptance of the WCO, the applicants' evidence on those matters and TDC's support for such provisions. The applicants' witnesses explained the importance of this partnership relationship for enabling the active involvement of Manawhenua in the determination and review of future replacement consents, upon prescribed environmental parameters, and on the basis of a future regional plan being in place which implements the WCO.

[564] Furthermore, they explained the importance of reflecting that partnership in the WCO; and providing recognition of a cultural health monitoring framework alongside other science-based monitoring parameters. Specifically, that is with the intent that cultural health monitoring is given equal footing or respect on the same basis as western scientific methods of assessment. The Court's recommended modifications to the Tribunal's WCO reflect the Court's acceptance of that evidence.

[565] The applicants asserted that this partnership approach will give effect to Manawhenua values and principles as kaitiaki, and that it will reaffirm and revitalise

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253 Stafford, supplementary evidence, 11 July 2022, at [89].

the Manawhenua relationship to their taonga, customary practices and use of wai and Te Taiao.

[566] It is clear from the evidence that central to the role of kaitiakitanga is the belief that the spiritual and physical survival of all living things is dependant on the maintenance of the mauri and wairua of Te Waikoropupū. Cultural traditions relate to the purity of the water, the preservation of which is integral to the cultural and spiritual wellbeing of Ngāti Tama and the maintenance of tribal traditions and cultural identity. Te Waikoropupū spring water was called the "water of life" or Wai Ora, the purest form of freshwater. Generations of Ngāti Tama whanau have used these sacred waters for cleansing and spiritual healing. These waters were central to the cultural traditions practised by tūpuna and remain so today.

[567] Based on this evidence, our understanding is that upholding Ngāti Tama tikanga to protect and sustain Te Waikoropupū and Wharepapa Arthur Marble Aquifer requires:

(a) firstly, that the WCO be framed so as to recognise the Te Ao Māori paradigm in which Huriawa dwells and the importance of whakapapa as the inseparable bond or connection between tangata whenua and the natural world, such that the health or hauora of the Te Waikoropupū is reflected in the health and wellbeing of the Manawhenua;

(b) secondly, that the WCO give direction for the Council to exercise its powers under s30(1)(e) and (f) in a way that recognises and provides for the exercise of kaitiakitanga, including through the development and operation of a genuine partnership with Manawhenua to ensure their active involvement in the implementation of the WCO (including decision-making processes).

C.4 History of Te Waikoropupū[254]

[568] It is believed that tribes first visited Mohua 700 years ago, as part of their expansion from Whakatu to Mohua and on to Te Tai Poutini. The lower Tākaka catchments and area encompassing Te Waikoropupū was a strategic site, a kāinga on whānau journeys for mahinga mātaitai (food gathering). Te Waikoropupū was the gateway to the pounamu ara (greenstone trails); whoever controlled Te Waikoropupū also controlled the inland and coastal ara to Te Tai Poutini.

[569] Raids by Te Ātiawa, Ngāti Rārua and Ngāti Tama between 1828 and 1830 were the last tribal conquest of Mohua, resulting in an alliance of tribes from Taranaki and Tainui, who came to Te Tauihu armed with muskets and cannons. Under their chiefs Te Koihua, Niho, Takerei, and Te Pūoho, control was gained over much of northwest Nelson, including Mohua. Through raupatu, the authority of manawhenua and role of kaitiakitanga transferred to Te Ātiawa, Ngāti Rārua, and Ngāti Tama – an ongoing responsibility held since that time.

[570] Traditionally, the Tākaka catchments were used extensively for cultivation and habitation, due to the rich mahinga kai, mahinga mātaitai and other special resource areas found there. The diversity of habitats associated with the coast provided shelter for a wide variety of indigenous species. Manawhenua fished whitebait, herring, flounder and kahawai from estuaries and river mouths, while pipi, cockles and mussels were harvested from the extensive shellfish beds. Tūpuna were able to harvest bird species, which were found in abundance nesting near or feeding from the rich mud flats.

[571] In more recent times, there have been numerous attempts to commercialise Te Waikoropupū. Ms Little stated:[255]

> In the last 40 years as kaitiaki we have consistently fought for Te Puna Waiora o

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254 Manawhenua Mātauranga Report.

255 Little, EIC at [5]-[8].

> Te Waikoropupū to stop all commercialisation and to have it recognised as a wāhi tapu, a taonga tuku iho for all.
>
> It has been 40 years since I stood at Onetahua Marae distraught at the thought of glass bottomed boats on our puna. Through constant kaitiakitanga and aroha for our taonga Ngati Tama have consistently fought to stop all commercialisation and to have Te Puna Waiora o Te Waikoropupū recognised as a Wahi Tapu, a Taonga Tuku Iho for all.
>
> Other examples of commercialisation included Swimming, Diving tours, Gold mining, a 120 seat restaurant beside the Puna with a viewing theatre underneath and plans for a commercial water bottling plant 30 metres behind the reserve.
>
> If it were not for the Whanau, Hapu and Ngati Tama persistent determination to see Te Puna Waiora o Te Waikoropupū exists in its natural state, then we would not be standing here today disputing the facts and figures in this court. What you see today is the direct result of Kaitiakitanga and aroha for our Taonga Tuku Iho by Ngati Tama and the ahi kaa whanau.

[572] Ms Manson reinforced these views and further highlighted the struggle Ngāti Tama encountered with the Council over the years in seeking adequate recognition and involvement in planning and consenting processes affecting Te Waikoropupū. She referred to two cases in particular, *Kahurangi Virgin Waters Ltd* and *Gunsbro Ltd*, both involving water take consents in which Ngāti Tama were not consulted as an affected party. In both instances, the Council's decisions were successfully challenged by Ngāti Tama through legal processes.[256]

[573] Ms Manson's evidence was that these examples demonstrate how Ngāti Tama has had to make recourse to expensive and protracted litigation to assert their Manawhenua role in order to protect their taonga and waahi tapu. For these reasons, Ngāti Tama are now seeking that the WCO provide greater recognition

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256 Manson, EIC at [33]-[41].

of Manawhenua involvement in decision making and resource management processes:[257]

> As kaitiaki of Mohua, manawhenua seek greater recognition of the cultural significance of Te Waikoropupū and her contributing wai in an integrated way. We have continually sought greater respect for:
>
> (a) Participation in the management of catchment hauora (health);
> (b) Cultural values and interests informing decision-making; and
> (c) Recognition of manawhenua Māoritanga (culture, beliefs and practices).
>
> These moemoeā require commitment by manawhenua and Council to work towards achieving a greater level of trust and respect to support a mutually beneficial and positive working relationship.

[574] We accept Ms Manson's evidence on these matters.

C.5 Ecological values and features of Te Waikoropupū

[575] Dr Fenwick, a biologist engaged by the applicants, provided the following description of the biodiversity of the Main Spring:[258]

> Biodiversity within the basin surrounding Main Spring is amongst the most biologically diverse of any NZ springs. This near pristine biodiversity includes unusual plant and invertebrate communities, so that this ecosystem is considered outstanding and significant nationally and internationally.
>
> … Its 38 species of plants and 54 species of benthic invertebrates (plus another 80 in associated stream habitats) (Fenwick & Smith 2016), make Te Waikoropupū Main Spring basin a nationally significant spring, especially when its unusual submerged flora is considered.
>
> The spring basin's rich aquatic flora comprises some unusual plant associations: permanently submerged mosses and liverworts, terrestrial species growing fully

257 Manson, EIC at [29]-[30].
258 Fenwick, EIC at [29], [90]-[92] and [95].

> submerged, unusual growth forms of two moss species (see Fenwick & Smith 2016 for sources).
>
> Animal life in the springs basin includes two species apparently endemic to these springs (i.e., occur nowhere else), highest reported population densities of a common freshwater snail (Potamopyrgus antipodarum), the only South Island population of an otherwise North Island freshwater amphipod (Paracalliope karitane), and northern most populations of two caddis flies (Hydrobiosis chalcodes, H. johnsi).
>
> For these reasons, I consider that the springs' basin biodiversity approximates its pristine state, with respect to human contaminant effects.

[576] Dr Young, a freshwater ecologist engaged by TDC, described freshwater fish values at the Main Spring as follows:[259]

> Nine species of freshwater fish have been recorded in the vicinity of Te Waikoropupū Springs (New Zealand Freshwater Fish Database – accessed March 2017). This includes eight native species (longfin eel, shortfin eel, torrentfish, giant kokopu, koaro, inanga, upland bully, redfin bully) and the introduced brown trout (Young et al. 2017). On a national scale this is a relatively high diversity of native fish, but not as outstanding as neighbouring catchments like the Onekaka where at least 14 different species of freshwater fish have been recorded. It was agreed in the Aquatic Ecology JWS (paragraph 6) that the fisheries values of Te Waikoropupū are not outstanding.

[577] Dr Fenwick and Dr Young undertook expert conferencing in relation to the outstanding ecological values and features of Te Waikoropupū.[260] They agreed that the intrinsic values were outstanding, referring to Schedule 1 of the WCO attached to the Tribunal decision. They also agreed with the following findings of the Tribunal's report:

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259 Young, EIC at [143].

260 JWS: Aquatic ecology dated 20 July 2021.

> 208. The Tribunal finds that Te Waikoropupū Springs has outstanding wild and scenic characteristics …
>
> 209. There is no doubt that Te Waikoropupū Springs are outstanding in terms of their natural characteristics – the combination of water quality, water clarity, artesian pressure and the karst geology/aquifer system of which they provide the visual end point gives them a unique, easily recognised, value.
>
> …
>
> 215. In considering the many hundreds of submissions on this proposed WCO order virtually all submitters described Te Waikoropupū Springs as outstanding, of which visual clarity is a key component. The Tribunal accepts those submissions, and accepts the expert evidence, that Te Waikoropupū Springs is outstanding in terms of the exceptional natural clarity of its waters.

[578] We accept Dr Fenwick's and Dr Young's evidence on these matters.

[579] We did not receive any equivalent evidence on the characteristics and values relating to Fish Creek Springs. These comprise a number of individual springs that discharge into Fish Creek, which has a relatively small surface flow from a catchment outside the Department of Conservation reserve and is adversely affected by upstream land uses. We return to these effects below and also note the following:[261]

> large accumulations of green algae are often seen on the rocks in unshaded patches within Fish Creek during summer, but this seems to be the exception rather than a common phenomenon throughout the spring basin.
>
> Fish Creek tends to dry up once flows in the Main Spring drop below about 7000 l/s.

261 Young, EIC at [142] and [94] and Fig 3. Dr Mead stated that Fish Creek Springs dried up in January 2018, January-March 2019 and March 2020, EIC at [13].

[580] We asked the ecology and mātauranga Māori experts whether, from a water quality and ecology perspective, there is a need to provide the same level of protection to Fish Creek Springs as the Main Spring and whether that is practicable, recognising the different conditions that exist.

[581] Their response was:[262]

> The experts agree that from an ecological and water quality perspective, the two springs are interconnected and require the same level of protection. They consider that it would be impractical to manage the two springs separately given this level of interconnectivity, noting however, the differences between the two springs in terms of their flow permanence and potential influences from Fish Creek.
>
> The experts note information is poor on the ecological values of Fish Creek Springs. Although they agree Fish Creek Springs should be protected generally, the experts are not clear which specific parts of the WCO instruments should determine this.

[582] We accept that evidence. We also accept the explanation given by Ms Stafford and Ms Little of the mātauranga Māori view as follows:

> The experts agree that Fish Creek Springs is an important and interconnected natural attribute of the AMA and Te Waikoropupū Springs and requires the same level of protection.
>
> In accordance with Manawhenua tikanga Te Waikoropupū Springs and Wharepapa Arthur Marble Aquifer, Tākaka River and Waingaro River and tributaries, Fish Creek Springs, are of outstanding cultural significance because they embody Manawhenua identity, customs, practices and beliefs.
>
> The Cultural Health Index framework will inform what cultural indicators are monitored, where monitoring will take place and how often. A key process to inform the CHI framework is the Manawhenua cultural context for the Tākaka catchment (their relationship with Fish Creek Springs, Te Waikoropupū,

262 Stafford and Little, JWS Ecology and Mātauranga Māori in response to Question 10(a).

waterbodies and the catchment, cultural heritage sites, wāhi tapu, mahinga kai attributes, cultivation sites, pathways which link important places, habitats and associated taonga, taonga species significant to the catchment including ngāhere, manu, ika and ngārara, and any further distinguishing characteristics based on Manawhenua lived experiences and observations.

The choice of cultural indicators is guided by Manawhenua Mātauranga, tikanga and kawa, customary traditions and practices, taonga species harvest and use in the Tākaka catchment and Mohua. Cultural indicators associated with mauri, relates to the ability of waterbodies to sustain life. Te Mana o te Wai is at the heart of catchment hau ora/health, with water quality and flow being key considerations. Mauri is measured by indicator taonga species, the relationships of those species to their habitat, and the extent of that habitat. These matters will inform monitoring considerations at Fish Creek Springs, Te Waikoropupū and the catchment and is central to kaitiakitanga. See Appendix 3 for further information.

Culturally-based monitoring and scientific monitoring are complementary and provide further understanding on the state of waterbodies and the catchment.

The spiritual and physical survival of all life forms is dependent on the maintenance of the mauri (life force), wairua (spirit), mana (power) and tapu (sacredness) of wai. Because the physical and the spiritual elements of the natural world and wai are inseparable, the health of the whole system reflects the well-being of Ngāti Tama whānau and hapū and their ability to implement kaitiakitanga.

C.6 Water quality of Te Waikoropupū

[583] A deterioration in water quality at, and effects on the values of, Te Waikoropupū led to the originating application. The water quality parameter of primary concern is NO_3-N and sources of NO_3-N in the catchment are addressed in detail in section B. This section provides a summary of NO_3-N concentrations in Te Waikoropupū and changes that have occurred over time. More detailed information on NO_3-N and other water quality parameters of particular concern are discussed in more detail below.

[584] By way of an overview, NO_3-N concentrations in the Main Spring increased from around 0.31 mg/l in 1970 to 0.35 mg/l in the early 1990s and to more than 0.5 mg/l for a period in the summer of 2019/20 before starting to reduce, with a current five-year median value of 0.45 mg/l.

[585] Monitoring data for Fish Creek Springs is much more limited. Single results in the late 1970s and mid 1990s showed concentrations of around 0.21 mg/l. Four results in the early 2000s were in the broad range 0.4 to 0.45 mg/l. The much more comprehensive FOGB monitoring from 2016 showed a five-year median value to March 2020 of 0.4 mg/l[263] and that concentrations increased to around 0.5 mg/l for a short period in 2021 before starting to reduce.

[586] Under cross-examination, Dr Young was asked if he accepted that the Springs are showing negative signs of human influence. He replied:[264]

> Yes, there is an increase in nitrate nitrogen concentration at the Springs which, yeah, that was emphasised in the science panel report. It's been very clear for a long time and I consider that part of the reason for that is human interactions, the environment

[587] On the evidence, we find that natural concentrations of NO_3-N from the Upper Tākaka area of the catchment are less than 0.1 mg/l and from the Karst Uplands (excluding the effects of gorse), are potentially in the range 0.1 to 0.2 mg/l but below 0.3 mg/l. NO_3-N concentrations from the originally forested areas of the Valley floor would have likely been below 0.1 mg/l.

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263 Ecology and Mātauranga Māori JWS dated 22 July 2022 in response to Question 13(a).

264 Transcript at p 1005.

[588] The extent to which waters to be protected are in their natural state is relevant to our recommendation on the WCO.[265] The Tribunal commented in relation to natural state:[266]

> There is no definition of 'natural state' given in the RMA. We take it to mean as unmodified as possible. We have also assumed in line with case law[267] on 'wild, scenic or other characteristics', that it is the waters themselves, not the surrounding landscape, that needs to be considered.
>
> Ms Baker-Galloway for the Applicants confirmed orally in closing that the Applicants considered both Te Waikoropupū Springs and the Arthur Marble Aquifer to be in their natural state. The Special Tribunal concurs.

[589] Based on monitoring results now available, NO_3-N concentrations have risen to possibly two or more times natural concentrations, meaning the affected waters cannot be considered to be in their natural state in terms of NO_3-N. That does not mean they are not worthy of protection and potentially could mean that some reduction in NO_3-N concentrations may be necessary to preserve and protect Waikoropupū. It also leaves aside our finding that the subject waters remain in their natural state in terms of their tikanga Māori significance.

C.7 Spring flow volumes

[590] Annual mean spring flow volumes are shown on Figure P above for the Main Spring and the following Figure W for Fish Creek Springs, both provided by Dr Young.[268] The figures clearly show the variability in flows from year to year with Lowess curves[269] shown in red.

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265 RMA, s199.

266 Tribunal's Report at [114]-[115].

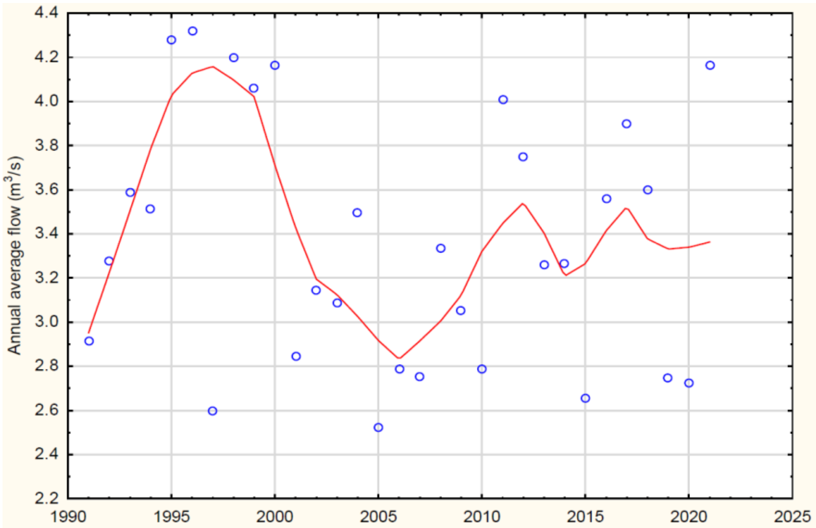
267 Re Draft Water Conservation (Mohaka River) Order W020/92 (PT) and Re Draft National Water Conservation (Buller River) Order 1989 C032/96 (PT).

268 TDC dated 26 July 2022.

269 A method of smoothing the flows.

Figure W

Mean annual flows at Fish Creek Springs 1991 to 2021



[591] There were large peaks in flows from Fish Creek Springs between 1995 and 2000. The peak at the Main Spring between 1995 and 2000 was much less pronounced than at Fish Creek. While there was a significant increase in flow in 2017, this was not observed to the same extent in Fish Creek Springs.

[592] The key observation from the flow data is that the Springs are subject to different hydrologic influences which complicate understanding of system geohydrology.

C.8 Age of water in the Springs

[593] Dr Stewart explained that tritium measurements had been undertaken over a period of 30 years to determine the age of water in the Main Spring and Fish Creek Springs. The average in the Main Spring was very consistent over that period at "close to eight years". The average for Fish Creek Springs was 3.5 years.[270]

270 Transcript at p 396.

[594] No other modelling or geohydrology expert disagreed with Dr Stewart's evidence relating to the ages of the water and we accept it.

C.9 Nitrate-nitrogen concentrations and loads reaching the Main Spring

[595] As noted in section C.6, NO_3-N is the main contaminant of concern at Te Waikoropupū. It can cause excess nuisance plant growth, algal blooms and toxicity to fish and invertebrates in aquatic systems. It has been the most extensively monitored parameter in the Springs and contributing water sources.

[596] We addressed NO_3-N in a catchment-wide context in section B. We address NO_3-N concentrations and loads and their effects on Te Waikoropupū in further detail in the following sections because of their relevance to the second key issue addressed in this section C – namely the threat to the values of Te Waikoropupū. Our evaluation was directed towards determining what NO_3-N concentrations are necessary to preserve and protect these values, which is the purpose of the WCO, and required consideration of risk in view of the significant uncertainties and unknowns that exist in the catchment.

[597] The new evidence before us on these matters is substantially more comprehensive than was available to the Tribunal. Except where we report otherwise, we accept the new evidence and base our following findings on that evidence. None of the opinions offered on the matters we discuss was significantly challenged in cross-examination.

Nitrate-nitrogen concentrations in the Main Spring 1970 to 2021

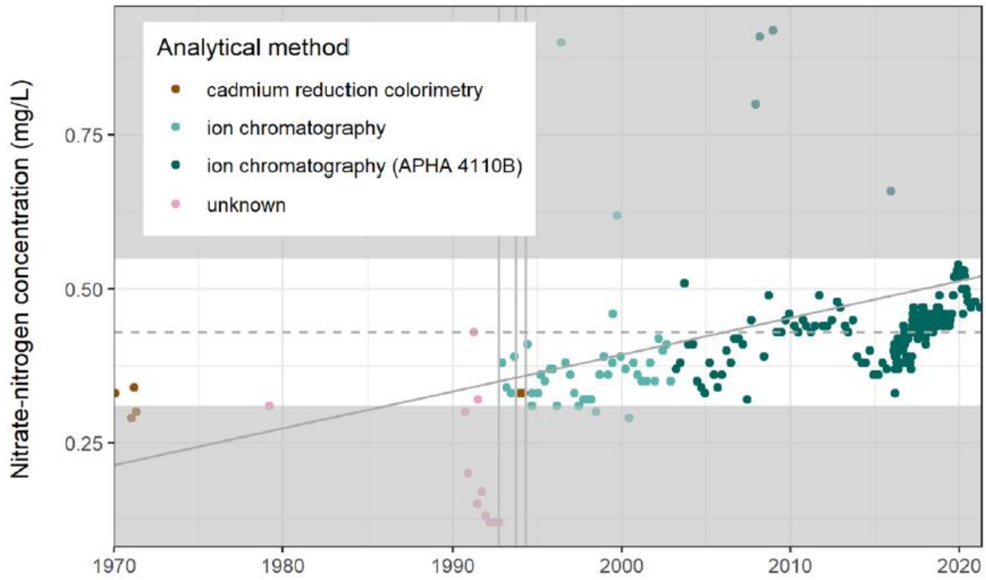
[598] Water quality in the Main Spring was tested sporadically for NO_3-N from 1970 on but the accuracy of some early results is uncertain. Dr Young referred to an NO_3-N concentration of 0.31 mg/l in the early 1970s. Three monthly monitoring of the Main Spring was initiated in 1991 as part of the National Groundwater Monitoring Programme. FOGB commenced monitoring of the

Main Spring, Fish Creek Springs and Fish Creek in February 2016 and monitored weekly until August 2018 and fortnightly thereafter.[271]

[599] Figure X summarises all NO_3-N concentration monitoring results for the period of record 1970 to 2021. The full sloping line shown on the figure indicates the trend and the dashed horizontal line indicates the median concentration. The white box indicates the natural variability defined by four Mean Average Deviations ('MAD') on either side of the median. Data points falling outside of this box are outliers. The vertical lines indicate changes in laboratories.[272]

Figure X

Nitrate-nitrogen concentrations at the Main Spring for the 1970 to 2021 period (combined dataset)



[600] Noting the significant changes in NO_3-N concentrations after the change of laboratories shown on Figure X, we place limited weight on the results prior to

271 Yuill, EIC at [22] and [23].

272 McArthur, EIC Fig 1, which in turn was reproduced from Fig 3.6 of Moreau 2021.

the mid-1990s. In view of this and the limited information available about land uses, the focus of our evaluation was on the period from 1993 onwards.

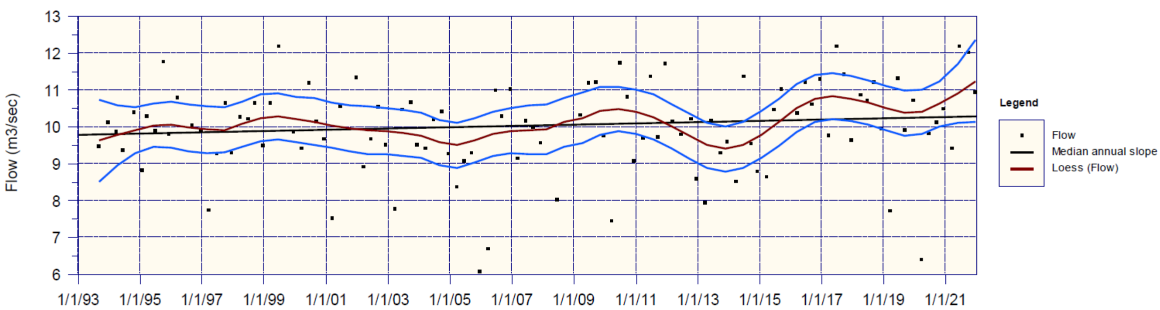
Nitrate-nitrogen loads and flows to the Main Spring 1993 to 2021

[601] Figures J and Y show the mean NO_3-N load to the Main Spring from 1993 to 2021 in tonnes of nitrogen a year (tN/y) and the flow from the Main Spring over the same period (m^3/s).[273] Dr Mead stated the seasonal Kendall trend found a virtually certain increase in NO_3-N of 1.4% a year and a possible increase in flow of 0.17% a year.

[602] Figure Y shows the flow increased from an annual average of around 9,800 l/s in the early 1990s to around 10,200 l/s in the early 2020s. This is slightly less than Dr Mead's possible increase of 0.17% a year.[274] While we note the increase during the period, we do not consider it material to our recommendation on the WCO, because it can be seen from Figure Y that daily flows varied between 6,000 and more than 12,000 l/s during the same period.

Figure Y

Water flow from the Main Spring between 1993 and 2021 based on daily flow record



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273 Figures Y – ZB reproduced from "Analysis of the TDC/GNS and FOGB data sets and monthly rainfall", D J Mead 26 July 2022.

274 Final information requested by the Court provided on 26 July 2022.

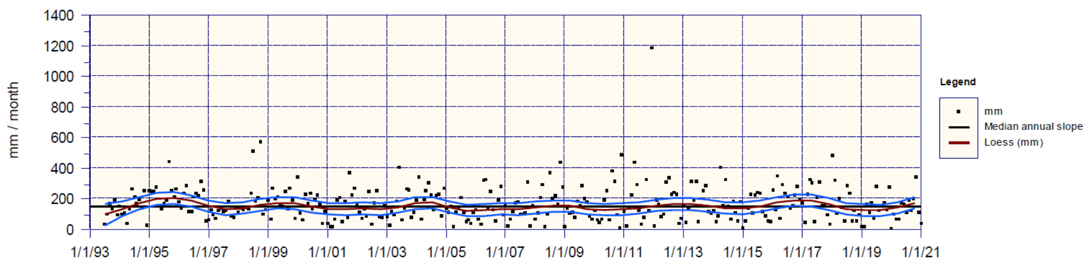
Rainfall in the catchment 1993 to 2021

[603] Figures Z and ZA show the mean monthly rainfall from 1993 to 2021 at Kotinga (downstream of the Valley Floor) and Harwoods (upstream of the Valley Floor), respectively. Dr Mead stated that a trend in monthly rainfall at Kotinga was exceptionally unlikely and unlikely at Harwood using the Seasonal Kendall trend test. A similar analysis for monthly rainfall at Hanging Rock showed a possible decreasing trend.

[604] TDC provided rainfall data for six monitoring sites in the catchment, noting that none of the trendlines shown for annual rainfall show statistically significant trends over time. However, Dr Young noted these are relatively short rainfall records and that trend analysis on just annual statistics has very limited statistical power, therefore, caution is required when interpreting these results.[275]

Figure Z

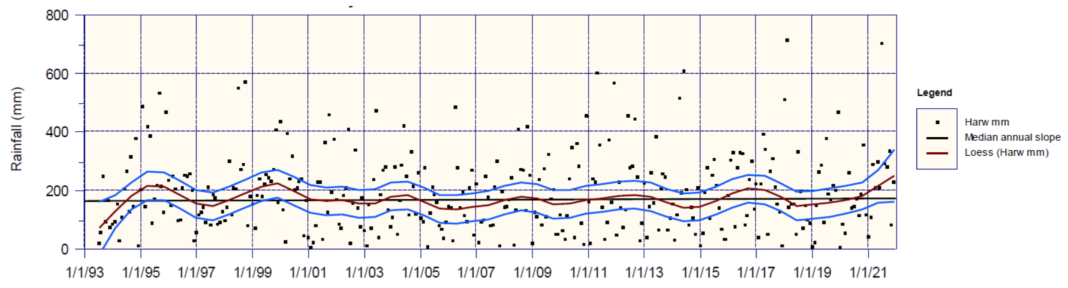
Monthly rainfall between 1993 and 2021 at Kotinga



275 Final information requested by the Court provided on 26 July 2022.

Figure ZA

Monthly rainfall between 1993 and 2021 at Harwoods

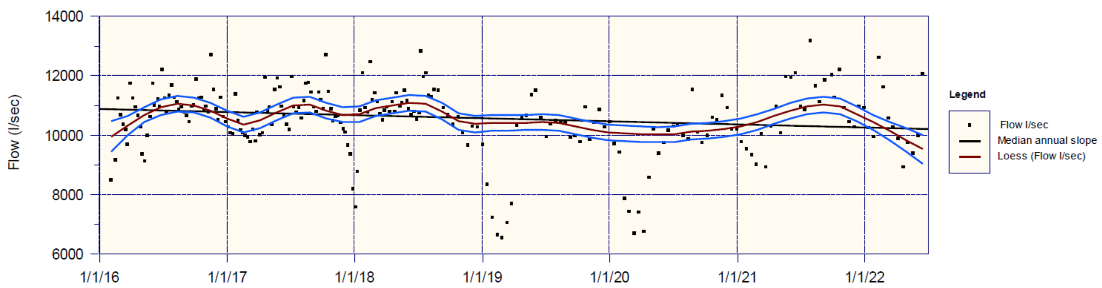


Nitrate-nitrogen loads and flows to the Main Spring 2016 to 2022

[605] Figures K and ZB in sections B.19 and C.11 respectively show the NO_3-N load to the Main Spring in kg/d from February 2016 to March 2022, based on the FOGB data set, and the flow from the Main Spring over the same period. Dr Mead stated the seasonal Kendall trend found a virtually certain increase in NO_3-N load of 3.6% a year and a virtually certain increasing trend in discharge flow of 3.3% a year. He considered that NO_3-N loads are closely correlated to flow.

Figure ZB

Water flow from the Main Spring between 2016 and 2022



Change in five-year rolling median nitrate-nitrogen concentrations at the Main Spring 1995 to 2022

[606] Figure Q on section B.19 shows the variability in the five-year rolling median NO_3-N concentrations at the Main Spring.[276]

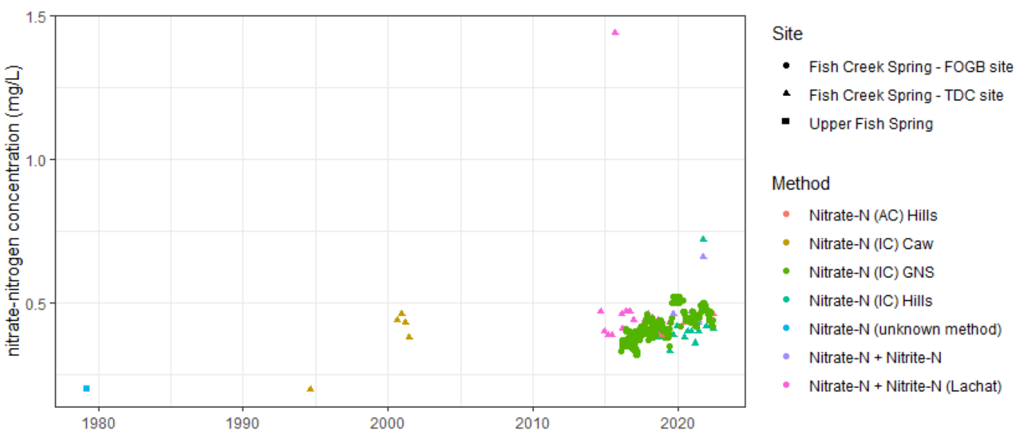
C.10 Nitrate-nitrogen concentrations and loads in Fish Creek Springs

Nitrate-nitrogen concentrations in Fish Creek Springs 1970 to 2021 and 2016 to 2022

[607] Figure ZC summarises all NO_3-N concentration monitoring results for the full period of record 1979 to 2022.[277] Figure L in section B.11 summarises NO_3-N load at multiple sites within the Fish Creek Springs cluster for the 2016 to 2022 time period.[278]

Figure ZC

Nitrate-nitrogen concentrations at multiple sites within the Fish Creek spring cluster 1979 to 2022



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276 JWS Ecology and Mātauranga Māori at App 2.

277 JWS Ecology and Mātauranga Māori dated 22 July 2022 at Appendix 1, Figure 1.

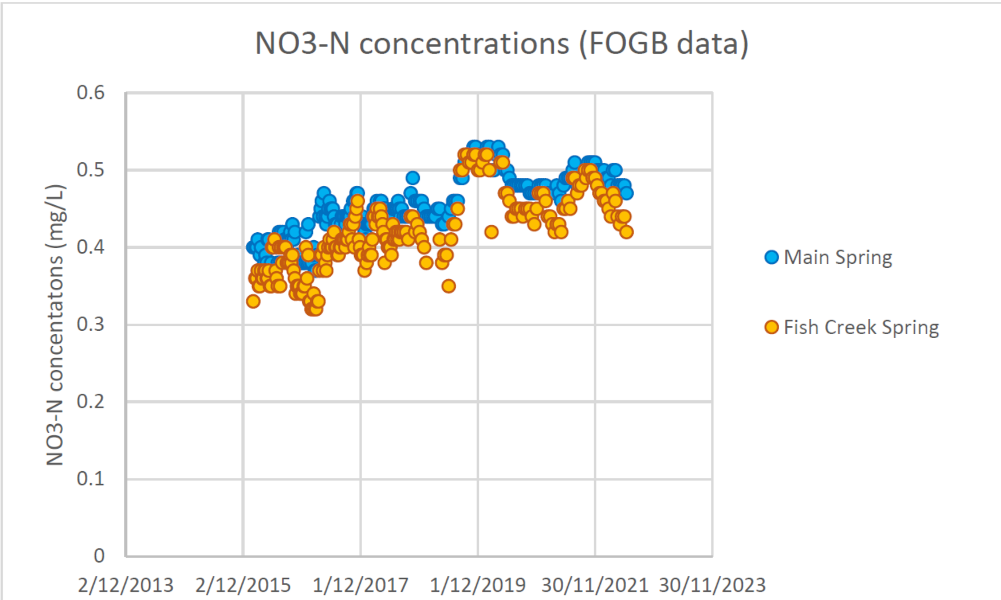
278 Mead, Analysis of long-term TDC data, 26 July 2022.

C.11 Comparison between nitrate-nitrogen concentrations and loads at the Main Spring and Fish Creek Springs

[608] Figures ZD and M compare NO_3-N concentrations and loads at the Main Spring and Fish Creek Springs for the period 2016 to 2022 based on more frequent FOGB data.[279]

Figure ZD

Nitrate-nitrogen concentrations at the Main Spring and Fish Creek Springs (FOGB Site) 2016 to 2022



C.12 Observed step changes in nitrate-nitrogen concentrations and loads at both Springs over time

[609] Dr Mead analysed changes in NO_3-N concentrations over the six years of the FOGB monitoring record.[280] He found that the change was not linear, with five step changes occurring over the six-year period, as shown on Figure ZE,

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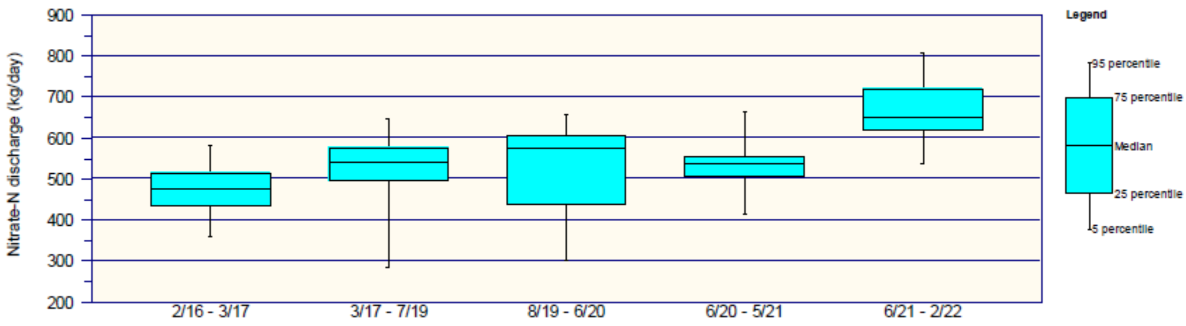
279 JWS Ecology and Mātauranga Māori dated 22 July 2022 at Appendix 1, Figure 3 and amended Figure 5.

280 Mead, EIC from [21].

(reproduced from his Figure 1). Each step change lasted between 10 and 30 months and NO_3-N concentrations showed little change within each period. Step changes occurred in less than a month.

Fig ZE

Combined nitrate-nitrogen loads discharged from both Springs for different periods between 2016 and 2022



C.13 Most recent trends in nitrate-nitrogen concentrations at the Main Spring and Fish Creek Springs

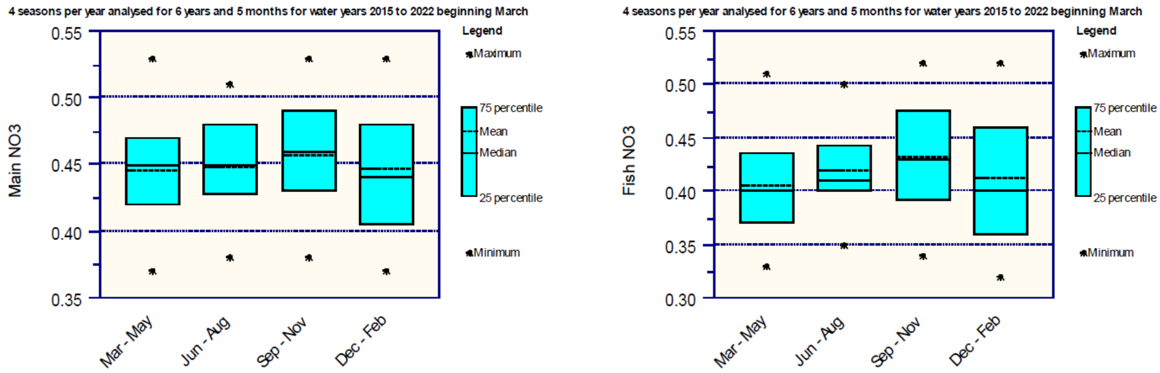
[610] Figure ZD shows a significant downward trend in NO_3-N concentrations from about September 2021.

C.14 Seasonality effects on nitrate-nitrogen concentrations

[611] Ms McArthur, Dr Mead and Ms Moreau statistically tested quarterly seasonality effects for the Main Spring and Fish Creek Springs. They found a statistically significant seasonality effect for NO_3-N concentrations at Fish Creek Springs only. Concentrations of NO_3-N were highest in Fish Creek Springs in the spring, followed by winter. Figure ZF illustrates the seasonality effect.

Figure ZF

Seasonal nitrate-nitrogen concentration box plots for the Main Spring (left) and Fish Creek Springs



[612] The experts found there were strong seasonal effects on discharge (water flows) at both Springs and, correspondingly, NO_3-N mass loads also showed strong seasonal effects for the Main Spring and Fish Creek Springs. Put another way, the NO_3-N load increases and decreases as the flow increases and decreases.

[613] The Court inquired as to whether this information provided any guide to the most likely source of NO_3-N reaching the Springs. The Court understands from the JWS-Nitrate that Ms McArthur, Dr Mead and Dr Fenwick consider that the seasonality of NO_3-N concentrations in Fish Creek Springs may reflect this system's closer connection to sources of elevated winter/spring leaching.[281]

C.15 Overview of changes in NO_3-N concentrations and loads since 1993

[614] NO_3-N concentrations at the Main Spring increased from around 0.35 mg/l in 1993 to 0.4 mg/l in 2016.[282] This represents an increase of 0.05 mg/l over 23 years. The concentration reached 0.52 mg/l in 2019, a further increase of 0.12 mg/l in less than four years, a dramatically greater rate of increase.

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281 Somewhat confusingly, the JWS records Dr Young and Ms Moreau to preface that answer to the Court's question with "No". However, the JWS goes on to record their position as in agreement with the other experts.

282 Section B, Table 9.

[615] Increases in NO_3-N loads are discussed in section B. The estimated load was 133 tN/y in 1993, 175 tN/y in 2016 and 206 tN/y in 2021.[283] This represents an increase of 42 tN/y over 23 years to 2016 and a further increase of 31 tN/y over the next five years, or an annual average rate of increase of more than three times in the latter period.

C.16 Potential for increasing nitrate-nitrogen concentrations to adversely affect Te Waikoropupū

[616] A 2007 Bylaw prohibited contact with the waters of Te Waikoropupū because of the presence of Didymo in the Springs, which was a relatively new threat at that time.[284] Dr Fenwick and other experts identified the diatom *Rhizoclonium riparium* as another example of the threats to the Springs basin's biodiversity. As to why this diatom is of concern, he stated that:[285]

> Although present within the springs basin for at least 15 years, it flourishes in hard (high dissolved calcium carbonate) and slightly saline water, such as that in Te Waikoropupū, and can form substantial floating rafts and/or mats covering the bottom communities under higher nitrate concentrations (Kilroy & Novis 2020).

[617] We reviewed the reference cited by Dr Fenwick,[286] which included the following additional observations:

> R. riparium is remarkable for its ability to inhabit waters across a very wide range of salinity …. The species' growth in fresh water appears to require hard water… . Te Waikoropupū Springs water meets these requirements.
>
> R. riparium typically grows as mats attached to beds of waterbodies but, like other types of filamentous algae, may detach from the bottom after rapid expansion and

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283 Section B, Table 9.
284 Lamason, EIC at [14].
285 Fenwick, EIC at [150].
286 C Kilroy P Novis "The green filamentous alga Rhizoclonium in Te Waikoropupū Springs A molecular and ecological assessment" (2020) NIWA, June 2020.

float to the surface.

Experimental work on R. riparium suggests that growth rates may be markedly enhanced by increasing temperature in the range up to 15 °C or higher. … Continuous measurements in the main part of the Springs from October 2017 to January 2018 suggested a constant temperature of around 11.7 °C.

Experimental studies have demonstrated that increasing light levels also stimulate R. riparium growth. Very high water clarity in Te Waikoropupū Springs would therefore favour expansion of R. riparium on the bottom.

The nutrient requirements of R. riparium are unclear except that waters with a high N:P ratio (which is the case in Te Waikoropupū Springs) may provide a competitive advantage for Rhizoclonium over other types of algae. Records from the literature and other New Zealand locations indicate that abundant Rhizoclonium (growing on the bottom or as floating mats) occurs in a wide range of dissolved N and P concentrations.

[618] Ms McArthur stated:[287]

Rhizoclonium spp. are known to occupy eutrophic (nutrient enriched) habitats in Aotearoa New Zealand (Biggs 2000). Filamentous algae (such as *R. riparium*) prefer lower velocities (Biggs 2000) and will therefore tend to colonise marginal areas of the Springs where velocities are less.

[619] NIWA reviewed the potential risks to aquatic flora at Te Waikoropupū if an annual median NO_3-N limit of 0.55 mg/l was applied.[288] They concluded that:

It is possible that the floral assemblage of Te Waikoropupu Springs could be altered if the annual median nitrate-nitrogen concentration increases to 0.55 mg NO_3-N/L. Taxa that prefer or tolerate more nutrient enriched conditions may become more abundant and those that prefer less enriched conditions may decline. Taxa associated with increased nutrient enrichment include five species of algae (esp. *Vaucheria* sp.) currently known to be present in the Springs and four of the

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287 McArthur, EIC at [63].

288 Memorandum dated 18 July 2018, Common Bundle at 47.

> five exotic vascular plant species that are present, including one species that has been subject to removal by hand-weeding …. Increased NO_3-N concentration also increases the risk associated with incursions of other noxious vascular plants, like *Lagarosiphon* and *Elodea,* which are likely to grow and spread faster with increased nutrient supply. **Setting a** NO_3-N **limit closer to the current annual median concentration of water in the Springs increases the likelihood that any potentially detrimental alteration to the floral assemblage of the Springs is avoided, or at least managers will be able to respond to changes sooner.**
>
> (Our emphasis)

[620] During the Court's hot-tubbing of ecology and mātauranga Māori experts,[289] we explored whether the median NO_3-N concentration was continuing to rise. By reference to Ms McArthur's data, Dr Hickey observed that the medians had been level for the last three years and Ms McArthur agreed. Dr Hickey also stated that the SOI, which is explained in section B, goes in 10-year cycles. He expressed the view that, as we are reaching the end of a cycle, a downward trend should soon start to appear, indicatively in the next year or two. This appears to have started based on monitoring data.

[621] We also asked if our understanding was correct that at NO_3-N concentrations of 0.45 or even up to 0.5 mg/l, nitrate toxicity was not an issue based on Dr Hickey's evidence. No expert disagreed with that understanding, other than Ms McArthur stating that:

> I would largely agree with that view other than we don't know all toxicity information or all species that (inaudible 11:32:15) within the Spring so given what we do know about toxicity and what Dr Hickey has presented and is within the basis of the National Policy Statement toxicity attributes states then I would agree.

[622] We next sought clarification from the experts about the risks of increasing NO_3-N concentrations "in terms of introduced species, increased risk of algae

289 Transcript from p 474.

growth and all this kind of thing and … if phosphorus stays the same, how significant is an increase in nitrate likely to be"?[290]

[623] Dr Young responded by saying both nitrogen and phosphorus influence the risk. If phosphorus concentrations were to increase, that would significantly increase the risk of algal growth and problematic aquatic plant growth in the Springs. He considered phosphorus is probably controlling the growth of algae but that nitrogen is also relevant. However, he explained that he is unsure if any further increase in nitrogen would increase the risk.

[624] Dr Fenwick agreed with Dr Young and made the point that usually there are multiple factors operating simultaneously and small changes in the balance of those multiple factors that can tip the balance in an ecological system and create a problem. We understood this to mean that a different type of ecosystem would develop compared to what is there now, with adverse effects on indigenous flora and fauna and biodiversity values.

[625] Ms McArthur agreed with both Dr Young and Dr Fenwick but thought "… we are perhaps over a threshold now. We don't necessarily know where that threshold was". She stated that periphyton plants and algae are incredibly adaptive and will take competitive advantage of whatever conditions they can. She noted her understanding that the rhizocloniums are readily able to out-compete other organisms as a result of potentially nitrogen but there are other factors at play. She considered any increase in NO_3-N would be experimental. We understood this to mean that the effects could not be predicted.

[626] Dr Hickey agreed with the above opinions. He also identified the important role played by the 30,000 Potamopyrgus snails per square metre in managing periphyton growth. His evidence reinforces Dr Fenwick's point about not tipping the balance. He did consider this a low to moderate risk at present.

290 Transcript from p 487.

[627] From the experts' responses to our questions, we are satisfied that if NO_3-N concentrations increase much more, a tipping point could occur that would compromise the values of Te Waikoropupū.

[628] Ms Stafford provided guidance on how this issue should be considered from a mātauranga Māori world view.[291] She explained:

> The key focus for Ngāti Tama is to look at our puna Te Waikoropupū Springs, to acknowledge the values and principles that we hold for Te Waikoropupū.
>
> So what will make the puna well, what will help it sustain itself and so for Ngāti Tama it's important to look at catchment health so we speak about ki uta ki tai, we speak about the interconnected relationship of the whole ecosystem, we talk about the water from the mountains to the sea.
>
> And so the effect of having an increase from the day we lodged the Water Conservation Order in a nitrate level from 0.41 and upwards is that it diminishes the mauri, the mana and the wairua, the integrity of our puna and so our 0.45 limit in the Water Conservation Order is a signal and a trigger to say that we need to do something … and that's a compromised position because it's gone past the 0.45 so it's a compromised position. Ngāti Tama has taken into account all information.
>
> We certainly don't deny the community's need to have water for their livelihood but the reality is, is that our puna is not well and if it continues to have rising levels of nitrate it is going to impact on us.
>
> The Mātauranga knowledge has been absent for a very, very, very long time and so it's part of the gaps in the information that needs to be brought forth.
>
> Looking at our puna, the importance for us to ensure that we are focused on the puna.

291 Transcript from p 491.

C.17 Future monitoring of Te Waikoropupū and overall limits to be recommended for inclusion in the WCO

[629] Monitoring and reporting are duties of TDC under RMA s35, not s30(1)(e) or (f), in relation to which a WCO can impose restrictions or prohibitions on the exercise of TDC's powers.

[630] Nevertheless, a fundamental concern of the applicants (and a number of other parties) is that there is a need for a monitoring framework, at least to be part of the WCO. Those parties prefer requirements be set that are as directive as possible. Those positions arise in a context of concern in the community about the inadequacy of TDC monitoring to date. We made a number of observations on aspects of monitoring and the paucity of TDC evidence in relation to what the monitoring indicates in section B.

[631] Further, we are in no doubt that, without the additional monitoring data provided by FOGB, our recommendation on the WCO would not have had an adequate basis.

[632] We acknowledge the concerns those parties have expressed. Nevertheless, apart from the jurisdictional scope limits of a WCO, we find in any case that it is not appropriate to set monitoring requirements as sought by the applicants and supporting parties for a number of reasons. These include:

(a) lack of necessary information to inform the choice of the most appropriate groundwater and surface water monitoring locations within the WAMARA;

(b) a need for flexibility to allow future modification of the programme to reflect new information and changing circumstances, which could not be provided in a WCO and would require a WCO change process before it could be done;

(c) a need for confidence as to the adequacy and cost effectiveness of any future monitoring programme, including a need for an independent peer review of the programme to be undertaken;

(d) the importance of taking into account other TDC financial commitments in the development of a programme, matters the Court is not in a position to inquire into or direct.

[633] That does not detract from the quality of the evidence presented on monitoring, both mātauranga Māori and western science.

[634] The ecology and mātauranga Māori experts agreed that there is value in monitoring Fish Creek Springs and the Main Spring for water quality. They consider that, as water quality is different at both Springs, the water quality limits should generally also be different.[292]

[635] We consider it to be appropriate and in the best interests of Te Waikoropupū that cultural monitoring be undertaken with details to be determined by Manawhenua in consultation with TDC. We recognise that in our recommended WCO and will recommend it to the Minister. We do not consider details should be overly-specified in the WCO as they are likely to change over time as experience and understanding changes. Hence our draft WCO is limited to a broad discretionary direction.

[636] Water quality experts had previously agreed that NO_3-N, dissolved oxygen, water clarity and dissolved reactive phosphorus should be monitored and have limits.[293] We agree. They also discussed other parameters that should be monitored, agreeing on some but not others.

[637] For the four parameters where limits are required, we consider it both appropriate and necessary to define the basis on which compliance is to be measured but beyond that, there is no role for the WCO to set general monitoring requirements. These are more appropriately determined by TDC. However, in

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292 JWS Ecology and Mātauranga Māori dated 22 July 2022.

293 JWS Water Quality dated 19 July 2021 at [21].

recognition of the applicants' and other parties' concerns about TDC's historical management of Te Waikoropupū, we provide comment in section C.18 on some matters relating to monitoring arising from the evidence that TDC may wish to consider.

What is the appropriate limit for nitrate-nitrogen?

[638] Concerns about NO_3-N concentrations reaching Te Waikoropupū have been the subject of discussion for many years, including during the Tākaka Freshwater and Land Advisory Group (FLAG) process established by TDC in 2013 and discussed in a Science Report dated March 2017.[294] We have discussed above the rapid acceleration in the rate of increase in NO_3-N concentrations since 2016 or possibly somewhat before, noting that concentrations have since started to reduce.

[639] We find these large increases over such a short space of time must have increased the risk of adverse effects on the values of Te Waikoropupū. While there is no way to quantify the extent of the increased risk, it must be considered as potentially very significant. We find it requires the application of the precautionary principle. Accordingly, it is necessary to consider carefully the date when NO_3-N concentrations were at levels that would sustain Te Waikoropupū.

[640] The Court initially considered two possible dates from which an NO_3-N limit should apply at the Main Spring.[295] The first is the date of the Minister's appointment of a Special Tribunal to hear and report of the application in July 2017 (2017 state). The second is the state at the start of the Court hearing (2022 state). Another date suggested in the applicants' opening submissions was the date of release of the Special Tribunal Report in March 2020 (2020 state). It also needs

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294 Ecosystem Health of Te Waikoropupū, Roger Young, Graham Fenwick, Andrew Fenemor, Magali Moreau, Joseph Thomas, Graham McBride, John Stark, Chris Hickey, Mark Newton.

295 Minute dated 19 May 2022 at [15].

to be kept in mind that the applicants first raised concerns about the adverse effects on Te Waikoropupū and requested a WCO in 2013, almost 10 years ago.

[641] Eleven experts agreed that the 2022 state for NO_3-N in the Main Spring is a median concentration of 0.45 mg/l, being the same whether calculated based on the median values for the last 5-, 8- or 10-year periods to 1 July 2021. They also agreed that a rolling median is the suitable compliance statistic for nitrate.[296] Since that time, most experts have agreed that a five-year rolling median of monthly sample data should be used.[297]

[642] No evidence was provided on the 2022 state for Fish Creek Springs.

[643] The JWS ecology and mātauranga Māori records that Dr Young, Dr Hickey and Ms Moreau agreed the NO_3-N median state in July 2017 was 0.42 mg/l in the Main Spring based on TDC three-monthly data, and 0.37 mg/l at Fish Creek Springs based on FOGB data (being the only data available). Ms McArthur and Dr Fenwick considered that both TDC and FOGB data should be used to calculate the median for the Main Spring, in which case the median state would be 0.40 mg/l.

[644] The same JWS records that the experts agreed that using both sets of data, the current NO_3-N median state in March 2020 was 0.44 mg/l in the Main Spring and 0.40 mg/l in Fish Creek Springs.

[645] In the views of some of those experts, setting the limit at 0.45 mg/l would make no provision for variability in annual median concentrations arising from such naturally occurring changes due to rainfall as an example. The potential effects of climate change are a further consideration when setting a limit that could be in place for a substantial number of years. We note that the NPSFM provides

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296 JWS Water quality, ecology and hydrology dated 5 August 2021 at [20] and [26].
297 JWS Ecology and Mātauranga Māori in response to Question 13(b).

that "attribute states and baseline states may be expressed in a way that accounts for natural variability and sampling error".[298]

[646] We directed further expert conferencing to investigate a two-step method for monitoring compliance with the NO_3-N (and DRP) concentration limits, recognising that natural variations affect concentrations.[299] The science experts agreed in principle that a two-step process would be helpful with an early warning component and final limit component. Ms Little and Ms Stafford supported the approach and stated that cultural health monitoring information would be available to inform the cultural context of the catchment and to guide, support and inform early warning trigger assessments.

[647] Despite the broad agreement of the experts on matters of principle, important aspects of the two-step process were unclear from the JWS. That is no reflection of the efforts of the experts. Rather, it is a consequence of the many complexities and uncertainties that exist.

[648] Two early warning options were considered by the experts – a 95th percentile value and a three-year rolling median value. To assist our understanding, we sought further clarification from the experts through Court questions. It was clear to us that significant further work would be required before we could be satisfied as to the practical application of such an approach. After further careful consideration, we determined that an early warning system could not be relied on to prevent non-compliance with a NO_3-N limit at any of the dates listed above without other measures to reduce NO_3-N concentrations reaching Te Waikoropupū.

[649] Dr Young's evidence indicated that, if a NO_3-N limit of 0.45 mg/l was to apply, natural variations would increase concentrations by a further 0.06 mg/l at times, to a concentration of 0.51. Other evidence indicated that greater increases

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298 NPSFM at cl 3.10(4).
299 JWS Monitoring compliance 12 August 2022.

have occurred; it can be seen from Figure ZD that NO_3-N concentrations exceeded 0.5 mg/l at both Springs for a period of two to three months in the 2019/20 summer period, averaging around 0.53 mg/l over that period at the Main Spring.

[650] Based on the clarifications we received from water quality and ecology experts, we proceed on the basis that the NO_3-N concentration at which a tipping point could occur is not known. We do not know how long concentrations would need to be at that level before the values of Te Waikoropupū would be unacceptably compromised. It is not known how long it would take to implement land use controls to reduce NO_3-N concentrations, or how long after that would be required to restore Te Waikoropupū, or how successful that would be.

[651] In view of these major unknowns and the acknowledged outstanding values of Te Waikoropupū, we consider the precautionary principle should be applied. There are no precedents to assist us to determine how much precaution should be applied in the complex hydrological environment that supplies groundwater to Te Waikoropupū.

[652] We must be guided by the s199 purpose of a water conservation order as we have set out in section E.[300]

[653] We are also required to have regard to the NPSFM 2020[301] with its objective to ensure that natural and physical resources are managed in a way that prioritises:

> (a) first, the health and well-being of water bodies and freshwater ecosystems
> (b) second, the health needs of people (such as drinking water)
> (c) third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

300 Section 199(1), RMA.
301 Section 212(b), RMA.

[654] When considering the baseline state to be used for the purposes of recognising and sustaining and preserving and protecting the values of Te Waikoropupū, we had regard to the definition in cl 1.4 of the NPSFM, which means the best state out of the following:

> (a) the state on the date it is first identified by a regional council
> (b) the state on the date on which a regional council set a freshwater objective for the attribute under the National Policy Statement for Freshwater Management 2014 (as amended in 2017)
> (c) the state on 7 September 2017.

[655] TDC has not yet set a freshwater objective for NO_3-N, so (b) does not assist. It is not clear when TDC first identified NO_3-N as a concern, although Dr Young stated that increasing NO_3-N concentrations have been known about for a long time and this was emphasised in the FLAG Science Report.[302] As noted above, that report was dated 31 March 2017. Hence, TDC had been made aware about concerns relating to NO_3-N and can be considered to have identified the concern on a date well before the Minister's appointment of the Tribunal and before the date of 7 September 2017 in paragraph (c) of the definition of 'baseline state' in the NPSFM.

[656] In view of the complexities and uncertainties of this case, the state on 7 September 2017, the date in subclause (c) of the definition of best state, is to all intents and purposes the same date as when the Minister appointed the Tribunal and later than the date TDC identified a concern about NO_3-N. In anticipation that the Minister will expect the Court's recommendation not to be inconsistent with the NPSFM, we consider there to be a strong case to adopt a date no later than mid-2017 for determining the best state and almost certainly earlier as the

302 Transcript at p 1005.

problem had been identified by the applicants in 2013. TDC was made aware of that soon after.[303]

[657] The Science Report recorded that the median concentration over the 10 years prior to 2017 was 0.41 mg/l[304] and that NO_3-N concentrations had increased by 0.1 mg/l between 1970 and 2017. Interestingly, this was a period of 47 years, while the concentration subsequently increased by a further 0.1 mg/l in less than 10% of that time. This reinforces the concern that Te Waikoropupū has been subjected to a dramatic increase in NO_3-N concentrations in a very short space of time, presenting an unknown and, in our view, unacceptable risk to its values.

[658] As noted above, Dr Young, Dr Hickey and Ms Moreau agreed the current NO_3-N median state in July 2017 was 0.42 mg/l in the Main Spring based on TDC three-monthly data. Ms McArthur and Dr Fenwick considered that both TDC and FOGB data should be used to calculate the median for the Main Spring, in which case then current median state would be 0.40 mg/l. Dr Young pointed out that this calculation includes an element of temporal bias,[305] as the 2016/7-year FOGB data included 52 results whereas TDC data included only four results a year for the four previous years.

[659] After wide-ranging consideration of the issues, options and consequences and the need for certainty and clarity for all parties, we have determined that the WCO should be framed on the basis of a five-year rolling median NO_3-N concentration of 0.41 mg/l based on monthly monitoring. A case could also be made for setting the limit at 0.40 mg/l based on consideration of FOGB and TDC data combined. However, this is complicated by the temporal bias issue and we

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303 Yuill, EIC at [10].

304 Ecosystem Health of Te Waikoropupū, Roger Young, Graham Fenwick, Andrew Fenemor, Magali Moreau, Joseph Thomas, Graham McBride, John Stark, Chris Hickey, Mark Newton.

305 Transcript at p 1016.

do not have the evidence to justify the lower limit at this time. However, this is a limit that should be considered in detail as part of the regional plan process.

[660] In summary, the Court recommends that the WCO's water quality restrictions prescribe a limit of 0.41 mg/l for NO_3-N for the following reasons:

(a) Te Waikoropupū has outstanding values that all parties and the Court agree must be preserved and protected;

(b) Te Waikoropupū has been subject to increasing NO_3-N concentrations for an unknown period of years, including by approximately 68% in the last 50 years. Concentrations are now substantially above natural concentrations;

(c) NO_3-N loads increased by around 40 tN/y between 1993 and 2016, and 70 tN/y between 1993 and 2021;

(d) the evidence shows that these increases have resulted primarily from anthropogenic activities in the WAMARA, with increased irrigation from 2005 onwards being a significant contributor and gorse being another but less potentially significant contributor;

(e) based on the evidence, we are satisfied that any NO_3-N concentration at or above the 2020 current state of 0.45 mg/l cannot be relied on to preserve and protect the values of Te Waikoropupū, particularly in view of uncertainties that arise because of climate change. There has been insufficient time since these concentrations have been consistently present to be satisfied that the values can be preserved and protected at such concentrations, and they are already significantly above the concentrations present when the applicants first sought a WCO;

(f) nuisance plants have already been observed and there is currently no scientific basis to determine when a tipping point could occur;

(g) the median NO_3-N concentration at the Main Spring over the 10 years to 2017 was 0.41 mg/l;

(h) based on an investigation undertaken by NIWA and reported on in

July 2018:[306]

> Setting a NO_3-N limit closer to the current annual median concentration of water in the Springs increases the likelihood that any potentially detrimental alteration to the floral assemblage of the Springs is avoided, or at least managers will be able to respond to changes sooner.

(i) concentrations in 2017 reasonably, although not completely, reflect those at Te Waikoropupū before the very large increase started in or just before 2016, when risks to values would have been lower;

(j) adopting a date in early to mid-July 2017 is broadly consistent with interpretation in the NPSFM regarding the "best state" to recognise and sustain the values of Te Waikoropupū, which we are required to have regard to;

(k) to be consistent with cl 1.6(3)(b) of the NPSFM, where information is uncertain, we interpret it in the way that will best give effect to the NPSFM;

(l) the NPSFM requires that first priority is given to the health and wellbeing of water bodies and freshwater ecosystems. By recommending a NO_3-N limit of 0.41 mg/l, we consider the WCO will be consistent with this requirement and will have no adverse effects on the second requirement to meet the health needs of people (such as drinking water);

(m) the recommended limit will require changes in land use practices[307] that will affect the ability of people and communities to provide for their social, economic, and cultural wellbeing, now and in the future, the third of the NPSFM priorities. However, by setting a compliance date of 1 January 2038 as described in the main report, we have recognised that significant time will be required once a new regional

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306 Common Bundle, at [47]. Implications of 0.55 mg/l nitrate-nitrogen limit for Te Waikoropupū aquatic flora, Matheson et al. We note this was not tested in evidence and not relied on in making our recommendation, but it is consistent with our own findings.

307 As part of the regional plan process.

plan becomes operative before any improvement works take effect and NO_3-N concentrations are reduced to meet the limit;

(n) any reductions in NO_3-N concentrations and loads reaching Te Waikoropupū required by the regional plan will only be possible if controls are placed on activities that caused the increased concentrations and loads in the last 15 or so years. On-going discharges will continue to be possible, but at more sustainable levels.

[661] We consider that, if a limit of 0.41 mg/l is appropriate to protect the Main Spring, it will be appropriate to protect Fish Creek Springs. We are satisfied that this would address the mātauranga Māori view expressed above by Ms Stafford and Ms Little that "Fish Creek Springs is an important and interconnected natural attribute of the AMA and Te Waikoropupū Springs and requires the same level of protection".

[662] Taking into account the complexities and considerable unknowns and uncertainties that exist in the WAMARA, we consider a median NO_3-N limit of 0.41 mg/l will:

(a) preserve and protect the values of Te Waikoropupū;

(b) be consistent with the single objective of the NPSFM to ensure that natural and physical resources are managed in accordance with the concept of Te Mana o te Wai in a way that prioritises first the health and wellbeing of water bodies and freshwater ecosystems; and

(c) enable manawhenua to exercise rangatiratanga and kaitiakitanga in a way that will maintain the mauri, the mana, the wairua and the integrity of the puna.

[663] It is probable that NO_3-N concentrations will exceed 0.45 mg/l from time to time in the future, even after new controls on activities take effect. Accordingly, some element of risk to the values of Te Waikoropupū will remain, albeit a low risk based on our evaluation of the evidence as a whole. Future monitoring will

enable the risk to be reassessed over time, and changes made to the regional plan if found necessary.

[664] Those findings inform our recommended WCO provisions. We also refer to our related findings in section E.2 – E.3 (as to what s199 and 200 RMA may allow), E.5 (as to the precautionary principle) and E.7(as to natural justice).

[665] Until the limit has been consistently met, restrictions are required on the granting of resource consents and the making of rules that may permit any point source or diffuse discharge of any contaminant into water (or onto land in circumstances in which it may enter water) in the WAMARA that would be likely to cause or contribute to any significant increase in NO_3-N concentrations in either water body. These are as specified in cl 8 of the recommended WCO in Annexure 1 of Part 1.

[666] Compliance will require seven or more exceedances of the 0.41 rolling median NO_3-N limit in any 12-month period starting from 1 January 2038. In the event that more than seven exceedances occur, TDC must immediately initiate an investigation and take any remedial action found necessary as soon as practicable. A stepped further reduction programme for NO_3-N will need to be provided for in the TEP to be implemented progressively in the event of non-compliance with the limit or in the event that trends from 2030 on indicate that compliance is unlikely to be achieved.

[667] Prior to 1 January 2038, there is no basis on which to reliably set a compliance limit. To manage risk during this period, we recommend the inclusion in the WCO of a duty that is triggered by the NO_3-N concentrations in the Springs exceeding a rolling median of 0.44 mg/l. If there are seven or more exceedances of the trigger in any year, TDC should undertake a review to determine the likely cause and implement contingency measures to reduce NO_3-N concentrations to below the trigger level. In particular, those measures would likely include the notification of provisions, for inclusion, in the proposed regional plan. The review

should be subject to independent review by at least two suitably qualified and experienced experts, including a mātauranga Māori expert.

[668] Based on our requests for clarification from relevant experts, reducing NO_3-N concentrations at Te Waikoropupū will require an equivalent percentage reduction in NO_3-N load, or in the order of 10%. The actual figure will need to be determined by TDC. The activity controls to achieve the required reduction will need to be determined by TDC through the TEP process. In our view, a combination of reducing NO_3-N discharges from gorse where practicable and controls on activities in the Valley Floor will be necessary. To ensure equity, consideration should be given to the recognition of any significant reductions in NO_3-N discharges from activities that already have been achieved voluntarily.

Dissolved reactive phosphorus (DRP)

[669] The water quality experts agreed that DRP is the mobile and bioavailable form of phosphorus and is more relevant for the management of Te Waikoropupū than total phosphorus.[308] Concentrations are typically very low with a median concentration over the last 10 years of 0.005 mg/l at the Main Spring. The five-year median concentrations at Fish Creek Springs to the 2017 and 2020 years were also 0.005 mg/l.[309]

[670] Based on the expert evidence discussed above, the current DRP concentrations are likely to limit the growth of nuisance algae in Te Waikoropupū, meaning any increase could have an adverse effect on values. Accordingly, we consider a single compliance limit of 0.005 mg/l should apply to both Springs. There is no evidential basis to set a lower limit along the same lines as that for

308 JWS Water Quality dated 19 July 2021 at [26c].
309 JWS Ecology and mātauranga Māori in response to Question 13(a).

NO_3-N. While TDC may choose to adopt a three-year rolling median as an early warning indicator,[310] that is not a recommendation.

[671] It will be important that future monitoring specifies low analytical detection limits so any changes over time can be identified.[311]

[672] In the event that seven or more exceedances of the limit occur in any 12-month period from the date the WCO takes effect, TDC must immediately initiate an investigation and take any remedial action found necessary as soon as practicable.

Dissolved oxygen

[673] All experts agreed it would be useful to monitor dissolved oxygen (DO) but noted there is limited existing information for Fish Creek Springs to inform limit setting.[312] For the avoidance of doubt, we consider it would be inappropriate for the Court to attempt to set limits without sufficient information and accordingly do not set a limit for Fish Creek Springs.

[674] The median of quarterly spot DO measurements recorded over the period from 2015 to 2021 was 6.2 mg/l (Moreau 2021). A continuous DO logger was installed in Te Waikoropupū (on the outside edge of the viewing platform and 5-10 m away from the largest spring vent) in early 2016. The results indicated that DO is typically between 50-65% saturation, which is equivalent to 5.5-7.0 mg/l. Measurements of DO saturation collected from near the Main Spring vents in the early 1970s indicated concentrations of 6.4-7.0 mg/l or 58-64% saturation.[313]

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310 Being the best available early warning trigger from the JWS Compliance Monitoring at 1.III.

311 Young, EIC at [108] and [109].

312 Ms McArthur and Dr Fenwick considered the same limit as the Main Springs should apply.

313 Young, EIC at [118]-[125].

[675] The Tribunal recommendation-version of the WCO requires that DO shall be no less than 45% saturated. Dr Young supported this limit but noted that a single DO measurement below 45% saturation would mean that the limit would be breached. He recommended that a 5th percentile should be used as the compliance metric.[314]

[676] He considered that compliance with the limit should be determined using a continuous DO dataset collected from directly above the Main Spring vent over a 3-month period. This should be from October to January within one year of the WCO being gazetted and subsequently at five-yearly intervals, potentially in conjunction with the detailed continuous water clarity measurements over the same three-month period.[315]

[677] We accept Dr Young's recommendations.

Water clarity

[678] The experts agreed that for the Main Spring, limits should be set for two statistics, the median and fifth percentile and these should be measured within one year of the gazetting and five-yearly thereafter. Monitoring should occur over a three-month period from October to January using a calibrated transmissometer suitable for measuring high clarity water or similar/advanced instrumentation.[316] The experts agreed that the limits should be a median of 72 metres and a fifth percentile of 68 metres.[317]

[679] The experts agreed it would not be practical to monitor water clarity in Fish Creek Springs using the specialist equipment needed.

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314 Young, summary of evidence dated 28 June 2022 at [25] and [26].

315 Young, EIC at [45], [195] and [196].

316 JWS Water Quality dated 19 July 2021 at [31] and [36]-[38].

317 JWS Ecology and Mātauranga Māori dated 22 July 2022 in response to Question 11.

[680] We accept the experts' recommendations.

C.18 Monitoring of other parameters

[681] We set out our findings above on the basis of compliance for each of the four water quality parameters agreed and recommended by the experts as requiring limits. Where there is no evidence to support a case to set limits for other water quality parameters, we have no basis to restrict the monitoring of parameters.

[682] Nevertheless, there is a high level of agreement between parties and experts alike that additional monitoring of the Springs is necessary and that monitoring of both surface waters and groundwaters in the Tākaka River catchment upstream of the Springs is a necessary part of ensuring the protection and preservation of Te Waikoropupū.

[683] It is evident from our inquiry that there is a need for a comprehensive independent review of TDC's current surface and ground water monitoring programmes so that they make a meaningful contribution to future protection of Te Waikoropupū. We note Mr Thomas made reference to the Tribunal making judgements about the inadequacy of the monitoring programme at the time it made its decision and recommended that there needed to be a review of that.[318]

[684] We also note that TDC is very largely constrained in its options for groundwater monitoring because of the complexity and difficulty of identifying representative monitoring sites within the aquifer systems and the difficulty and very high costs of drilling into the Arthur Marble. We consider that now is an appropriate time to review the contribution the programme is making to understanding the groundwater system and acting as an early warning system for possible increased adverse effects on Te Waikoropupū.

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[318] Transcript at p 806.

[685] As a minimum, the surface water quality monitoring programme needs amendment to reflect the new evidence arising from the inquiry that total nitrogen and dissolved organic carbon need to be included because of the nitrification that occurs in the aquifers. It was unclear to us what the objective of the surface water quality monitoring programme is. The absence of any TDC evaluation or evidence on surface water quality and how the results are used and/or anticipated to assist in protecting Te Waikoropupū highlights the need for greater clarity.

[686] The Court is firmly of the view that TDC is the appropriate body to define the future monitoring programme, ensuring that is done with fresh eyes, and that it would be inappropriate for us to seek to do so. We note that a significant amount of expert evidence and questions relating to different aspects of future monitoring emerged through the inquiry. We anticipate that may assist and inform TDC and the parties in developing any future monitoring programmes.

[687] We consider a review of the groundwater monitoring programme by one or more suitably qualified and experienced independent expert or experts not previously involved in the programme should be undertaken and this could be expanded to include a catchment-wide monitoring programme with clear objectives as to what the programme is intended to achieve. We discussed other aspects of monitoring in section B.

[688] These are matters for TDC to adjudge in cost-effectiveness terms and in accordance with its RMA responsibilities.

Monitoring locations and frequency

[689] The experts agreed that monitoring should continue at the Main Spring site used by TDC. The experts agreed that monitoring should continue at the Fish Creek Springs site used by the FOGB monitoring programme since 2016.[319]

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319 JWS Ecology and Mātauranga Māori dated 22 July 2022 in response to Question 10(c).

[690] The relevant experts agreed that monthly monitoring at the Main Spring and Fish Creek Springs was appropriate for most attributes except water clarity and dissolved oxygen, which require specialist equipment and programmes.[320] We accept their recommendations on both monitoring sites and frequencies for the purpose of meeting compliance requirements.

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320 JWS Ecology and Mātauranga Māori dated 22 July 2022 in response to Question 10(d).

Section D

Findings as to minimum flows and allocation

D.1 Purpose of section D

[691] Section D describes TDC's proposed conceptual framework for setting minimum flows and allocation limits in the WAMARA and current allocations, before considering the effects of taking additional water from the WAMARA on flows reaching Te Waikoropupū. It next summarises the concerns of other parties and the effects of taking additional water on the water quality and values of Te Waikoropupū. It then considers the recommendations of the Special Tribunal and how minimum flow and water allocation limits should be defined before setting out an overall evaluation as to consideration of the needs of primary and secondary industry.

D.2 The proposed conceptual framework

[692] Dr Young presented evidence on minimum flows and allocation limits on behalf of TDC. He described his conceptual framework and approach and made recommendations for how restrictions in the WCO should pertain to minimum flow and allocation limits. He stated:[321]

> Flow is the defining feature of rivers and streams. Minimum flows and allocation limits are two critical flow regime parameters that need to be prescribed to sustain in-stream values and proper functioning of river ecosystems. Minimum flows are required to provide a refuge to sustain populations and meet minimum water quality requirements while allocation limits are required to maintain flow variability and avoid long periods of flat-lining at the minimum flow.
>
> The conceptual framework and historical flows approach recommended are directly applicable to surface water systems that contribute to Te Waikoropupū

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321 Young, EIC at [17]-[21] and [55].

> Springs. The framework should also be applicable to Te Waikoropupū Springs and contributing aquifers on the basis that these groundwater dependent ecosystems have acclimatised to the current flow regime and that any effects of flow reduction will be proportional to the reduction in flow. Therefore, effects will be relatively small as long as the changes in flow are limited and within the range experienced naturally, and not held at low levels for long periods of time.
>
> The concept of setting a minimum flow and allocation limit to protect in-stream values of rivers and streams is also relevant to the protection of values in aquifers and associated springs because organisms living within these systems will also be influenced by the amount of water flowing through the system.
>
> For Te Waikoropupū Springs I recommend a minimum flow of 90% of the 7-day MALF (6895 L/s) and an allocation limit applying cumulatively to the whole AMA of 10% of the 7-Day MALF (766 l/s). I recommend that the cease take flow for all groundwater takes occurring directly from the AMA should be equal to the minimum flow plus the allocation limit (i.e. 6895 + 766 = 7661 l/s).
>
> The Special Tribunal decision largely adopted my recommendations on a minimum flow and allocation limit for Te Waikoropupū Springs, with a minimum flow for the Springs of 6895 L/s and a cumulative allocation limit of 766 L/s for all waters contributing to the Arthur Marble Aquifer Recharge Area.

[693] With regard to the effects of water allocation on the state of a resource, he stated:[322]

> Historical flow methods involve setting minimum flows and allocation limits based on historical flow statistics. It is assumed that the ecosystem has adjusted to the 'natural' flow regime and that a reduction in flow will cause a reduction in the biological state (abundance, diversity etc.) proportional to the reduction in flow. It is usually also assumed that the natural ecosystem will only be slightly affected as long as the changes in flow are limited and the stream maintains its natural character. It is implicitly assumed that the ecological state cannot be improved by reducing flow relative to the natural flow regime. Historical flow methods are low

322 Young, EIC at [57].

risk approaches aimed at maintaining an ecosystem in its existing state.

[694] Dr Young stated that the mean annual low flow ('MALF') has commonly been used as a benchmark for flow setting in New Zealand since the early 1990s and that the risk of ecological impact increases the more that flow is reduced. When in-stream resource values are factored into the decision-making process then the greater the resource value, the less risk is generally deemed acceptable.

[695] He considers minimum flows of 90-100% of MALF to be environmentally conservative and that retention of 90% MALF is unlikely to result in detectable effects on existing population levels given the high degree of environmental variability that is experienced in fish and invertebrate populations. He referred to practices elsewhere in New Zealand which indicate minimum flows were set at 90% of the MALF or less.[323] When asked by the Court if he was aware of any situations in New Zealand where no extraction below the MALF had been allowed he replied:[324]

> I can't think of anything. I know certainly some [areas] there's abstraction allowed at considerably well below the [MALF] which is why I've considered cease takes at the [MALF] in this situation to be very conservative and precautionary. But no I can't think of anywhere that does that at the moment, sorry.

[696] Dr Young also identified that in conjunction with minimum flow setting, consideration needs to be given to setting an appropriate flow allocation limit to maintain the key features of natural flow variability and avoid prolonged periods of flat-lining at the minimum flow. This is particularly important for consumptive allocations where the water is not returned to the water body. When making his recommendation of an allocation of 10% of the MALF, he had taken into account that:[325]

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323 Young, EIC at [62]-[64], [68] and [73]-[75].

324 Transcript at p 1023.

325 Young, EIC at [69], [86] and [91].

> Te Waikoropupū Springs (and the Springs River downstream) has high native fish diversity, significant water quality values and contributes to downstream whitebait and trout fishery values in the Waikoropupū River and lower Takaka River. In my opinion the overall instream ecological value of Te Waikoropupū Springs is high, which triggers the most conservative flow allocation.
>
> Benchmarking the minimum flow and allocation limit against the 7-Day MALF for the Main Spring (i.e. flows from the Main Spring Basin and Dancing Sands Spring) is conservative because flows from the Fish Creek Springs, and flows within the Arthur Marble Aquifer that are thought to discharge off the coast are not incorporated into the calculations.

[697] By way of an explanation of the second of the above quoted paragraphs, the total volume of flow generated in the WAMARA is in the order of 20,000 l/s.[326] Of this, indicatively, the mean flow reaching the Main Spring is 10,000 l/s, with a further 3,300 l/s reaching Fish Creek Springs and the remainder bypassing both Springs and discharging direct to Golden Bay. This means that not all additional water taken would reach the Springs in any event, with the proportion depending in part on where in the WAMARA it is taken from.

[698] We have carefully considered Dr Young's view that benchmarking the minimum flow and allocation limit against the 7-day MALF for the Main Spring may be conservative when considered in the WAMARA wide context. However, we do not consider that can be assumed for the Main Spring itself because, as Dr Young stated, the greater the resource value, the less risk is generally deemed acceptable.

[699] Dr Young recommended that once the minimum flow level is reached, all non-essential abstraction should cease, noting that abstraction for reasonable domestic and stock drinking requirements and for firefighting is generally allowed to continue. It is recognised that the flow may naturally drop below the minimum flow even after a cease take is implemented, but it is generally considered that these

326 Section A.8, Table 3.

extreme low flow events should not be exacerbated by continued water abstraction.[327]

[700] Dr Young considered the option of reducing the allowable take in steps as the flow decreased but recommended against it. He explained that in the implementation of any stepped process, there would be a need for some separation between stages. As to that, he observed that on the basis of the hydrology of the system, the gap between steps would be quite small in the WAMARA, making the approach impractical.[328] We accept his opinion on this.

[701] He recommended that minimum flows controlling water allocation and takes from contributing waters to Te Waikoropupū (i.e. upper Tākaka River and Waingaro River) should be determined separately since there is not a simple relationship between instantaneous flows at the Springs and flows in these zones.[329]

[702] On the evidence, we find that any limits on flows from contributing sources should be made by TDC following community consultation and a peer review of Dr Young's recommendations. We consider this is more properly the role of TDC, not of the Court as part of a WCO process. In any event, the evidence was insufficient to enable us to do so.

[703] Procedures and limits as to how the taking of water recommences after any cease take requirement no longer applies should be determined as part of the same process. Preferably, this would be as part of the TEP process, subject to further takes being shown to not adversely affect the values of Te Waikoropupū.

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327 Young, EIC at [81].
328 Transcript at p 1023.
329 Young, EIC at [93].

D.3 Currently authorised water allocations

[704] Mr Thomas stated:[330]

> The current (i.e. as of February 2022) total allocation from all the consented 21 water permits (consumptive) in the areas related to the confined and unconfined AMA is 517.8 l/s. …
>
> … Hence the total allocation from these permits since 2003 is 330 l/s which is 64 % of the allocation of 517.8 l/s. The other 36% (187.8 l/s) allocation existed before this with most of it being from the Waingaro River with a total allocation of 137.6 l/s (27%) … . There has been no new water permits granted in the recharge area since the 2010 Waitui Stream take permit which is about 12 years ago.

[705] Further information was provided by Mr Thomas in response to a request from the Court[331] and is shown on Figure N. It indicates that, since the 2010 date referred to by Mr Thomas, water allocations have increased by approximately 15%. This lack of attention to detail and understanding of the significance of providing incomplete or unreliable evidence, which was also apparent in other aspects of his evidence, was unhelpful and undermining of our capacity to rely fully on that evidence. Nevertheless, we accept 517.8 l/s as the current authorised allocation as it corresponds to the volume of 313,000 m^3/week shown on Figure N as being authorised from 2016.

[706] Mr Thomas estimated that the Waingaro River contributes around 8% of the water recharging the WAMARA. He also considers that any direct river takes from the Waingaro River should be treated as 8 % of the take rate for that reason. On that basis he stated:[332]

> There are currently 4 direct takes from the Waingaro River totalling 137.6 l/s.

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330 Thomas, EIC at [128] and [129].

331 TDC memorandum dated 27 June 2022, Court Exhibit JT1.

332 Thomas, EIC at [70], [71], [138] and [140].

> Hence the total AMA recharge surface water takes shown in Figure 22, less Waingaro takes, total 341 l/s. Using the 8% of Waingaro take rate equates to 11 l/s contribution to TWS from the Waingaro river allocation. Total AMA recharge surface water to TWS would then be 352 l/s (342 l/s + 11 l/s). Adding this to the two other allocation totals categorised in Figure 22 (AMA recharge groundwater and marble AMA groundwater) the total water allocation from the recharge area related to TWS directly would be 391 l/s. This means that, subject to further Council bona fide review of existing consents, there would be an additional 375 l/s that could be allocated under the RMA, subject to the balance of the provisions of the WCO.

[707] We do not have sufficient information about losses from the Waingaro River to the WAMARA to enable us to rely on Mr Thomas' assumption that such takes should be accounted for as 8% of the actual take. In view of the potential for adverse effects on Te Waikoropupū, we consider an independent peer review must be undertaken to confirm the geohydrology of the WAMARA at or before the time of any future application to take water from any part of the WAMARA.

[708] As recorded in section D.2, Dr Young recommended that an allocation limit of 766 l/s should apply cumulatively to the whole of the Arthur Marble Aquifer. While we place greater reliance on Dr Young's evidence, we are unaware of any peer review of his recommended minimum flow and allocation limits having been undertaken. We accept his reasoning in relation to flowing surface waters, however, its applicability to a sensitive groundwater and Spring environment was not tested to any significant extent in cross-examination or by technical rebuttal evidence by other experts. Accordingly, as noted above, we consider independent expert review of Dr Young's recommendations is also required as part of the TEP process.

[709] Our recommendation to the Minister is that the allocation limit for water taken from the whole of the WAMARA should be 766 l/s. The WCO provides for this to be increased subject to verification by way of an independent peer review by a suitably qualified and experienced expert that additional water can be taken from the Waingaro catchment without reducing the minimum flow from Te

Waikoropupū below 6895 l/s. In addition, the 766 l/s allocation limit from flows reaching Te Waikoropupū should be seen as an upper limit that may need to be reduced in the TEP process depending on the outcome of the peer review.

D.4 Effects of taking additional water from the WAMARA on flows reaching Te Waikoropupū

[710] Messrs Weir and Fenemor developed a model of flows from the Springs. They found their modelled flows matched well to measured flows, particularly during lower flow conditions. They then used the model to run several hypothetical scenarios to predict the response of flows under different land and water use assumptions, including no consumptive use, status quo (i.e. existing use) and total additional abstraction similar to the proposed 766 l/s peak allocation, but not the exact figure.

[711] Mr Weir explained that there is a clear and obvious hydraulic response at groundwater monitoring sites as a result of river and land surface recharge. Because of this, the dynamic response in groundwater levels and Spring discharge has been modelled using a series of eigen models. He stated that:[333]

> Although eigenmodels are simplified representations of real aquifers, they are suitable for situations for which dynamic hydraulic response is the primary interest (Bidwell & Burbery, 2011). They are particularly helpful in situations where the aquifer system is not known in sufficient detail to construct a more detailed numerical model. Consequently, they are suitable for use in the Takaka Valley.

[712] The status quo scenario was intended to reflect the state of land development in the WAMARA and was used to calibrate the models. It was based[334] on a peak allocation rate of 495 l/s, which is 25% higher than the 391 l/s estimated above by Mr Thomas. It was based on an irrigated area of 2,275 ha,

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333 Weir, EIC at [3.4].
334 Weir, EIC at [4.2].

compared to TDC land use information which gives the current irrigated area as in the order of 1,000 ha from Figure N.

[713] The likely future irrigation scenario modelled was based on an additional allocation of 283 l/s, which is broadly similar to the 248 l/s derived by subtracting Mr Thomas' existing allocation figure of 518 l/s from the allocation limit of 766 l/s. A no consumptive use scenario was also considered to represent the state of the groundwater system unaffected by irrigation, other consumptive use (e.g. water supplies) and subsequent use. It was based on the status quo scenario but with all water use removed and all existing land use assumed to be dryland.

[714] The modelled results are shown in Table 14, which are reproduced from Mr Weir's Table 2.

Table 14
Model predictions of average flows and 7-day MALF at the Main Spring and Fish Creek Springs in litres per second

	No consumptive use		**Status quo**		**Likely irrigation**	
	Average	**7-day MALF**	**Average**	**7-day MALF**	**Average**	**7-day MALF**
Main Spring	9,910	7,490	9,740	7,250	9,720	7,240
Fish Creek Springs	3,110	640	3,060	530	3,050	510

[715] In his rebuttal evidence, Mr Weir stated:

> While I agree that water taken will deplete the Springs, I do not expect the effect at the Springs to be a similar amount (i.e. it is not a 1:1 relationship between take and effect). Rather, only some of the effects will arrive at the Springs. Water abstraction and use will also deplete off-shore flows (bypassing the Springs), other water bodies, and local storage around abstraction bores (only some of which will propagate to the Springs). The water used for irrigation may also result in some

> additional recharge to the groundwater system.
>
> The reduction in flow from the Springs for an allocation limit of 778 l/s is predicted to be approximately 190 l/s. This is derived from the difference in Spring flows between the "No Consumptive Use" and "Likely Irrigation 2" scenarios (refer to Paragraph 4.3 of my main evidence) and is 24% of the peak allocation. Hence, the effect is less than a 1:1 relationship with the allocation rate.

[716] We note that the 190 l/s relates to the Main Spring and there is a further difference of 50 l/s associated with Fish Creek Springs. This would give a combined flow reduction of 240 l/s compared to no consumptive use.

[717] Before presenting his summary of evidence, Mr Weir updated the model using Mr Thomas' revised estimates in paragraph [14], after which he concluded that:

> This updated work concluded that existing water allocation (391 l/s) is predicted to reduce 7-Day MALF in the Springs by approximately 140 l/s (1.8%). A total abstraction of 766 l/s (or an additional 375 l/s5) is predicted to reduce the current 7-Day MALF by a further 110 l/s (1.4%).

[718] When asked by the Court to confirm the reduction in flows to Te Waikoropupū that would result from an additional water allocation of 375 l/s, Mr Weir replied that it would affect the Main Spring by 110 l/s, in accordance with his updated summary evidence, and Fish Creek Springs by 90 l/s, which he said was not in his evidence.[335] This would result in a combined flow reduction of 200 l/s.

[719] We were initially unclear as to how to understand the Weir and Fenemor model, as we found the evidence poorly presented and confusing. This was partly accounted for by our having seen Mr Thomas' revised estimates and partly by the model's incorrect assumptions relating to the land area irrigated. The predicted

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335 Transcript at p 683-684.

reduction in flows shown in Mr Weir's Table 2 under the likely irrigation appeared implausible at 30 l/s to both Springs out of an increased allocation of 283 l/s.

[720] It was only in his read synopsis, filed just prior to his presenting evidence, that Mr Weir offered potentially credible predictions to the Court. His prediction of a reduction in flow of 200 l/s is not inconsistent with other evidence that a third of flows in the WAMARA by-pass the Springs and go direct to Golden Bay. If that is the case, it would take the accounted for flow to 300 l/s or 80% of the allocation. This may or may not be realistic, but it is much more plausible than the evidence as originally presented. We do not consider that irrigation will result in any significant additional recharge to the groundwater system as suggested by Mr Weir because deficit irrigation is practised in the WAMARA.

[721] We acknowledge the technical complexity of the geohydrology of the WAMARA, however, we are unable to place significant weight on the evidence presented by Mr Thomas in relation to groundwater in the Waingaro catchment or by Mr Weir in relation to modelling. While we do accept that an additional water take of 375 l/s could reduce flows reaching Te Waikoropupū by somewhere in the order of 200 l/s, this is not a reduction below natural flows, but below flows already modified significantly by hydro-electric power generation and other anthropogenic land uses.

[722] For this and other noted reasons, we find there is a need to apply the precautionary principle. According to that principle, we find that until such time as it can be demonstrated by independent peer review that taking more than 766 l/s from the groundwater system as a whole will not result in the flow leaving Te Waikoropupū being reduced below the minimum flow of 6895 l/s, the maximum additional take must not exceed 248 l/s over and above the existing take of 518 l/s.[336]

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[336] 766 l/s minus the existing allocation of 518 l/s.

D.5 Need to take water

[723] In conducting our inquiry, we are required to have regard to the needs of primary and secondary industry, and of the community.[337]

[724] Mr Savage stated that:[338]

> … the ability to undertake irrigation within the Takaka Valley is essential to maintain the long term viability of the existing farms. For those reasons, the proposed WCO should not prevent the current irrigation and nor should it preclude access to the additional 766 l/s of water being made available through regional plan rules.
>
> … without irrigation, farms will run out of soil moisture in 10 to 15 days. For the balance of the month the pasture growth will be heading towards zero. These events have been common in the past 5 years. We have experienced many 30 – 60 day low rainfall periods in the past 5 years.
>
> The fact that irrigation is being undertaken, and that there is a waiting list for irrigation takes, demonstrates that irrigation is needed.

[725] Dr Rowarth explained that:[339]

> In the context of increasingly unpredictable rainfall in the Takaka Valley, increased water allocation is important to maintain pasture quality and soil organic matter, thereby reducing the likelihood of organic matter decomposition and release of nutrients, including nitrogen, to the environment.

[726] Mr Matheson submitted that:[340]

> The Farming Interests would be prepared to accept that any further water made available for allocation is subject to a requirement that the nitrate nitrogen lost to

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337 Section 212(a), RMA.
338 Savage, EIC at [3.1] and EIR at [2.9] and [2.10].
339 Rowarth, EIC at [1.1].
340 Updated oral submissions dated 25 May 2022 at [17].

> ground does not increase within the AMARA because of the take and use. (That could involve transitioning of land use or re-allocation of land uses within the AMARA. ...)

[727] We are satisfied that witnesses giving evidence for Farming Interests demonstrated the importance and benefits for farms of existing irrigation in the way it is currently undertaken because of the climatic conditions that exist in the WAMARA. While Ms Dewes made a range of statements about the need for and the inefficiency of current irrigation, we find these do not assist as they are overly generalised and not supported by locality specific facts.

[728] As to the importance and benefits of irrigation for existing farms, we overwhelmingly prefer and accept the evidence of the Farming Interests. The WCO will not restrict the taking of water allocated by existing resource consents for the term of those consents. However, that does not lead us to find that there is a need to allow for additional irrigation or for other farms to start irrigating unless it can be demonstrated that it will not put the values of Te Waikoropupū at risk.

[729] We were told about the existence of a so-termed "waiting list" held by TDC of farming operations seeking irrigation allowance. Mr Savage expressed the view that "The fact that irrigation is being undertaken, and that there is a waiting list for irrigation takes, demonstrates that irrigation is needed".[341] When cross-examined about the waiting list, Mr Savage replied that it has been around for a long time, a decade, and it hasn't been adjusted, so he is not sure of the current views of those on the waiting list as to how they view irrigation in their systems.[342]

[730] Ms Langford's understanding is that the list "… is simply an expression of interest by those individuals that have put themselves on that list quite a few years

341 Savage, EIR at [2.10].
342 Transcript at p 564.

ago".[343] Mr Sowman explained it came about 10 years ago, that is, around 2012, and that "there was effectively an expression of interest from the council to land owners and some of us who were already irrigating as to the opportunity for or interest in future irrigation in the Tākaka Valley". He said there was "no due diligence on behalf of our family to the feasibility of that".[344]

[731] Based on Mr Thomas' evidence to the Tribunal, the quantity of additional water included on the waiting list is 280 to 321 l/s.[345] He confirmed the waiting list has no regulatory force.[346]

[732] Reference was made in evidence to the "FLAG Report"[347] and views expressed about allocation limits. On the matter of need, we do not give the report any significant weight, finding that in all relevant respects it has been overtaken by other evidence before the Court. However, we note it records that "Staff have advised FLAG that the waiting list should be formalised to ensure it operates as intended for any new water take applications in these zones (within the respective allocation limits) … ".

[733] In our view it would be premature and inappropriate for TDC to act on that recommendation until such time as the TEP process is concluded and the TEP is operative. In any case, in light of the evidence we have discussed, we find the existence of the waiting list falls well short of demonstrating a need for additional water takes. We do not give it significant weight in our findings.

[734] Accordingly, we disagree with the Tribunal finding that the waiting list demonstrates a need for additional water.

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343 Transcript at p 539.

344 Transcript at p 587.

345 Special Tribunal Recommendation Report at [343].

346 Thomas, EIR at [27].

347 Tākaka Freshwater and Land Advisory Group Recommendations Report for freshwater management in the Tākaka Freshwater Management Unit, June 2019.

[735] Mr Copeland, a highly experienced economist called by the Farming Interests, informed us that agriculture and agricultural product processing industries are key drivers of the Tasman District economy in general and that of the Tākaka Valley. In his opinion, were a WCO to prevent access to irrigation water in the WAMARA, that would significantly impact the economy and, therefore, the needs of primary and secondary industry and related needs of the community. He offered estimates that, in average seasons, the flow-on economic impacts of preventing water access would be in the order of $0.49M p.a. for business revenue and $0.51M for household incomes. His comparable estimates for dry seasons were $1.52M for business revenue and $1.52M for household incomes.

[736] However, while Mr Copeland's analysis assists us to a degree, it does not help us to interrogate the relative marginal economic impacts of the potential outcome scenarios regarding needs. In particular, under any scenario, a WCO would not entirely prevent water access.

[737] We received no other probative evidence of any established need to take additional water for other purposes.

D.6 Concerns raised by other parties

[738] Ms Stafford stated that:[348]

> The principles and values of Ngāti Tama and NPS-FM Te Mana o te Wai requires people to think about water as a living breathing taonga in its own right that needs to be looked after rather than a commodity to be taken until it is gone or pushed to its limits until it can no longer survive.[349]

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348 Stafford, EIR at [17].

349 Te Mana o te Wai Guidelines for Mana Whenua National Policy Statement for Freshwater Management 2020 at p 10.

[739] Under the heading "Te Mana o te Wai", which is referenced as "The first right to water is the water itself", the "Mātauranga Māori Report for the Tākaka Catchments" states in relation to the WAMARA:

> Manawhenua support the current allocation of wai. Manawhenua stress the importance of taking a 'precautionary approach'[350] to the allocation of wai (no further allocation), in particular for the area that recharges Te Waikoropupū. Te Waikoropupū is of immense significance to manawhenua, as a wāhi tapu a wai tapu and a taonga. Protecting the waters of Te Waikoropupū is integral to the spiritual and cultural well-being of manawhenua; it is a fundamental part of manawhenua identity and the maintenance of tribal traditions.

[740] Mr Yuill referred to Mr Fenemor's evidence which "shows greater nitrate leaching from irrigated land than from dryland". He stated this underlines the fact that we don't have reliable grounds for saying it is safe to increase water allocation or intensity of operations in the aquifer recharge area.[351]

[741] He also referred to an earlier report prepared for TDC by Dr Young[352] which provided the following advice on appropriate minimum flows for the major rivers of the Takaka Valley:

> Detailed habitat analyses and modelling is required to determine appropriate minimum flows for the Takaka North rivers and Major Rivers and their tributaries. If the expense of detailed habitat analyses cannot be justified for these rivers then a conservative approach would be to set the minimum flow at the MALF.

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350 A precautionary approach considers tohu (indicators) of water body hauora, such as the nature of the water body and the potential adverse impacts of water allocation – for example water bodies which are sensitive to changes in water volumes and reduced flows (such as smaller water ways and wetlands); water bodies which have cultural or biological significance (such as ngā puna and river mouths); and already degraded water bodies, which are more sensitive to low flows.

351 Yuill, EIC at [79] and [80].

352 Yuill, EIC at [17] and Appendix 6 referring to R G Young "A framework for flow management in the Takaka River catchment" (2006) prepared for Tasman District Council. Cawthron Report No. 1172. 21.

[742] Mr Brass considers that:[353]

> Unless there could be certainty that further abstraction would not affect any of the values and characteristics of Te Waikoropupū, then providing for the economic water use needs of industry ahead of the health and well-being of Te Waikoropupū would be inconsistent with the hierarchy of obligations under Te Mana o te Wai.

[743] SOS is opposed to any additional taking of water from the WAMARA.

[744] Professor Williams expressed the view that statistics such as MALF provide a measure of the state of discharge from Te Waikoropupū but offer little insight into the state of the aquifer or the processes and activities that led to that low flow.[354] However, he did not suggest any alternatives.

[745] In reading his synopsis of evidence, Professor Williams made the observation that too much focus on water takes and low flows at the Springs deflects attention from the main problem, which is deteriorating water quality in the Wharepapa Arthur Marble Aquifer and how to arrest it.[355]

[746] Dr Fenwick stated that:[356]

> **The relationships of groundwater ecosystems to hydrodynamics** and the groundwater surface are too poorly known for us to determine ecological flows for aquifers and allocation limits. Proposed national environmental standards fail to acknowledge and consider groundwater ecosystems and their biodiversity.
>
> For this reason, I recommend no further takes of water [from] contributing rivers, streams and aquifers.

[747] He expanded on his views elsewhere in his evidence-in-chief and rebuttal evidence, emphasising the uncertainty around what the effects on ecosystems will

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353 Brass, EIC at [97(b)].
354 Williams, EIC at [65].
355 Williams, synopsis of evidence at [6.6].
356 Fenwick, EIC at [50] and [51].

be and his view that there should be no further allocation except in accordance with conditions proposed by the applicants. In his synopsis of evidence, he stated:[357]

> Given that precise quantification of effects of reduction in flow cannot be done even for rivers (Young & Hay 2017), I do not have confidence that Dr Young's "specifically developed" minimum flows and water allocation limits for these hydrologically complex aquifers are properly precautionary from an ecosystem health perspective.

[748] Ms McArthur stated that:[358]

> There is little technical certainty underpinning the Special Tribunal drafting of clause 3 and therefore adverse effects on the Springs from increased allocation of water and irrigation on farmland in the central valley may not be avoided in a timely manner. In my opinion a precautionary approach is needed to any potential increase in contaminants or stressors that may affect the aquifers or springs, given the risk of unknown ecological thresholds or tipping points being reached. In the absence of technical certainty of the effects and when they might occur it would be precautionary to not allow further abstraction of water.

D.7 Effects of taking additional water on the water quality and values of Te Waikoropupū

[749] As stated in section B.16, we are satisfied that deficit irrigation as currently practiced in the WAMARA is unlikely to cause significant, if any, increased NO_3-N loss at the time of or immediately following irrigation. However, the increased nitrogen held in the soil in whatever form increases the overall quantity of nitrogen potentially available to be flushed out during heavy rainfall.

[750] Our evaluation of monitoring results in section C indicates that NO_3-N concentrations started to increase in around 2005, just after the time increased

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357 Fenwick, synopsis of evidence at [31].

358 McArthur, EIC at [156].

water was allocated for irrigation purposes. All nitrate experts agreed that leaching rates increase with irrigation, with the table in the JWS nitrate indicating a possible doubling of the rate. Mr Fenemor's model predicted an increase in NO_3-N reaching Te Waikoropupū under a future increased irrigation scenario.[359]

[751] We accept that there are significant uncertainties associated with both the indicative leaching rates in the JWS nitrate and Mr Fenemor's model predictions. However, all three strands of the evidence indicate NO_3-N concentrations increase, not decrease with increased irrigation. Overall, the evidence is compelling that increasing the allocation of water to allow further irrigation will result in increased NO_3-N reaching Te Waikoropupū.

[752] Ms Stafford gave a mātauranga Māori view, explaining that:[360]

> And so the effect of having an increase from the day we lodged the Water Conservation Order in a nitrate level from 0.41 and upwards is that it diminishes the mauri, the mana and the wairua, the integrity of our puna and so our 0.45 limit in the Water Conservation Order is a signal and a trigger to say that we need to do something … and that's a compromised position because it's gone past the 0.45 so it's a compromised position. Ngāti Tama has taken into account all information.

[753] Our recommendation to the Minister is that current NO_3-N concentrations must be reduced to preserve and protect the values of Te Waikoropupū. We accept that it may be possible to make changes in irrigation practices to reduce leaching rates. However, until that has been demonstrated by future monitoring of the Springs, the evidence before us is that the authorisation of further water for irrigation purposes without having first reduced existing NO_3-N concentrations

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359 Fenemor, EIC at [1.3] "While the modelled projections of Table 2 suggest that current development, mainly farming in that part of the valley floor of the Takaka Valley recharging the AMA, contributes most of the nitrate-nitrogen in the Te Waikoropupū Springs flow, adoption of the 766 l/sec water allocation limit is projected to increase Main Spring nitrate concentrations by 0.03 mg/l (7%)."

360 Transcript from p 492.

sufficiently will present an unacceptable risk to the undisputed outstanding values of Te Waikoropupū.

D.8 Recommendations of the Special Tribunal

[754] The Tribunal recorded that:[361]

> Irrigation is a key aspect of farming in this catchment, and therefore water allocation is at the forefront of considerations for a WCO. The Special Tribunal is aware of the existence of an informal waiting list for water allocation. In relation to the wider Takaka Water Management Area we remind ourselves that the needs of primary and secondary industries and of the community are their **reasonable needs**, rather than hopes and aspirations for the future.[362] The waiting list represents a quantifiable reasonable need.
>
> …
>
> For these reasons we consider the WCO needs to provide for water allocation that will enable continued irrigation and additional water resource availability for irrigation. The draft WCO provides for this in clause 7e, through a "green light' approach, whereby additional water, to a capped limit of 766 L/s, can be accessed once there has been 3 consecutive years' data showing no increase in nitrate/nitrogen levels. This approach ensures that water quality is paramount, but that if the nitrate nitrogen readings are trending steady, or even decreasing, then it is appropriate to enable more water to be abstracted. …. The Order allows for additional water allocation but not without the farming community having to show they are having a positive or at least a neutral effect on the values of Te Waikoropupū Springs.
>
> …
>
> We acknowledge the primary sector seeks certainty that existing water take and discharge resource consents will be able to be renewed without being open to interpretation or challenge. However, there will always be a level of uncertainty,

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361 Special Tribunal Recommendation Report at [360]-[366].

362 *Oreti River Water Conservation Order*: Special Tribunal Report at [282].

especially in an environment of changing national standards with regard to water and ever tighter requirements for land use practices, particularly with regard to farming. This is also partly due to governmental responses to climate change. The Tribunal did not find that there was an overwhelming industry or community need for water which displaces the presumption of protection, beyond what is already provided through existing resource consents (which the Order cannot affect) and the amount represented by the waiting list. There is a potential to cater for an increased demand for water, as the FLAG report identified, up to a maximum amount specified by Dr Young for that report and in evidence before us (766 L/s). However, in order to balance the protection of the waters identified in Schedule 1 of the Order, access to this additional amount, which has the potential to act as a carrier of contaminants, is predicated on monitoring results in respect of nitrate nitrogen, which in this case acts as a proxy for water quality overall.

[755] The Tribunal's recommended WCO includes the following restrictions:

No resource consent may be granted or rule included in a regional plan that –

a. Will cause the flow of groundwater from Te Waikoropupū Springs to fall below its mean annual low flow [being a flow of 6895 litres per second].

e. Will result in the cumulative consented consumptive abstraction from the waters in Schedule 2 exceeding 10% of the 7-day mean annual low flow at Te Waikoropupū Springs (10% of the mean annual low flow being 766 litres per second), provided that this subclause will only permit additional consumptive abstraction from the waters in Schedule 2 or from a groundwater abstraction point within the recharge zone of the Arthur Marble Aquifer if monitoring of NO_3-N at Te Waikoropupū Springs has established that the annual median of monthly samples of NO_3-N has not increased for a period of 3 consecutive years.

D.9 How should any minimum flow and water allocation limit be defined

[756] Mr Matheson raised the issue of whether cl 9(a) of the proposed WCO should refer to 90% of MALF or a fixed figure. He noted that the Farming Interests' expert prefers a reference to 90% of MALF, whereas the Council prefers

a fixed figure of 6895 litres/second.[363] He explained that 90% of MALF will allow that figure to change over the long term with climate change and move either up or down.

[757] The Farming Interests called Mr Fenemor. In his evidence-in-chief he offered the opinion that the WCO should be stated in absolute number terms so as to avoid ongoing debate about what is the current MALF and to avoid a moving allocation target. He also considered that the allocation limit should be stated as an absolute number as opposed to a percentage of the MALF to avoid a situation where the MALF decreases and existing allocations could then exceed the limit.[364]

[758] It appears to us that on this matter Mr Fenemor is in agreement with TDC.

[759] We prefer absolute numbers as providing greater certainty for all parties and simpler implementation. Until such time as there is certainty that water quality limits are met and there is a very high level of certainty that future water allocation for additional irrigation will not increase NO_3-N concentrations reaching Te Waikoropupū, it is not appropriate in terms of the precautionary principle that additional allocations be made.

[760] Potentially, this could take until 2035 or thereabouts or beyond. We include provisions in the WCO for absolute numbers for minimum flow and allocation limit set in the WCO to be subject to confirmation in the TEP that may increase the minimum flow or decrease the allocation limit once more robust predictive tools are available.

D.10 Overview of our response to concerns raised by Manawhenua and other parties

[761] We have considered carefully the concerns expressed by Manawhenua and

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363 Opening submissions, dated 18 May 2022, at [2.1], [6.8].
364 Fenemor, EIC at [1.10] and EIR at [5.4].

some other parties about the potential adverse effects of further water takes from the WAMARA on the values of Te Waikoropupū. We are satisfied that the expressed concerns about water quality are addressed to the extent that is reasonably achievable on the current state of knowledge by the provisions of cl 8 of the WCO recommended to the Minister (including in cls 8 and 9 and the overarching duties). The WCO leaves aside the capacity to take further protective measures, including through controls on water takes, in the future as may then be justified on the then state of knowledge.

[762] We have recommended an upper limit of future additional water takes based on the only hydrological evidence we received, which was presented by Dr Young. While concerns were expressed about the effects of taking additional water in submissions and by experts and in questioning, an insufficient evidential basis was provided to justify setting a lower limit in the WCO than recommended by Dr Young.

[763] We have made clear our concerns that Dr Young's evidence is not supported by any other expert opinion and we strongly recommend that it be subject to independent peer review, based on a ki uta ki tai approach, before limits are set in the regional plan process. This is a Council function, but we have made specific provision in the WCO for the minimum flow to be raised and the allocation limit to be reduced if found necessary through the regional plan process.

D.11 Overall evaluation of our response to the needs of primary and secondary industry

[764] We addressed the needs of primary and secondary industry in section D.5. We accept that for the farming industry, irrigation is important and benefits existing irrigators because of the variable climatic conditions. The WCO will not restrict the taking of water allocated by existing resource consents for the term of those consents.

[765] In evaluating the evidence on future water allocation capacity, for irrigation,

we have kept in mind that s212 uses the word "needs" in its ordinary sense. That ordinary meaning implies a threshold of being essential or at least highly important. A number of existing farms have been operating without irrigation up until now. We were told there have been no applications for additional water made over the last 10 years and that this was due to the restraint of the farming community. This suggests that, while irrigation would improve a situation, it is not "essential" or "necessary" and will be influenced by economic factors.

[766] In evaluating needs, we have given primacy to the s199 purposes of the WCO. On the evidence before the Court, increases in water allocation and associated irrigated areas since 2005 have resulted in increased NO_3-N concentrations at Te Waikoropupū. We find that a highly significant factor weighing against the enablement of further irrigation development. As we have explained, we find the precautionary principle should be applied in our determination of appropriate WCO restrictions for NO_3-N and flow allocation.

[767] Subject to the protective purposes of the WCO being fulfilled, we find that the WCO should allow for the proper testing of any case for "need" for water in the consent application context. Therefore, we have included in cl 9 a subclause (e) as follows:

> (e) The Council must ensure that for all new takes of water that contribute to the flow at Te Waikoropupū Springs:
>
> (i) …
>
> (ii) there is a reasonable need to take that water instead of taking water from a source that does not contribute to that flow.

[768] We are satisfied that the WCO fairly and sufficiently accounts for the existing needs of farming operations and other primary industry, whilst requiring such uses to ensure appropriate water quality targets are met.

[769] Given the risks that NO_3-N pollution presents for the Springs and their values, we find that the WCO's prescribed NO_3-N limit of 0.41 mg/l would need to be demonstrated to be met consistently for a sufficient period of time as one prerequisite to enabling further irrigation. We determine that period should be for five years. That is because that period:

(a) aligns with the five-year running median compliance period recommended by the experts;
(b) is consistent with the five-year calculation period for the Macroinvertebrate Community Index (MCI) score and Quantitative Macroinvertebrate Community Index (QMCI) score in the NPSFM 2020; and
(c) provides a balance between no period of confirmation and an indicative 10-year cycle between consecutive low and high-flow periods shown on the graphs in section B.

[770] We find an additional prerequisite for enabling any additional irrigation is that it is demonstrated that there is sufficient head room available to allow an increased allocation of water for irrigation without causing the 0.41 mg/l NO_3-N limit to be exceeded. This is as provided for in the recommended WCO in Annexure 1 of Part 1.

[771] We have designed the flow restrictions by reference to two defined parameters: for a "minimum flow" for Main Spring and an "allocation limit". In addition, we provide a cease take regime. In summary, the restrictions are as follows:

(a) for minimum flow, from parts of the WAMARA that drain to Te Waikoropupū, we set a default limit of 6895 l/s. However, applying the precautionary principle, we enable a greater flow volume to be prescribed by a regional rule if TDC adjudge that as appropriate to better achieve the overarching duties as to preservation and protection in cl 6(a);

(b) for the allocation limit, we prescribe a default of 766 l/s. For the same reasons as for minimum flow, we enable a lesser volume to be prescribed by regional rule.

[772] In terms of accounting for future needs, we recognise the importance of providing due flexibility to allow TDC to design its plan regime equitably and in a way that is responsive to the different needs and conditions facing particular farming operations. That is allowed for in our design of the relevant WCO restrictions as we have described.

Section E

Determinations and findings on legal principles

E.1 Interpretation principles

[773] We are to ascertain the meaning of the WCO regime according to the text and in light of the purpose of the RMA provisions and their context (s10, Legislation Act 2019).

E.2 Interpretation of ss 199 and 200

"Notwithstanding anything to the contrary in Part 2…"

[774] Section 199 commences "Notwithstanding anything to the contrary in Part 2" before prescribing the purposes of a WCO.

[775] As submitted for TDC, those words make clear that not all of pt 2 RMA is to be ignored (or set aside) but only those aspects which are contrary to the purposes stated in s199.[365] Taking that somewhat further, both the s199 purposes and the purpose and principles in pt 2 RMA require contextual interpretation and in most respects they are aligned rather than incompatible. As such, we prefer an interpretation of pt 2 to be made through the lens of s199 and in the context of the consideration of the particular waters in issue and their identified values and characteristics.

[776] Our primary focus is on recognising and sustaining the identified values of the subject waters. That primary focus encompasses consideration of what the WCO may provide for in terms of preservation of identified natural state waters as far as possible in their natural state and associated provisions for protection.

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365 Opening submissions for TDC, dated 18 May 2022, at [23], referring to *Rangitata South Irrigation Ltd v New Zealand and Central South Island Fish and Game Council* EnvC C109/04, 5 August 2004, at [21].

Subject to that primary focus, we must have regard to the other required considerations in s212. Notably, those include the relevant RMA policy or planning instruments and the needs of primary and secondary industry, and of the community.

[777] In those respects, the broader sustainable management purpose in s5, RMA is supplanted. Furthermore, we do not entirely apply the approach to the interpretation of pt 2 with reference to RMA planning instruments as set out by the Supreme Court in *Environmental Defence Society Inc v New Zealand King Salmon Co Ltd*.[366] The important qualifier in applying that guidance is that these considerations are subject to the primary and other considerations directed by s212 RMA.

'Natural state'

[778] The permissible scope of a WCO depends to some extent on the intended meaning of 'natural state' as used in s199:

(a) if waters are in their natural state, a WCO can serve to preserve that state "as far as possible";

(b) if waters are not in their natural state, that does not necessarily preclude a WCO. In such cases, a WCO can still serve to recognise and sustain waters' values if those values are outstanding. To those ends, the WCO can still prescribe restrictions, prohibitions and other provisions.

Submissions

[779] For the Farming Interests, Mr Matheson acknowledged the importance of accounting for mātauranga Māori in the interpretation of 'natural state'. Nevertheless, he submitted the outcome is similar in the sense that from that

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366 *Environmental Defence Society Inc v New Zealand King Salmon Co Ltd* [2014] NZSC 38.

dimension also the waters are considered outstanding as of today and not requiring any enhancement of their cultural health state.

[780] Counsel for the applicants submitted that a purely time-bound approach to determining 'natural state' does not fully capture a mātauranga Māori approach. Rather, for those purposes, counsel submitted that we should treat 'state' as encompassing an intergenerational relationship between the subject waters and Manawhenua.

'State'

[781] 'State' is to be determined by the Court as at the date of its deliberations afresh on the evidence before us. That is simply as part of our responsibility to make findings on the evidence as to the state of the water bodies in order to inform our recommendation on whether the Tribunal's report should be accepted, modified or rejected.

[782] "State" generally has its ordinary meaning, namely a condition at a particular point in time.[367] However, as the mātauranga Māori evidence made clear, "state" also encompasses a whakapapa relationship of wai and Manawhenua which is inter-generational and pertains to cultural health and wellbeing.

[783] 'Natural state' is to be interpreted, in this case, from the perspectives of both western science and tikanga Māori. That is as provided for under s199 and pt 2, RMA. Section 199(2)(a) and (c) are properly read in conjunction to the effect that a tikanga Māori perspective can inform the determination of 'natural state' where the water body has or contributes to values of outstanding significance in those terms. Moreover, applying ss 6(e), 7(a) and 8, it is appropriate that we read both "waters" and "natural state" as encompassing a mātauranga Māori dimension insofar as that is demonstrated in the evidence before the Court (or related

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367 New Zealand Oxford Dictionary.

submissions).

[784] In those matters, we are also guided by various authorities on the proper consideration of tikanga Māori in New Zealand law. According to the Supreme Court's guidance in *Ellis v R,*[368] we rely on the unchallenged evidence called by the joint applicants in ascertaining tikanga principles (and on submissions).[369] We also find of some assistance the various cases noted by counsel where the Courts have used tikanga in statutory interpretation. In *Re Edwards Whakatohea,*[370] this was to interpret phrases in the Marine and Coastal Area (Takutai Moana) Act 2011. In *Trans-Tasman Resources Ltd v Taranaki-Whanganui Conservation Board*,[371] the Supreme Court did so to interpret phrases in the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012.

[785] As Ms Little informed us, waiora is water in its purest form, used in rituals to purify and sanctify and has the power to give life, sustain wellbeing and counteract evil. She explained that 'waiora' also means health.[372] From a mātauranga Māori perspective, we understand that waters adjudged by Manawhenua as waiora are properly to be considered, for the purposes of s199, as in their natural state. Ngāti Tama adjudge Te Puna Waiora o Te Waikoropupū as waiora and we find accordingly.

'Outstanding'

[786] Subject to one rider, we agree with Mr Thomsen that "outstanding" is to be adjudged according to whether the relevant value is "out of the ordinary on a national basis". The rider concerns those characteristics that are of outstanding

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368 *Ellis v R* [2022] NZSC 114.

369 Oral outline of closing submissions for hearing dated 27-28 October 2022, referring to *Ellis*, at [120]-[125].

370 *Re Edwards Whakatohea* [2021] NZHC 1025, [2022] 2 NZLR 772.

371 *Trans-Tasman Resources Ltd v Taranaki-Whanganui Conservation Board* [2021] NZSC 127, [2021] 1 NZLR 801 used tikanga to interpret phrases in the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012.

372 Little, EIC, at [52].

significance in accordance with tikanga Māori (s199(2)(c)). That value calls for scrutiny of how the characteristic pertains to the relationship that the wai has with Manawhenua, in accordance with tikanga and mātauranga Māori.

'Recognise', 'sustain', 'preservation' and 'protection'

[787] As used in s199, each of these words has its ordinary meaning:

(a) 'recognise' is intended in the sense that a WCO serves to acknowledge and specify the values of the waters found to be outstanding;

(b) 'sustain' is intended in the sense that a WCO serves to support and maintain those recognised values, and encompasses the associated "protection" of those values (and/or characteristics);

(c) 'preservation' does not refer per se to those values but to the natural state of the subject waters, if these are found to be in that state. Therefore, it is intended in the sense that, in such cases, a WCO may provide for the preservation of the natural state of the subject waters as far as possible. By contrast, the object of the 'protection' duty in s199 is the recognised outstanding values of the subject waters. In a practical sense, where waters are found to be in their natural state, the duties as to preservation and protection will closely inter-relate. In essence, if natural state is lost, values will be compromised and vice versa.

'Preservation' and 'protection' and the Treaty of Waitangi principle of active protection

[788] As a matter of law, a WCO is secondary legislation made by the Crown. As our role as a Court includes a recommendation to the Minister on the substance of the WCO, under s8 RMA we take into account the Treaty of Waitangi principle of active protection. Under ss199 and 200, RMA, a WCO can help assist the Crown to take that principle into account.

[789] As we have noted, s199 specifies that a WCO can provide inter alia for:

> the protection of characteristics which any water body has or contributes to, and which are considered to be of outstanding significance in accordance with tikanga Maori.

[790] As we set out in Part 2, we find that the subject waters, as Te Puna Waiora, are in their natural state in accordance with tikanga and have outstanding values in terms of tikanga significance (as well as in several other respects). As for tikanga aspects, we also give reasons why we find that the WCO needs to express several related duties as to TDC's exercise of powers under s30(1)(e) and (f).

[791] Part of what informs those findings is s8 and the Treaty principle of active protection. Section 8 extends that to the Minister, in recommending on a WCO. Plainly, as an Order in Council, a WCO is capable of being an instrument of active protection for and on behalf of the Crown. In substance, it is an instrument of Executive direction in this case to TDC on matters pertaining to its exercise of powers under s30(1)(e) and (f). As a statutory planning authority under the RMA, TDC is itself to act in accordance with the specifications in pt 2, including in s8.

"Restrictions or prohibitions" in s200 can encompass duties

[792] Section 200 further defines what a WCO can include in defining the "meaning of" a WCO. An aspect of that is that is in its specification that a WCO:

> … imposes restrictions or prohibitions on the exercise of regional councils' powers under paragraphs (e) and (f) of section 30(1) (as they relate to water)

[793] The reference to "powers under" does not strictly correspond to the language of s30. That is, s30 prescribes "functions", not powers *per se*.

[794] The relevant TDC functions in s30(1) for the purposes of s200 are as to control of:

(a) the taking, use, damming and diversion of water and of the quantity, level and flow of water in any water body, including controls pertaining to maximum and minimum levels and flows and ranges (s30(1)(e)) ('flow allocation'); and

(b) discharges of contaminants into or onto land, or water and of discharges of water into water (s30(1)(f)) ('water quality').

[795] The "exercise of" "powers under" those s30(1) provisions primarily refer to the exercise of the powers in pts 5 and 6, RMA concerning planning and consenting of activities as specified in s30(1)(e) and (f).

[796] We interpret "restrictions" on those powers as being capable of extending to how related duties, including as to monitoring under s35, are exercised. Section 35 prescribes that local authorities are to "gather such information, and undertake or commission such research, as is necessary to carry out effectively its functions under this Act…". The RMA's "functions" include those in s30, notably including the functions specified in s30(1)(e) and (f). In cases where a local authority's exercise of its RMA powers (e.g as to planning or consenting) cannot properly fulfil its s30(1)(e) and (f) functions without associated monitoring, we read s200 as allowing for a WCO to impose restrictions as to monitoring. In such cases, this comes within the ambit of "restrictions or prohibitions on the exercise of regional councils' powers under paragraphs (e) and (f) of section 30(1) (as they relate to water)".

E.3 Do ss199 and 200 allow a WCO to require enhancement of a water body or restoration of its health?

Submissions

[797] TDC and the Farming Interests submitted that it is not part of the purpose of a WCO to enhance the quality of waters adjudged outstanding. Counsel drew in particular from observations in the 2004 Environment Court report on the

Rangitata WCO in *Rangitata South Irrigation*.[373]

[798] For TDC, Mr Thomsen submitted that "outstanding" is to be adjudged according to whether it is "out of the ordinary on a national basis". On that submission, we observe that the case law supporting it does not consider how 'outstanding' is to be adjudged where it pertains to significance in accordance with tikanga Māori (s199(2)(c)). The relevant tikanga is highly localised, namely that of manawhenua, namely of Ngāti Tama ki Te Tauihu, Te Ātiawa and Ngāti Rarua. Plainly, it is not helpful to apply any national comparative measure on this set of values. However, that aside, the more substantive aspect of Mr Thomsen's argument is that the role of a WCO is to restrict a regional council's powers "to the extent necessary" to maintain the *current* quality and quantity of waters.

[799] Allied to that point, counsel maintains that the Court is obliged to find a benchmark 'existing date' as at which the relative quality and quantity of the subject waters is to be determined. Having determined that, counsel argues that the Court cannot recommend a WCO that would effectively require enhancement to that "existing date" quality and quantity of the waters.

[800] Mr Thomsen submitted that the 'existing date' should be the date of the Tribunal's report, i.e. 17 March 2020. Insofar as this bears upon limits that may be prescribed in regard to water quality and quantity, Mr Thomsen focussed specifically on the key water quality attribute of NO_3-N. As the Tribunal prescribed the limit for that to be 0.44 mg/l, Mr Thomsen submitted that the Court should not set a more restrictive limit.

[801] For the Farming Interests, Mr Matheson agreed with Mr Thomsen that the Court should not set a more restrictive limit for NO_3-N than 0.44 mg/l. He also agreed, drawing from the same authorities as relied on by Mr Thomsen, that the

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373 Opening submissions for TDC, dated 18 May 2022, at [20]-[25], [35]-[39] referring to *Rangitata South Irrigation Ltd v New Zealand and Central South Island Fish and Game Council* EnvC C109/04, 5 August 2004 at [17], [20]-[24], [30].

Court could not require enhancement of water quality or quantity and, therefore, needed to determine an "existing date" as a benchmark for those purposes. However, he took a slightly different view on what that benchmark "date" should be. As noted, his submission on that was that water "state" has to be adjudged by the Court as at the date of deliberation (or this report). However, his derivation of a limit for NO_3-N of 0.44 mg/l is the five year median level for the period 2017 – 2022.[374]

[802] Other parties submit that the Court is not constrained in the terms argued on behalf of TDC and the Farming Interests. Ms Baker-Galloway and Ms Hill for the applicants submitted that, in light of s7(f) RMA, it was open to the Court to enhance the quality of the waters to a state the Court determined to be necessary for the health of the waters.[375] In response to the Court's questions, Ms Gepp for SOS submitted that *Rangitata* should be distinguished as not involving the mātauranga Māori or water quality degradation dimensions at issue in this case. She submitted that the passages from *Rangitata* relied on by TDC and the Farming Interests were simply a finding on the evidence. In any case, counsel pointed out that so-termed 'current state' as referred to in other submissions does not appear in the RMA and 'natural state' is not to be limited to 'current state'.[376] Counsel for the DG and Mr Mather for FOGB essentially concurred.

Sections 199 and 200 enable a WCO to require enhancement subject to the s199 purpose

[803] We find that all matters that inform the Court's finding on whether the subject water bodies qualify for a WCO under ss199 and 200 are to be determined as at the date of the Court's deliberations for its report to the Minister. That is simply as part of the Court's de novo inquiry role and extends to findings, for the

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374 Closing submissions for the Farming Interests, dated 13 October 2022, at [3.3]. We record that part of Mr Matheson's argument concerns natural justice limits as are next addressed in this report.

375 Reply submissions for the joint applicants, dated 20 October 2022, at [5].

376 Closing submissions for SOS, dated 7 October 2022, at [15]-[22].

purposes of ss199 and 200, as to:

(a) whether and in what respects the subject waters are outstanding and in their natural state; and
(b) whether those waters' values qualify as outstanding.

[804] However, it does not follow that a WCO's specified limits and related restrictions can only go as far as to maintain the status quo in terms of the various attributes used to determine current water quality.

[805] It is important to bear in mind that we are considering two related purposes of a WCO in this case, namely as to the natural state of the subject waters in accordance with tikanga Māori and the outstanding values recognised for those waters.

[806] In both respects, there is plainly a close association with the state of the subject waters' relevant water quality attributes. That is in the sense that they are part of what informs the evaluative judgment necessary as to whether the waters are in their natural state and have outstanding values.

[807] The Farming Interests and TDC fairly point out that the subject waters can qualify for a WCO as being in their natural state and having outstanding values, notwithstanding the present levels of NO_3-N and other contaminants. It does not follow, however, that the WCO's s30(1)(e) and (f) restrictions must require no more than that the current state of specified water quality attributes be maintained. For instance, in the case of NO_3-N, the Court does not have any sound basis to find that maintenance of a level of 0.44 mg/l as the calculated five year median level of that attribute in the Springs for the period 2017 – 2022 would not jeopardise the ecology and related outstanding values of the Springs.

[808] Neither ss199 or 200 nor other provisions in pt 9 RMA prescribe that a WCO must not include restrictions that have the effect of requiring some enhancement of the state of water quality attributes. Rather, the primary purposes

of a WCO as prescribed in ss 199 and 200 are as to:

(a) recognising and sustaining values;
(b) preserving the natural state of outstanding water bodies as far as possible; and
(c) protecting recognised values.

[809] An important set of those 'values' is as to the subject waters' recognised tikanga Māori significance.

[810] Provided that they serve the s199 purpose, we find nothing in the RMA to preclude the setting of limits that effectively require enhancements of a water body's attributes, whether biophysical or cultural.

E.4 To what extent can a WCO restrict planning and monitoring?

Submissions

[811] Differences on these matters crystallised in closing submissions we heard in the October 2022 hearing. In that hearing, parties offered their different refined positions (and associated drafting) on the substance of the restrictions and other provisions that should be recommended for inclusion in the WCO.

Requirements as to planning

[812] On the matter of what a WCO can direct in regard to a regional plan, differences were largely matters of degree. No parties disputed that planning is one of the "powers under paragraphs (e) and (f) of section 30(1) (as they relate to water" and, hence, within the auspice of s200, RMA. However:

(a) the applicants and supporting parties generally preferred relatively greater prescription in the WCO, as a higher order instrument, as to matters of substantive plan content;[377] whereas

(b) TDC and the Farming Interests favoured an interpretation whereby WCO requirements were more in the nature of specifying "bottom lines".[378]

Monitoring

[813] The applicants submitted that the evidence strongly supports a requirement in the WCO as to monitoring of the subject waters and contributing surface and groundwaters, at least to "establish a baseline of water quality (state) of the protected contributing waters that flow into the AMA moving forwards".[379] The applicants proposed that the WCO include requirements to:[380]

(a) measure the present state of water quality (groundwater and surface water) and aquatic ecology (subterranean and surface) and their changes over time at WAMA input sites and outflow sites; and

(b) assess direction of compliance with WCO requirements (improving, stable, deteriorating).

[814] Furthermore, the applicants sought that the WCO mandate "cultural health" monitoring by or on behalf of Manawhenua.

[815] As for jurisdictional scope, counsel for the applicants submitted that s30(1)(e) and (f) do not pertain just to rules that control quality and quantity of water. As such, they submitted that it is open to the Court to prescribe how that control is to be carried out in a WCO "whether that be a package or combination of rules, monitoring and enforcement requirements, keeping of records, consultation, etc. those are all 'controls' on freshwater functions to ensure

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377 Closing submissions for the applicants, dated 28 October 2022, at [55].

378 Closing submissions for TDC, dated 14 October 2022, at [23], [24], closing submissions for the Farming Interests, dated 13 October 2022, at [3.25].

379 Closing comments for the applicants, dated 28 October 2022, at [27].

380 Closing comments for the applicants, dated 28 October 2022, at [30].

outstanding values are sustained".[381] In essence, monitoring requirements are an intended fetter on discretion in the exercise of s30 functions such that the Council carries out the discretion "within the bounds of the Executive's prerogative".[382]

[816] Counsel submitted that including its requested monitoring regime in the WCO would assist to uphold the Court's obligation to have regard to the NPSFM (s212(b)). As such, it would assist the Executive to promulgate "consistent and [complementary] instruments in the planning hierarchy for the Council to eventually implement". Specifically, counsel noted that cl 3.18 of the NPSFM prescribed directions for regional councils to establish "methods" (including mātauranga Māori measures) for "monitoring progress towards achieving target attributes states and environmental outcomes", including to recognise long term trends.[383]

[817] TDC and the Farming Interests submitted that the extensive monitoring regime sought by the applicants extended beyond the scope of a WCO (although TDC signalled that, in principle, extensive monitoring was required for the protection of the Springs and cultural health monitoring by Manawhenua is appropriate).[384]

[818] Counsel for TDC and the Farming Interests drew attention, for instance, to relevant RMA provisions in terms of which:

(a) NPS can encompass a range of matters pertaining to integrated management and both the substance and preparation of regional plans and those plans must give effect to them; whereas

(b) WCO are prescribed to serve a narrower water body specific purpose and regional (and district) plans must only be not inconsistent with

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381 Closing comments for the applicants, dated 28 October 2022, at [55].

382 Closing comments for the applicants, dated 28 October 2022, at [34].

383 Closing comments for the applicants, dated 28 October 2022, at [34]-[39].

384 Closing submissions for the Farming Interests, dated 13 October 2022, at [3.27], [6.20]-[6.26], [7.17]; closing submissions for TDC, dated 14 October 2022, at [41]-[43], [50].

them.

The WCO can include planning restrictions but there is only constrained scope for monitoring requirements

[819] WCOs are part of a set of instruments for Executive supervision and direction to regional councils as to their exercise of their s30 functions. A common thread to each of these instruments is that the choice to intervene through them is initially that of the Minister, as an aspect of the Minister's functions under s24. Plainly, the Court's recommendation on a WCO should be approached on the understanding that the Minister and the Executive would seek that any directions it gives through a WCO will be materially compatible with what they have directed through the NPSFM. The two instruments are intended to work in relevant collaborative terms, rather than in a replicative way or at cross-purposes. However, the more significant issues concern the relative extent to which a WCO can operate as an instrument of supervision and direction compared, in particular, to the NPSFM.

[820] As with other instruments of Executive intervention, WCOs are subordinate to the RMA. What they can address or direct is only as the RMA prescribes.

[821] In terms of overall design, the RMA frames its mandate for regional council and unitary authority resource management by reference to:

(a) *functions* "for the purpose of giving effect to" the RMA (s30);

(b) *powers* that may be exercised for fulfilment of those functions, for instance as to planning and consenting (pts 4 – 6); and

(c) *duties* that must be carried out in the exercise of powers (e.g. in pt 4).

[822] In addition, the RMA prescribes purposes for NPS and WCO and different requirements on how regional plans must account for them.

[823] In considering these scope questions, it is helpful to compare what the RMA prescribes in each of these respects.

Comparisons as to statutory purposes

[824] A NPS broadly serves to "state objectives and policies for matters of national significance that are relevant to achieving the purpose of" the RMA (s45) and is required to do so (ss45(1), 45A(1)).

[825] A WCO serves a much narrower water body specific purpose. That purpose is in summary to "recognise and sustain" and provide for the protection of identified "outstanding" values and characteristics of identified water bodies (and preserve as far as possible any 'natural state' water body considered outstanding) (s199).

Comparisons as to how NPS and WCO can direct the exercise of local powers including in planning and consenting

[826] A NPS is capable of effectively significantly directing on all matters within the broad compass of the s30 functions of a regional council (or unitary authority) including as to integrated management of a region's resources and of the related purposes of a regional plan (in s63). Those directions can extend to what a regional plan must or must not contain or address and how it is formulated.

[827] Under s45A RMA, a NPS can:

(a) state objectives and policies for matters of national significance;
(b) state other matters that can include, for example, relatively prescriptive methods or requirements, required matters RPS and/or plans are to achieve or provide for (or conversely constraints or limits), required provisions to be included in RPS or plans; and
(c) give directions on monitoring, record-keeping or reporting.

[828] A regional plan must "give effect to" a NPS (s67(3)). In the consideration of resource consent applications, regard must be given to any relevant provision of a NPS (s104(1)).

[829] In comparative terms, the RMA's specifications on how a WCO can bear upon the exercise of local planning and consenting and other powers are less prescriptive and more open-ended, with one exception: WCOs are instruments specifically designed to pertain to an identified water body or water bodies for the confined protective purposes of s199.

[830] A WCO primarily serves to restrict or prohibit a regional council or unitary authority's "exercise of powers under" s30(1)(e) and/or (f) in regard to the specified water body. Section 30 prescribes "functions" rather than "powers". As such, s200 is to be read to encompass those powers that may be exercised in fulfilment of the functions in s30(1)(e) and/or (f) for the subject water body. That is primarily the planning and consenting powers but can encompass duties, by way of restrictions, as to how those powers are fulfilled.

[831] A WCO is not necessarily confined to only restricting or prohibiting the exercise of those powers. Given s199, it can be reasonably inferred that a WCO can include associated measures that serve to recognise and sustain and provide for the protection of outstanding values and characteristics (and preserve as far as possible the natural state of any water body considered outstanding). That inference is further supported by the duties imposed on consent authorities by s217 (including to not grant a water permit "contrary to any restriction or prohibition *or any other provision of* the order") (our emphasis).[385]

[832] However, by contrast to s45A's specifications for what a NPS may include, there is no express capacity for a WCO to state directions on monitoring or reporting. Furthermore, the RMA directions for how a WCO influences planning

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385 *Otago Regional Council v Otago Regional Council* [2010] NZEnvC 210 at [43]-[46].

and consenting are materially different from those for NPSs. A regional plan is not required to give effect to a WCO, only to be "not inconsistent with" it (s67(4)). A WCO only becomes a matter to which regard must be given in the consideration of a consent application if the consent authority adjudges that to be necessary (s104(1)(c)).

[833] Considered overall, a WCO can bear upon the exercise of a similar range of powers under s30(1)(e) and (f) as can a NPS. However, that is in terms intended to enable greater discretionary judgements to be applied by regional councils (and those delegated to exercise their consenting powers).

[834] NPS and WCO are both Executive instruments for intervention in local resource management. The Executive can be deemed to seek that on any matters in which a NPS gives direction, anything in a WCO on the same matter is to be applied in a manner that still allows fulfilment of that direction.

E.5 Do we apply the precautionary principle or approach?

Submissions

[835] No parties disputed the potential relevance of the precautionary principle (or its close RMA cousin, the "precautionary approach"). Differences centred on what that should mean for relevant restrictions or prohibitions concerning exercise of TDC's powers under s30(1)(e) and (f). In particular, that pertains to appropriate limits for NO_3-N. For SOS, Ms Gepp and Ms Iorns noted the importance of considering this in the particular context and by reference to certain factors.[386] TDC acknowledged a need for a precautionary approach given the three-dimensional complexities of the aquifer system and the associated uncertainty concerning the functioning of groundwater dependent ecosystems. Given the incomplete understanding of the contributing aquifers, Mr Thomsen submitted that precaution is properly applied "when assessing a regulatory tool like a WCO".

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386 Opening submissions for SOS, dated 20 May 2022, at [39]-[45].

However, he added that this does not mean the risks cannot be quantified while applying the precautionary approach.[387]

The precautionary principle should be applied to NO_3-N and flow

[836] We set aside the so-termed 'precautionary approach' as it has been understood in cases such as *Sea-Tow Ltd v Auckland Regional Council*.[388] In essence, that is because this concept derives from the application of the definition of 'effect' in s3, RMA and that definition has no application to s199 (which does not refer to 'effect').

[837] However, the 'precautionary principle' is well-recognised in international law and properly fits with ss199 and 200.

[838] Section 199 is framed in terms of recognising, sustaining and protecting outstanding values (and preserving as far as possible natural state waters). An inherent aspect of doing that in this case is in effectively managing threats to those values. In ordinary usage, "sustain" includes maintain and that encompasses due management of risk to protect the recognised values of waters from harm. In circumstances where there are scientific uncertainties on key matters pertaining to risk management, the precautionary principle can apply. That is the position that the evidence demonstrates here in regard to both NO_3-N and water allocation. That is particularly the case in regard to the setting of limits for NO_3-N and the flow regime. We cannot safely derive threshold limits as would ensure that the natural state of the Springs is preserved and their values are sustained and protected from vulnerabilities and causes of potential harm.

[839] Therefore, we apply the precautionary principle to our determination of those limits and associated restrictions.

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387 Opening submissions for TDC, dated 18 May 2022, at [88], [89].

388 *Sea-Tow Ltd v Auckland Regional Council* EnvC A066/06, 30 May 2006 at [457].

[840] In the absence of being able to derive reliable threshold limits, judgement is required as to how we derive limits to best protective effect. In essence, that judgement is as to how much precaution is sufficient. We acknowledge the helpful submissions on these matters for SOS. In applying our judgement in these matters, we bear in mind:

(a) the highly sensitive nature of values of the subject waters, in essence for the various reasons we have traversed;
(b) the present significant uncertainties concerning risks of potentially irreversible harm to those values; and
(c) the significant capacity to minimise those risks by practicable regulatory intervention.

[841] We are satisfied that it accords with the purpose of s199 to apply it to our consideration of the management of the risks presented to values from NO_3-N pollution and from water allocation and the flow regime. The application of that principle in each case is one factor that informs our determination of appropriate restrictions in the WCO.

E.6 Is a principle of "non-regression" relevant for consideration?

Submissions

[842] Ms Gepp and Ms Iorns for SOS submitted that an associated principle of "non-regression" should inform the Court's recommendation on the WCO.[389] Counsel referred to the following definition of this principle offered by the World Commission on Environmental Law of the International Union for Conservation of Nature ('IUCN'):[390]

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389 Opening submissions for SOS, dated 20 May 2022, at [98]-[106].

390 IUCN World Declaration on the Environmental Rule of Law (2017), Principle 12. Ref: https://www.iucn.org/sites/dev/files/content/documents/english_world_declaration_on_the_environmental_rule_of_law_final.pdf

> States . . . shall not allow or pursue actions that have the net effect of diminishing the legal protection of the environment or of access to environmental justice.

[843] Counsel submitted that it could be used by the Court in making decisions on wording or elements of the WCO and also be capable of being reflected in the WCO as a guiding principle.

We decline to apply this principle

[844] We are mindful that we are a statutory court tasked with undertaking our inquiry and making recommendations according to the specifications of the RMA. By contrast to the precautionary approach, we find no mandate to apply this principle to our evaluation nor to require it to be considered under the recommended WCO as a principle.

[845] On the evidence, we can apply the precautionary principle in order to serve the purpose in s199. Were we to apply a non-regression principle, we would be effectively finding a purpose additional to s199. It would be ultra vires to do so.

E.7 Do natural justice principles preclude the Court from prescribing a NO_3-N limit more stringent than 0.44 mg/l?

Background

The applicants' case to the Tribunal and the Tribunal's recommendation

[846] There is firstly the background of the application and the Tribunal's report. The original application had sought a NO_3-N limit of 0.40 mg/l. In their case to the Tribunal, the applicants' position varied from that limit to other more concessional limits and they ultimately sought at that stage a limit of 0.45 mg/l. The Tribunal recommended a somewhat more stringent limit of 0.44 mg/l.

The applicants' s209 submission to initiate the Court's inquiry

[847] Properly, in their submissions on these matters, counsel confine their focus to the applicants' s209 submission. Whilst other s209 submissions were filed, none of them pursued any relevant departure from the Tribunal's recommended regime for NO_3-N.

[848] The applicants' submission comprised a notice of motion and supporting affidavit. The notice of motion requested that the inquiry be into the Tribunal's report in order that the Court recommend "the amendments as outlined in this Notice of Motion and supporting Affidavit".[391] The substance of the applicants' submission is in the notice of motion.

[849] Their submission sought to maintain a 0.44 mg/l limit. However, it also sought an expansion on the water quality parameters, a significantly expanded regime for monitoring NO_3-N limits and a more stringent related restriction on the exercise of consenting and planning powers (in then proposed cl 9, the equivalent of the Court's recommended cl 8). The notice of motion explains the applicants' position as follows:[392]

> Clause 9 is proposed to be amended by clarifying it applies to where contaminants may enter water (directly or indirectly) and by restricting the grant of resource consents, or permitted activity rules, that would cause any deterioration in any one or more of the values listed in clause 4 and / or and of the revised limits in Schedule 3. This clause is critical in ensuring the outstanding waters recognised can be preserved in their natural state. By linking this requirement to the outstanding characteristics identified in clause 4 as well as Schedule 3, all values recognised to be outstanding will be taken into account in assuring preservation is achieved as far as possible, and that the Order is consistent with the national Policy Statement Freshwater Management (NPSFM).

[850] In addition, the applicants' submission sought significant changes to the WCO for the monitoring and protection of the cultural health of the subject

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391 Applicants' s209 notice of motion, dated 1 May 2020, at [1].
392 Applicants' s209 notice of motion, dated 1 May 2020, at [18].

waters, according to tikanga Māori. The notice of motion explains their position including as follows:[393]

> A more complete list of attributes is also proposed to be included in Schedule 3 which corresponds with outstanding characteristics and features listed in clause 4 and in Schedules 1 and 2. This includes cultural values in accordance with Tikanga Māori and Ecosystem Health, which are proposed to be monitored for no deterioration in Te Hauora o te Wai, and a no trend of decreasing ecosystem health (as defined), respectively.

The evidence

[851] The applicants' evidence in chief and rebuttal evidence did not pursue anything more stringent. However, as noted, the Court made directions for several rounds of expert conferencing including on relevant matters pertaining to NO_3-N.

[852] After all the evidence, including as set out in a number of JWS prepared according to the Court's directions, we signalled to parties a preliminary view (subject to closing submissions) that a limit of 0.40 mg/l may be called for. In light of that preliminary indication, the applicants submitted in their closing submissions for the October 2022 hearing that the WCO should incorporate:

(a) interim (until 30 June 2035) limits of 0.45 mg/l (for Main Spring) and 0.42 mg/l (for Fish Creek Springs); and

(b) long-term (commencing 1 July 2035) limits of 0.40 mg/l (for Main Spring) and 0.37 mg/l (for Fish Creek Springs).

Submissions

[853] As we have noted, the Farming Interests and TDC maintained that the

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393 Applicants' s209 notice of motion, dated 1 May 2020.

Court should uphold the Tribunal's recommended NO_3-N limit of 0.44 mg/l.

[854] On the matter of jurisdictional scope, Mr Matheson properly acknowledged that the Court's role in a WCO inquiry is different from that of a typical appeal, including in the fact that the ultimate purpose is to make a recommendation on a WCO to the Minister. However, as a caveat to that, he submitted that:[394]

> … the scope of any jurisdiction may be narrowed or refined throughout that process such that if recourse was made to relief sought at the very outset in circumstances where the relief had been amended since then, then that would give rise to a jurisdictional concern based on a breach of natural justice.

[855] Mr Matheson characterised the differences between 0.40 mg/l and 0.44 mg/l as material for his client, representing a ten percent reduction on an already low figure. He added:[395]

> Importantly, the ability to achieve this reduction will vary from farm to farm – some farms, that have already significantly reduced their nitrogen discharge may have very few (if any) feasible options left; other farms, who have not taken those steps, may well have. The point is that not all farms or farming systems are the same, and the ability to further reduce nitrogen discharges (and over what timeframe) will vary.

[856] Counsel submitted that the Court lacks jurisdiction to recommend any materially more stringent NO_3-N limit than 0.44 mg/l (as recommended by the Tribunal) and it would be a breach of natural justice to do so.

[857] The latter submission was premised in particular on an analysis of the applicants' s209 submission and their evidence-in-chief and rebuttal. As for the s209 submission, Mr Matheson focussed in particular on the fact that it sought to maintain a 0.44 mg/l limit.

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394 Closing submissions on behalf of the Farming Interests, dated 13 October 2022, at [3.15].
395 Closing submissions on behalf of the Farming Interests, dated 13 October 2022, at [3.17].

[858] Counsel argued that the applicants did not foreshadow what they ultimately sought in their closing submissions for the October 2022 hearing.[396] He added that, were the Farming Interests to have been alerted to the potential for a significantly more stringent NO_3-N limit than 0.44 mg/l, they would have wanted to call additional evidence. That is particularly given how greater stringency in this limit would impact on their farming operations and needs.

[859] Furthermore, Mr Matheson observed that not everyone with potentially relevant interests is before the Court. Before the Court contemplated recommendation of a limit of 0.40 mg/l for NO_3-N (which we take to also refer to any recommendation for a limit of 0.41 mg/l), he submitted that we would need provide opportunity for those unrepresented persons to join the proceeding. On this aspect, he submitted:[397]

> … the Court would need to renotify that proposal and allow the opportunity for any new party to join. The Court would also need to allow any party the opportunity to brief and call new evidence on the effect of this new limit, including the implications of that limit on the community and on the needs of primary and secondary industry (s 212(a), RMA). Specific evidence would need to address, for example, how feasible the proposed reduction was on each of the land uses affected and when that reduction might be able to be achieved. Specific economic evidence would be called on the impact of such a limit and the resulting reduction in land use intensity that might be required. In the absence of a specific s 292/293 power for an inquiry, at this point in the process it is unclear what procedural route the Court could use to direct that process.

[860] In essence, Mr Thomsen adopted Mr Matheson's submissions on these matters.

[861] The applicants and other parties submitted that the procedures applied by the Court have not offended natural justice principles. Ms Baker-Galloway and

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396 Closing submissions on behalf of the Farming Interests, dated 13 October 2022, at [1.3](b)(i)(bb).

397 ` Closing submissions on behalf of the Farming Interests, dated 13 October 2022, at [3.20].

Ms Hill usefully summarised relevant principles as being that parties are given adequate notice and opportunity to be heard and that the decision-maker be disinterested and unbiased. In terms of those matters, they noted that the original WCO application included the proposed lower 0.40 mg/l limit. Furthermore, they point out that the applicants' s209 submission preserved a broad basis for scope, by seeking any relief needed to ensure values are protected. Finally, they submit that those directly affected have had the opportunity to engage in this process since public notification in 2015, and the most directly affected parties are appellants (s209 submitters) in this hearing.[398]

Natural justice principles are not offended

[862] In our summary of the parties' submissions on these matters, we have not traversed one important aspect of Mr Matheson's case, namely that upholding the Tribunal's recommended limit of 0.44 mg/l would not fail to uphold the s199 purposes of a WCO. His argument was from the premise that the waters would continue to qualify given they and their values are outstanding notwithstanding that the current median state of NO_3-N in the waters is 0.44 mg/l.[399] We refer to our earlier discussion on why we do not accept that submission.

[863] Rather, on the basis of our findings in Part 2, we find that a reduction from that NO_3-N current state is necessary to uphold the purposes in s199.

[864] On the appropriate NO_3-N limit, it is correct to observe that the applicants' s209 submission sought that a limit of 0.44 mg/l be maintained. However, read in its immediate and procedural context, this aspect of the submission was not in the nature of prescribing relief. Nor was it realistically to the effect of not referring that aspect of the Tribunal's Report to the Court for inquiry. Nor can it realistically be treated as disarming other parties. Properly informing themselves of the RMA's WCO inquiry parameters for the Court, all parties ought to have remained alert to

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398 Closing submissions for the applicants, dated 20 October 2022, at [38].
399 Closing submissions on behalf of the Farming Interests, dated 13 October 2022, at [3.18].

the potential for a more stringent limit to ultimately be recommended by the Court.

[865] Even as recommended by the Tribunal, the NO_3-N limit cannot be treated in isolation from associated restrictions on the exercise of powers under s30(1)(e) and (f). Explicitly, the applicants' submission seeks that those associated restrictions be revisited. Furthermore, that is in the context of seeking a range of other inter-related changes to the WCO so as to better preserve natural state and protect recognised outstanding values (which the applicants sought be expanded and modified). An important aspect of what the applicant pursued in its submission pertains to better recognition of the tikanga Māori significance of the waters and better monitoring and protection of its cultural health. Those aspects cannot realistically be treated as unrelated to the effective control of all sources of risk to those values, including from NO_3-N.

[866] The applicants' submission is properly read in a context of the characteristics of an Environment Court inquiry that all parties can be expected to be cognisant of. An aspect of this is that, unlike a notice of appeal, a s209 submission is not required to nominate relief. The only relevant specification is that a submission can be either on the whole or a part of a Tribunal's report. The applicants' submission was on the whole Report. As such, it initiated an inquiry into the entire Report.

[867] In terms of the scope of the inquiry, nor is s212 on matters for consideration confined to what submissions say. It extends also to the original WCO application, in which the applicants pursued a more stringent limit. It encompasses the NPSFM. We point out that the applicants' submission expressly seeks that the WCO is consistent with that instrument. Our recommended restrictions are designed to be consistent with the NPSFM baseline date. It encompasses the needs of primary and secondary industry, and of the community. Explicitly, therefore, notification of the inquiry enabled opportunity for those with such needs to join as parties to present what they considered appropriate for the consideration of the Court in the inquiry. The applicants' submission ought not

realistically to have disarmed potentially interested persons from doing so, given the expressly broader scope of matters for consideration in the inquiry. Moreover, as noted, all those matters are subject to the overarching requirement that the Court consider the purpose of a WCO and other matters in s199.

[868] The notification of an inquiry allowed opportunity, unconstrained by the submission made by the applicant, for those interested to engage on all matters of relevance for the Court to consider in order to inform the Court in its recommendation in this report.

[869] Furthermore, nor is it realistic to characterise the applicants' evidence in chief and rebuttal as disarming parties from putting their own position on an appropriate NO_3-N limit. The pre-filed evidence simply did not allow for the Court to make any safe recommendation with regard to what NO_3-N restrictions would be required in the WCO to fulfil the s199 purposes. We add that the evidence before us revealed that the Tribunal's recommended limits were not soundly based. For example, they were framed on the misunderstanding that NO_3-N concentrations reduce as they are transported through the WAMA whereas the evidence before us demonstrated that they increase.

[870] Therefore, the Court made directions for several rounds of expert conferencing following which the evidence, including in JWS, was carefully tested (including by Court questioning). Specifically, in regard to the evidence on NO_3-N, those directions encompassed several matters relevant to reaching informed findings on limits. This included modelled loadings and anticipated sources and the risks it posed for the recognised outstanding values of the subject waters.

[871] The Court also actively engaged with counsel and representatives on these matters as to the need to remediate and supplement the evidence parties tendered in these matters. For example:

(a) on 29 April 2022, the Court issued a Minute noting the voluminous evidence then before us and that the proceeding was an inquiry for a specific purpose of informing the Court's recommendation on the substance of any WCO and directing that parties confer and file a joint memorandum on the key disputed issues;

(b) on 5 May 2022, by joint memorandum, the parties recorded, as one of the disputed matters, "how the requirement to protect water quality and clarity" should be expressed and "how granting of consents and future regional plan rules will be limited by the identification of limits" in the WCO. Accepting that the parties, at that stage, indicated their preferences for less restrictive limits, the Court also communicated that it was not satisfied that the evidence filed, including in rebuttal, would provide a sound basis for the Court's required findings;

(c) the Court explained its intentions concerning expert conferencing both in open court and by Minute. For example, the transcript records the following indication given by the Court just prior to one adjournment to allow for further conferencing:[400]

> … one of the things I feel is missing is information on land use in the catchment and the issue that concerns me is that different land uses produce different quantities of nitrogen and to me it's a fundamental requirement for effectiveness catchment management …
>
> The other thing that is very important to decision making on this case is what land use changes have occurred that might be indicating when nitrate started moving …
>
> And then the next logical step then is for experts to look at the different areas of land and put a very broad indication of what sort of nitrate losses would be expected from each of those …

[872] It was in light of all that supplementary evidence having been received and all evidence being tested that the Court gave its preliminary indication to parties

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400 Transcript, 25 May to 1 July 2023, pp 4-5.

that a limit in the order of 0.40 mg/l – 0.41 mg/l.[401] In particular, on behalf of the Court, Commissioner Hodges then observed:[402]

> Nitrate limit in the Main Spring
>
> We consider that:
>
> (a) the upper limit that could be considered if Te Waikoropupū is to be preserved and protected is the current state, which the experts agree is 0.45 mg/l nitrate nitrogen (NO_3-N); and
>
> (b) the lower limit that can be considered is the current state in 2017, being the date the Minister referred the application for a WCO to a Special Tribunal, and the date of 7 September 2017 being the "best state" as required by s 1.4 of the NPSFM 2020. We have assumed for present purposes that the limit should be 0.41 mg/l.
>
> Our preliminary view is that the limit should be 0.41 mg/l because of certain matters I now summarise:
>
> (a) one is the need to preserve and protect Te Waikoropupu, acknowledged by all parties to be a taonga, in circumstances where there is a high level of uncertainty about the level of NO_3-N concentrations which might "tip the balance" from the current ecological state to one where adverse effects could start to occur;
>
> (b) a second is the consequent need to adopt a precautionary approach, particularly where there is added uncertainty about the potential for increased effects to occur as a result of climate change; and
>
> (c) a third matter is that this limit would represent the best state as required by clause 1.4 of the NPSFM 2020.
>
> Compliance
>
> Our current expectation is that a two-stage NO_3-N compliance limit approach based on monthly sampling of the Main Spring will be adopted as follows:
>
> (a) an early warning limit based on 95th percentile values with details yet to be finalised; and

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401 During the hearing, Commissioner Hodges indicated his thinking was in the order of 0.41 mg/l; and a follow up Minute indicated the lower figure.

402 Transcript, p 1086, l 26 – p 1087, l 28.

(b) a not to be exceeded five-year running median limit of 0.41 mg/l, which will require confirmation by way of statistical testing and other review processes.

As His Honour has signalled, details of the form of review and statistical testing will be finalised following in light of directed further conferencing and in light of legal submissions. It would assist if agreed methods could be recommended to the Court.

[873] The Court continued active engagement with the parties about these matters to assist their preparation for the October 2022 hearing. To assist parties at that stage, the Court issued a Minute attaching a progress draft WCO based on the Court's consideration of the evidence to that point and inviting submissions. That preliminary draft WCO updated the Court's preliminary observations recorded in the above-noted transcript extract by specifying a 1 July 2035 limit for NO_3-N of 0.40 mg/l.

[874] In addition, the Court remained actively engaged with parties on all aspects of the inquiry procedure including timetabling of the calling of all evidence. The Court communicated with parties at various stages of the inquiry about matters of procedure.

[875] All parties were readily able to have sought further procedural directions during the Court's lengthy inquiry, including as to the calling of supplementary evidence.

[876] Therefore, we do not accept that a recommendation for a set of more stringent NO_3-N restrictions than recommended by the Tribunal (including as to a limit) would be contrary to principles of natural justice insofar as the Farming Interests are concerned.

[877] For similar reasons, nor do we accept the assertion that there is any natural justice impediment to doing so in regard to persons who are not represented before the Court. The Tribunal's Report was published, as the RMA requires. The

Court's inquiry is significantly a matter within the public domain, with its proceedings being a matter of significant media interest. The inquiry has at all times been public, including in special arrangements instituted by the Court for it to be available by live-feed. The RMA makes provision for persons who are not s209 submitters to seek to join an inquiry through s274. Some have taken up that opportunity.