IN THE MATTER **of the Resource Management Act 1991**

AND

IN THE MATTER **of the hearing of submissions on Proposed Plan Change 1 (and Variation 1) to the Waikato Regional Plan**

TOPIC 1

BY **FEDERATED FARMERS OF NEW ZEALAND INC, FEDERATED FARMERS OF NEW ZEALAND (WAIKATO REGION) 1999 INCORPORATED, FEDERATED FARMERS OF NEW ZEALAND – ROTORUA TAUPO PROVINCE INCORPORATED, FEDERATED FARMERS OF NEW ZEALAND (AUCKLAND PROVINCE) INCORPORATED**

("FEDERATED FARMERS")

Submitter with ID: 74191

To **WAIKATO REGIONAL COUNCIL**

STATEMENT OF PRIMARY EVIDENCE OF PAUL FREDERICK LE MIERE FOR FEDERATED FARMERS ON HEARING TOPIC 1

15 February 2019

FEDERATED FARMERS OF NEW ZEALAND

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EXECUTIVE SUMMARY

1. Objective 1's long term direction and Objective 3's short term direction should be the desired outcome of the Vision and Strategy and identified values rather than numeric targets.

2. NPS-FM intended to allow water quality movement as long as it remains within a NOF band (unless it is below a national bottom line) and similar movement within a band is appropriate for PC1.

3. There are several problems with monitoring and the reporting which will constraint the development of PC1 and hamper informed decision making. PC1 and future plans will require more robust data to support efficient and effective interventions.

4. The use of lake rather than rivers attribute bands for the Waikato river distorts the current state of chlorophyll and consequentially also impacts on N and P because of its relation with them as secondary attributes when clarity is considered.

5. N is lowest in a hierarchy of things that influence clarity and values of PC1.

6. The best data currently to hand indicates that the nitrogen load to come is discernible only in the decimal points, that it is unlikely to materially impact chlorophyll levels.

7. FFNZs alternative proposal does address N and the N load to come but in proportion to the effects of N on the values and desired outcomes anticipated in the Vision & Strategy because of N's place in the hierarchy of causes of water quality issues. FFNZ considers its interventions by reductions to the 75th percentile and FEPs, amongst others, will address N (and the load to come) more than sufficiently while PC1 has an overemphasis on N controls and a one size fits all approach.

8. My analysis of the (available) current state data to 2016 (for rivers) indicates that around half the rivers may currently meet the ten year river targets and of the balance most need only modest improvements to meet the ten year targets.

9. In respect of trends in the river, my analysis of available Regional Council data indicates that most sites currently show only slight or no trends. Where trends are evident, significantly more sites show improving rather than deteriorating trends in the ten year period from 2008-2017.

10. In respect of groundwater, the most dependable data shows more improvements trends in Nitrate than deteriorating trends.

11. In my opinion, the available data indicates that the collective investments from all sectors – urban and rural – over recent years means the trajectory towards the ten year targets is well underway.

12. PC1 will deliver much greater than 10% reductions in N, P, Sediment and *E.Coli* which is the short term targets.

13. It is not helpful for the S42A report in response to a submitter's concerns to say that the CSG would have considered the matter and therefore the CSGs decision stands. If the CSG decision cannot be justified or there are better way or solutions to give effect to the RMA and Vision & Strategy then the CSG decision should not be followed.

14. The projected economic impact of PC1 on the individual landowners, and the regional and national economy is going to be enormous and I consider it may even be an underestimation of the hardship.

15. In the last paragraphs I reason why alternative approaches to reductions should not be summarily dismissed based on the thought that any reductions in losses for whatever reason would inevitably mean that reductions in losses in other areas need to be even greater.

INTRODUCTION

16. My full name is Paul Frederick le Miere. I am the North Island Regional Policy Manager at Federated Farmers.

17. I am giving evidence on behalf of Federated Farmers (**FFNZ**) about the Collaborative Stakeholder Group (**CSG**) process, water quality trends and states, NPS-FM and FFNZ's policy arguments and perspective on the issues raised in the Topic 1 hearing of the Proposed Plan Change 1 (and Variation 1) (**PC1**) to the Waikato Regional Plan.

18. In this statement, where I refer to FFNZ's submissions I am referring to FFNZ's submission on Variation 1 unless I specifically state otherwise.

Qualifications and experience

19. I have a first class BSc Hons and PhD from the University of Reading, UK in crop science. Before starting at Federated Farmers I was the Director of Environmental Management and Rural Economy for the States of Jersey (Jersey Government). I was responsible for policy development and implementation within the agricultural

sector for areas such as subsidies, rural economic development, environmental stewardship schemes and environmental compliance.

20. Since 2008, I have worked at Federated Farmers as the North Island Regional Policy Manager. I manage a team of ten senior regional policy advisors, a GIS analysis and a policy coordinator. My role involves work across the RMA field, particularly water quality and water quantity issues (within Federated Farmers I lead our freshwater team).

21. During my time at Federated Farmers, I have been directly involved in numerous water related plan changes in various regions including:

    a. Waikato Regional Council's Variation 6 (water takes).

    b. Horizon's One Plan (water quality).

    c. Hawkes Bay's Tukituki Plan Change 6 (water quality).

    d. Greater Wellington Regional Council's Proposed Natural Resources Plan (which adopted rules for water quality and quantity).

    e. Gisborne District Council's Proposed Regional Freshwater Plan (which adopted rules for water quality and quantity).

    f. Bay of Plenty Regional Council's Plan Change 10 (I am giving evidence in the Environment Court hearing scheduled to begin in March 2019. It relates to nitrogen allocation in the Lake Rotorua groundwater catchment).

    g. PC1.

22. I have also been involved in water issues at a national level. This includes participating in the Land and Water Forum (**LAWF**) as the Federated Farmers' staff representative, as time has allowed.

23. LAWF was formed in 2009 in response to increasing dissatisfaction with the adversarial approach used under the RMA. The forum has provided numerous reports and they have all placed a heavy emphasis on the importance of all parties with interests in water working together to try to find solutions based on consensus.

24. I was directly involved during the first phase of work (from 2009 to 2012 when the first three reports were issued), until LAWF took a break. When LAWF reconvened in 2015 I chaired a LAWF working group on nutrient allocation. We produced a report for consideration by LAWF whose recommendations went into the fourth LAWF report

dated 27 November 2015. The finding of that report was that there was no optimum way of allocating nutrients.

25. My involvement in the phase of work from 2016 to 2018 has primarily been to support our policy advisor and Board member directly involved, although I have attended the odd meeting.

26. LAWF provided its last report in May 2018 and is currently awaiting the Government's response to that report. I was directly involved in the team within Federated Farmers which reviewed the draft of that report and provided feedback to the representatives we had on LAWF.

27. I was also a member of the Land and Water Partnership (**Partnership**). The Partnership was separate from LAWF and was a group of major primary sector organisations who came together to develop a collective action plan to ensure the sustainable use of freshwater resources by the primary sector.

28. In 2014, the Partnership engaged Jacobs to provide an analysis of six different nitrogen allocation options for the Tukituki, Selwyn Waihora and Rotorua catchments.

Federated Farmers

29. Federated Farmers is a not for profit, member funded organisation. It has a long and proud history of representing the needs and interests of New Zealand farmers involved in a range of rural businesses (dairy, drystock, arable cropping and horticulture). Federated Farmers is a pan sector organisation that works with farmers to ensure practical and workable outcomes.

30. Federated Farmers of New Zealand is the national body or umbrella body and is governed by a board of seven members (including a president) who are elected by the Federated Farmers' provinces at national council. Federated Farmers (**FFNZ**) has 24 provinces, with each one being a separate incorporated society and electing its own president and executive members. FFNZ also has industry groups (dairy, drystock and arable) with representatives elected by the provinces.

31. FFNZ employs the policy, technical, membership, support and other staff, and has the largest policy team outside of Government. We also pride ourselves in being New Zealand's largest independent advocacy organisation.

32. We separate our policy work into regional (covering all of the regional and district councils in New Zealand), national (covering policy happening at a Government or national level) and industry (cover policy happening at a Government or national level

that just impacts on a specific industry e.g. dairy). Alongside me, there are managers for South Island Regional Policy, Industry Policy and National Policy.

33. FFNZ aims to add value to its members' farming businesses. Its key strategic outcomes include the need for New Zealand to provide an economic and social environment within which:

    a. FFNZ's members may operate their business in a fair and flexible commercial environment;

    b. FFNZ's members, their families and their staff have access to services essential to the needs of the rural community; and

    c. FFNZ's members adopt responsible management and environmental practices.

Code of conduct for expert

34. I confirm that I have read the Environment Court's Code of Conduct for Expert Witnesses as set out in the Environment Court's Practice Note 2014, and I agree to comply with it.

35. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise, except where I state I am relying on the evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Scope of evidence

36. This evidence relates to Hearing Topic 1 and includes:

    a. Discussing National Objectives Framework in the NPS -FM including maintaining within a band;

    b. Analysing the water quality state and trends in Waikato and Waipa rivers and the science;

    c. Comment on PC1 provisions delivery on the short term targets.

    d. Comment on the Collaborative Stakeholders Group;

    e. Comment on the economic and social impact of PC1;

    f. Comment on a S42A report remarks on alternative approaches.

NATIONAL OBJECTIVE FRAMEWORK

37. The Regional Council used the process set out in NPS-FM to set the values, attribute states, objectives, limits and targets of PC1. I have been involved with the LAWF and consider it may be useful to explain to the Hearing Panel some background to the national policy statement and the workings of NOF especially the relationship between values, attributes, freshwater objectives and limits in NOF.

38. PC1 uses the iterative process described in the NPS-FM to identify values, assign attributes, set targets and limits. FFNZ considers that PC1's policies fail to then follow through and apply them as intended in the NPS-FM. The relationship between values, attributes, freshwater objectives and limits are referred to in Policy CA2 of the NPS-FM. I discuss briefly below how I understand Policy CA2 to work.

39. Every Regional Council through discussions with communities, including tangata whenua, need to:

    a. Identify **values** of each FMU[1]. Values are what people appreciate about the freshwater bodies like natural form and character or its uses like irrigation. The identified values are the drivers of the NPS-FM process and the core of what PC1 wish to achieve.

    b. The values are used to identify and assign an **attribute** that are applicable to the values (provided in the NPS-FM). An attribute is the measurable characteristics of the freshwater which supports or effects the particular value. For example, *E.coli* and cyanobacteria concentrations are important factors affecting the chance of a person getting sick after contact with water, so these are attributes of the 'human health for recreation' value. The attributes were selected on the advice of specialist science panels.

    c. An **attribute state** represents different levels of water quality for a particular attribute. Each attribute state is defined by a numeric range (bands) and a description that corresponds to a scientifically determined range of effects. For instance the 'A-state' indicates high or excellent water quality, and 'D' indicates unacceptably low or poor water quality which is insufficient to provide for the value. National Objective Reference Group took careful advice from National Objective Technical Group and set the attribute state bands at points of ecological change.

[1] FMU or Freshwater Management Unit is the management unit in which freshwater is managed. A regional council has to determine the appropriate spatial scale of the FMU.

d. Using the attributes a council then has to formulate **freshwater objectives** which provides for the values. A freshwater objective describes an intended environmental outcome in a FMU. It is the level the region wants each attribute to reach in the future which correspondence with the values. Freshwater objectives should be set at least within the same attribute state as the existing water quality or better. A Regional Council will need to consider when setting the freshwater objectives the limits what would be required to achieve the freshwater objectives.[2]

e. A **limit** is not a freshwater objective although there is a relationship because it is a tool to achieve the freshwater objective. I will refer to the importance of this distinction below. A limit is "the maximum amount of resource use available, which allows a freshwater objective to be met". A limit links the freshwater objective (the desired state) to use of the freshwater resource. A limit puts constraints on how much of that resource is available for use.

f. A **target** is another tool to achieve freshwater objectives. A series of targets can make up part of a staged work programme, designed so water quality is gradually improved over time to meet the relevant freshwater objective. As noted by the TLG targets for NPS-FM can be narrative or numeric.

40. As stated earlier the NPS-FM makes a distinction between freshwater objectives and limits and targets. The focus in freshwater objectives should remain on the value – and the anticipated outcome of the Vision & Strategy not on the limits. Does the Vision & Strategy require a number like 0.03 mg NH4-N/L Ammonia to be met or rather its values ie swimmability?

41. Further keeping objectives and targets separate is also a practical way to set a hierarchy of importance of different attributes and the relationship between them. As an example if the desired state is swimmability then the focus should be on the primary attributes E.coli and clarity followed in lesser terms by the secondary attributes like P and N. Putting all these attributes as equals into Objective 1 and 3 and setting targets with equal importance will lead to a lack of focus and inefficient management to achieve the desired outcome.

42. An approach which sets targets on all measurable attributes as the objective, with apparent equal emphasis on all attributes, misses communicating a whole layer of information on the linkages between attributes and values. The value can already

[2] NPS-FM policy CA2(f)iii

be met but we still fall short of the corresponding freshwater objective (if the limit/targets are the drivers in a freshwater objective).

43. PC1 Objective 1 and 3 suffer from the lack of differentiating between setting targets and a freshwater objective.

44. FFNZ submission sought that Objective 1 and 3 be amended so that it complies with the NPS-FM definitions of freshwater objective and limits by amending the objectives to reference the desired outcomes ie "water quality outcomes anticipated by the Vision & Strategy and the values^ by 2096" rather than the targets. I consider this will comply with the NPS-FM definition of freshwater objectives and keeps the focus on the values which allows for management of the attributes in a hierarchy to achieve the desired outcome.

45. At [344] of the S42A report the reporting officer states that numerical limits and targets are needed in the objectives to send a clear signal of the likely changes that would be required and that FFNZs submission point is a weakening of the direction set by PC1. I consider the above paragraphs 37 to 44 responds to this point but the remark in the S42A report implies that PC1 is drafted to desired outcomes that exceed those anticipated by the Vision & Strategy and values^ (which is what FFNZ asked for as direction for PC1 in Objectives 1 and 3).

46. There is another reason that numeric targets for objective 1 is inappropriate. We have concern (see FFNZ's submissions at [3.8] to [3.21]) with the accuracy and reliability of the targets. Despite the regional council's best efforts the attribute states in 1863 cannot be known to the second decimal point. A TLG report[3] on water quality in 1863 accepts the difficulties to establish water quality for that date because of a lack of data and other problems. The report then state the attribute levels for 1863 in both the NPS-FM bands and numerically some to the second decimal[4]. The NOF band is arguably a better reflection of the position in 1863 more than 150 years ago as it has the inbuilt tolerance being a range.

47. FFNZ's preference is to use only narrative targets for the 80 years targets. If the Hearing Panel considers this to be inappropriate then FFNZ recommends that the attribute bands (where applicable) as described in the TLG report of the water quality in 1863 be used.

[3] WRC, Prediction of water quality within the Waikato and Waipa River Catchments in 1863 Doc # 8800097 at 2, p4
[4] Above at table 4 page 16.

48. Because of FFNZ's concerns with the water quality state and trends data[5] and other issues with setting the short term targets we consider they should be described in attributes bands. I will discuss the issues with water quality state and trends in more detail later in this statement.

49. In short FFNZ agrees with the direction of PC1 and also with objectives 1 and 3 needing to set the direction. FFNZ also agree that the objectives should be to achieve the identified values in PC1 (which is specific what FFNZs recommended amendments propose to do). Because of reasons set out above we consider the articulation of Objective 1's long term direction should be the desired outcome of the Vision and Strategy and identified values^ rather than numeric targets that are

    a. According to the NPS-FM not to be part of freshwater objectives ;

    b. which may not align with the desired outcomes; and

    c. which have uncertainty.

50. Similarly Objective 3 should not contain targets or limits rather the desired outcome should be expressed ie 10% movement towards the outcome of the Vision and Strategy and identified values.

Maintain within a band

51. I note some submission points seeks provision in PC1 that directs that "maintain" or "protect" be stated as meaning that even the smallest increase in a contaminant should not be allowed ie there is no movement allowed within a NOF band. I also note that the Reporting Officer at [132] signals that the regional council intend to amend PC1 to clarify that no individual can expect to cause an increase in losses or any of the four contaminants.

52. I consider NPS-FM intended to allow water quality movement as long as it remains within a NOF band (unless it is below a national bottom line) and that this intention will similarly apply to the Vision & Strategy. My view is supported by:

    a. The Preamble to the NPS-FM which may assist its interpretation states "This national policy statement **allows some variability in terms of freshwater quality** as long as the overall freshwater quality is maintained within a freshwater unit."

[5] Discussed in paragraphs 54 to 152

b. The Land and Water Forum recommended that "maintain" means staying within the same band and "improve" means moving to a higher band. This would allow a degree of flexibility, but preclude degradation of water quality.[6]

c. Parliamentary Commissioner for the Environment suggests that the word "overall" should be deleted from Objective A2 in the NPS-FM and "maintaining or improving" should be clarified to mean staying within the same band in NOF.[7]

d. The Cabinet paper[8] evaluated "maintain or improving overall water quality" in [89] and [90] and considered in [92] that it should be maintain within a Band. It says:

> Maintaining or improving overall water quality
>
> 89. The Freshwater NPS directs that overall water quality is to be maintained or improved across a region. Some councils and communities are now debating what "maintaining" water quality means in relation to the water quality attributes that were introduced in 2014 as part of the national objectives framework.
>
> 90. Next steps proposed two ways to address these two issues. First, that overall water quality should be maintained or improved within a freshwater management unit (usually a catchment or sub-catchment, or sometimes multi-catchment) rather than across a region. Second, **that overall water quality can be maintained or improved if a Regional Council can demonstrate that the value (e.g. 'ecosystem health') is no worse off, or that it will stay within bands (where they have been defined, e.g. the "B" band for nitrate toxicity).**
>
> 91. The Freshwater Iwi Advisors Group is opposed to maintaining water quality within a band because this could allow further degradation of water quality. The Land and Water Forum and the Parliamentary Commissioner for the Environment have both recommended the band approach.
>
> 92. We have considered the views expressed in submissions and propose to amend the Freshwater NPS as indicated in Next steps and supported by LAWF. That is:
>
> a. amend Objective A2 to replace reference to 'a region' with 'a freshwater management unit'
>
> b. where attributes are defined in the Freshwater NPS, freshwater objectives to maintain overall water quality must be set within the same attribute band as existing water quality; and
>
> c. where attributes are not defined in the Freshwater NPS, freshwater objectives to maintain overall water quality must be set so that the values identified are not worse off when compared to existing water quality.
>
> 93. There are no new impacts associated with this amendment because it does not add any new requirement, is not inconsistent with the approaches taken by regional councils to date, and provides greater certainty to communities.

e. I also consider that if the relationship between values, attributes, freshwater objectives and limits are considered then it also makes practical sense that

[6] Land and Water Forum, 2012 Second Report of the Land and Water Forum:Setting Limits for water quality and quantity, and freshwater Policy-Plan-Making Through Collaboration. P22. Rec 6.
[7] Parliamentary Commissioner for the Environment, June 2015 Managing water quality: Examining the 2014 National Policy Statement p20 recommendation 1.
[8] The Cabinet paper: "Fresh water - proposals following *Next steps",* Feb 2017

movement can be allowed within a NOF band. As stated before National Objective Reference Group took careful advice from National Objective Technical Group and set the attribute state bands at points of ecological change ie where a decline/increase will actually influence the values. There will be less than minor depreciation of values if a contaminant moves within a NOF band.

WATER QUALITY AND THE SCIENCE

53. Under this heading I discuss matters raised in heading 6 of the S42A report - water quality and ecosystem health.

Lake-fed river attributes

54. The Reporting Officer at [64] of the S42A states that, while the Waikato River is fed by more than 17,000 kilometres of tributary streams, "it is considered to be a lake-fed river". I understand the rationale relates to impoundment in the hydro dams, the effect of which is to slow down the passage of the river to the sea from a matter of days to a matter of weeks.

55. Despite the role of the dams in creating conditions conducive to the growth of chlorophyll, the Waikato River has nevertheless a substantial flow (sixth highest in New Zealand at over 300 m3/second[9]) and chlorophyll levels are low.

56. The impact of Waikato being deemed a lake fed river is principally in relation to setting chlorophyll targets. The National Objectives Framework sets out bands for river chlorophyll (bottomline 200 mg/m3), and for lake chlorophyll (bottomline 12 mg/m3). The order of magnitude difference relates to long retention times in lakes, relative to flowing rivers.

57. Current state for chlorophyll at Tuakau is only 10mg/m3, ie, A band for rivers (<50 mg/m3), but C band for lakes (>5 and <12 mg/m3). PC1 proposes that the 80 year target at Tuakau be NOF Lakes B Band (>2 and <5 mg/m3).

58. Pausing at Tuakua for a minute, FFNZ recommends that chlorophyll targets in the lower Waikato should be changed from B to C band. The real chlorophyll challenge for PC1 is the lakes, not the Waikato river.

59. I already noted that PC1 uses Lake targets. Lakes chlorophyll targets are significantly more conservative than rivers on the assumption of long residence times stimulating algal growth.

[9] Te Ara – The Encyclopaedia of New Zealand

60. Waikato mainstem does not have problematic algae. The real issue is clarity with sediment the main culprit, not chlorophyll. For the above reasons chlorophyll targets in the lower Waikato should be changed from B to C band (if lakes targets are used - A band if river targets are used).

61. As stated before, the consequence of the chlorophyll targets is mainly in relation to the proposed nutrient limits – principally phosphorus and to a lesser extent nitrogen. Chlorophyll influences clarity to a lessor extent and its secondary attributes include nutrients - principally phosphorus and to a lesser extent, nitrogen.

62. In short the use of attribute bands for lake-fed rivers distorts the current state of chlorophyll and consequentially also impacts on N and P because of its relation with them as secondary attributes when clarity is considered. I expand on this below.

Overview of the four contaminants

63. This section of the s42A report presents high level descriptors of sediment, nutrients and microbes, and their potential effects. It is more relevant to discuss these attributes as they impact on Waikato values, supported by consideration of the region-specific context, and their relative importance.

64. A key value driving the PC1 framework is swimming because of the importance given to it in the Vision & Strategy. In this context, the primary (human health) attribute is microbes (E coli), followed by clarity.

65. In respect of clarity, it is my understanding that lower water clarity in the lower Waikato is principally influenced by sediment.[10] I attach at **PLM1** graphs that illustrates that the major influence on clarity at Tuakau is sediment (around two-thirds, with the Waipa catchment being a major contributor); while the minor influence is chlorophyll (around one-third, of which perhaps one-third comes from the large, shallow lakes on the lower flood plain).[11]

66. It is further my understanding that certain fine clay particles within the Waipa catchment disproportionately influence clarity, and that these localised areas "*are therefore a priority for soil conservation and riparian mitigations, out of proportion to their mass load contribution*"[12].

67. To the (lesser) extent that chlorophyll influences clarity, secondary attributes include nutrients - principally phosphorus and to a lesser extent, nitrogen. I attach marked

[10] WRC, 2015, Visual clarity of the Waikato and Waipa rivers, Figure 6
[11] The graphs is from WRC, Visual clarity of the Waikato and Waipa Rivers 2015 Report
[12] WRC, 2015, Visual clarity of the Waikato and Waipa rivers, page 16

PLM2 the TLG information sheet which concludes that "*phosphorus affects the annual median amount of floating algae in the Waikato River more that nitrogen does (and) efforts to control algae should focus most on controlling phosphorus (with) a secondary focus on nitrogen*".

68. In short N is lowest in a hierarchy of things that influence clarity and values of PC1.

Nitrogen Load to come

69. FFNZ considers that PC1 overestimates the importance of the Nitrogen load to come.

70. In regard to the Nitrogen load to come, the reporting officer at [88] of the S42A report states that '*once in groundwater, nitrate is very difficult to remove, with lag times up to 80 years before re-entering surface water".* This statement neglects to acknowledge different groundwater conditions which may attenuate (reduce) nitrate concentrations in groundwater. Work commissioned for PC1 in fact estimates that "*nitrate rich groundwater is likely to encounter reducing conditions in about 50% of the catchment area*" [13]. Attached marked **PLM3** (Figure 1) illustrates the variable reducing conditions across the catchment.

71. In respect of the size of the nitrate load to come, it is currently my understanding that modelled estimates for PC1 assess the load to come as relatively small increases at a number of sites in Upper Waikato.

72. The PC1 Simulation Report[14] identifies four sites which do not achieve 10% improvements, principally because the model assumes the full load to come is expressed within the ten year period.

Table 7 in the Simulation report quantifies the estimated load to come for these four sites (Attached and marked **PLM4**):

Site-attribute	Current state	Load to come	Current + LTC
Waikato @ Ohakuri - TN	0.215	0.07	0.281
Waikato @ Waipapa - TN	0.336	0.09	0.422
Waikato @ Whakamaru - TN	0.271	0.08	0.354

[13] TLG, November 2015, Prediction of sub-surface redox status
[14] TLG, 2016, Simulation of the proposed policy mix for the Healthy Rivers Wai Ora process, Table 7

Waipapa – median nitrate	1.21	0.56	1.77
Waipapa – 95th% nitrate	1.555	0.72	2.27

73. I point out that the load to come estimates are in the decimal points. To put this in the perspective of NOF bands for river nitrate: the mainstem sites are at the upper end of the A Band (with and without the load to come); and Waipapa is in the B Band (with or without load to come). I attach and mark **PLM 5** my graphic to illustrates this point.

74. In my opinion, this begs the question as to the practical implications of the nitrogen load to come. Importantly, the Technical Leaders Group (TLG) suggested (see **PLM4** page 32): "*The material implications for ecosystems of these observed breaches are arguably limited. The main implication of Total Nitrogen as a measure of water quality is its contribution to algal growth. Despite breaches being evident for TN in the Upper Waikato (Table 7), targets for chlorophyll are achieved in all scenarios. The improvement in chlorophyll in all scenarios reinforces the importance of phosphorus as the key nutrient that currently limits algal growth in the lakes of the Waikato River".*

75. It is relevant to note that the TLG went on to recommend further work to "better evaluate the load to come and the time trajectory of responses to interventions"[15].

76. Further to this, it is my understanding that work is currently underway (funded by MBIE, supported by WRC and DairyNZ), in two Waikato catchments (Waiotapu, Piako) to address this recommendation.[16] Find a copy attached and marked **PLM6**.

77. The work programme proposes, *inter alia,* that models commonly used in NZ focus on deeper, regional groundwater systems that discharge into rivers, rather than local systems which feed at sub-catchment scale into streams: "*accordingly, these models over-estimate lag times".*

78. Accepting that this research is work in progress, it is premature to speculate on the results. The key point however, is that the best data currently to hand indicates that the nitrogen load to come is discernible only in the decimal points, that it is unlikely

[15] TLG, November 2015, Estimation of lag time of water and nitrate flow through the vadose zone
[16] MBIE Critical Pathways Project: Unravelling sub-catchment scale nitrogen delivery to waterways

to materially impact chlorophyll levels, and that WRC are currently supporting a work programme to finetune the uncertainties.

79. FFNZs alternative proposal does address N and the N load to come but in proportion to the effects of N on the values and desired outcomes anticipated in the Vision & Strategy because of N's place in the hierarchy of causes of water quality issues. FFNZ considers its interventions by reductions to the 75th percentile and FEPs, amongst others, will address N (and the load to come) more than sufficiently while PC1 has an overemphasis on N controls and a one size fits all approach.

Monitoring and reporting problems

80. I agree with the reporting officer at [83] of the S42A report that the Regional Council river water quality monitoring programme has been "*relatively consistent since 1993*" but in my view, the current Regional Council monitoring and reporting programme is ill-aligned to the PC1 limits and management framework. I note at [89] of the S42A report that the Regional Council intend to review and update its monitoring programme. Nevertheless, this is of little assistance for the PC1 hearing. The problems are:

a. lack of monitoring data: Only 62 of the 74 sub-catchments have monitoring sites with PC1 targets. In respect of lakes, none of the four dune lakes are monitored, only four of the fifteen riverine lakes are monitored, and only eight of 35 peat lakes are currently monitored.

b. lack of reporting against PC1 attributes: PC1 presents limits/targets for ten attributes. Of these ten, data is available for only six attributes. The remaining four attributes (maximum chlorophyll, maximum ammonia, 95th% nitrate, 95th percentile E. coli) are not included in the latest state and trend reports published by Regional Council in 2017/2018; and I am not currently aware of any other mechanism in place for reporting current state or progress against these four attributes.

c. Timeliness of reporting: To my knowledge the most recent Regional Council's state and trend reports rely on data up to 2013 only in the case of groundwater quality[17], up to 2016 only in the case of river water quality state[18] [19], and up to 2017 only in respect of river water quality trends.[20] Where is the further five years

[17] WRC, 2014, Groundwater quality monitoring 2012-13
[18] WRC, 2017, Waikato River water quality monitoring programme – data report 2016
[19] WRC, 2018, Regional Rivers water quality monitoring programme – data report 2016
[20] WRC, 2018, Trends in River Water Quality in the Waikato Region, 1993-2017

of groundwater data and two years of river data? The Waikato region will be best served if the PC1 hearing is informed by the best data available and the Regional Council are in possession of monitoring data to the end of 2018. At minimum, five year medians to the end of 2017 should be available; and preferably, five year medians and trends – for all PC1 attributes - to end 2018.

d. A fourth issue is consistency of metrics. For example, PC1 proposes limits for nitrate and Regional Council trends are analysed for nitrate. However, Regional Council state reports present data only for "nitrate/nitrite" and Regional Council data loaded to the LAWA website[21] is presented only for "total oxidised nitrogen", ie, each a slightly different variation on the theme.

   In a context where limits are proposed, sometimes to the third decimal point, it is important that reporting metrics be appropriately aligned.

   Another aspect of consistent metrics is the measurement units. For example, PC1 presents attributes for mainstem Waikato as "milligrams" per cubic metre. By contrast, the latest Regional Council state report presents data as "grams" per cubic metre, ie, each value requires conversion to the PC1 metric in order to understand current state relative to the target.

81. In relation to PC1 modelling, I do not agree that data availability was not a constraint as this has been noted as an issue in many of the Regional Council's reports. For example:

   a. the PC1 Simulation report[22] acknowledges "*the scarcity of data related to many relationships represented in the model".*

   b. In respect of E.coli, the TLG advised[23] that "*there is substantial uncertainty in the model which reflects the difficulty in determining E.coli loads…complex modelling is not possible at this point in time as the input data is not available and the detailed dynamics of E coli generation and transport are not well understood*".

   c. In respect of sediment, NIWA reported that *"there is a dearth of information on bank erosion rates…determining the proportional contribution of bank erosion may require long term monitoring of flow and suspended sediment, in*

[21] Land and Water Aotearoa
[22] TLG, 2016, Simulation of the proposed policy mix for the Healthy Rivers Wai Ora process, page 6
[23] TLG, November 2015, Modelling E coli in Waikato and Waipa Catchments

combination with field measurements and sediment finger-printing approaches"[24]

82. There are several problems with monitoring and the reporting which will constraint the development of PC1 and hamper informed decision making. Indeed, it is my understanding that the need to improve base data and our understanding of hydrological pathways and cause-effect relationships is central to positioning PC1 as the first step, pending more robust data to support efficient and effective interventions.

State and trends

River States

83. Water quality varies across the Waikato and Waipa catchments. The s32 report (A.1.4.4) summarises a "mixed picture" relating to state and trends in sediment, nutrients and E. coli.

84. I consider that the "dumbing down" of state and trend data to simple polarisations (good/poor, smiley face/glum face) is insufficient to establish the context for evaluation of the efficiency and effectiveness of PC1 provisions.[25]

85. The critical test for PC1 is the extent to which sites currently meet or do not meet the ten year targets. The s42A report makes no statements on this point.

86. I assume that the reporting officer may be relying on the s32 report (D.4.1, Appendix One) which presents – for each site and attribute – the current state and whether maintenance or improvement is required to meet the 80 year targets. Again however, it is a significant omission that no analysis is presented relative to the 10 year targets. PC1s rules are predominantly concerned with achieving the short term 10 year targets.

87. Importantly also, the s32 report presents "current state" only up to 2014 (five year medians 2010-2014),ie, this data is now 4 years out of date.

88. In my opinion, as noted above, the PC1 hearing should be informed by the most recent data available. Failing that, the most recent Regional Council state and trend reports do at least present data through to 2016 (five year medians 2012-2016).

89. I have assessed this more recent "current state" data against the PC1 10 year targets, albeit, as noted earlier, I am only able to make this assessment for some

[24] NIWA, 2015, Waikato River suspended sediment – loads, sources and sinks
[25] S42A Report at [90] and [95]

PC1 attributes. This was not a trivial task. Current state information is spread across two reports (Waikato mainstem, plus Waipa/tributaries); both reports cover the whole region, necessitating manual extraction of PC1 sites; and both reports are structured by "areas' rather than by FMU, again necessitating manual extraction and re-assembly into the PC1 FMU framework.

90. The primary value driving the PC1 targets is swimming, in support of which the primary attributes are E coli and clarity.

91. I am unable to provide an update for E coli as the Regional Council does not report the 95th percentiles.

92. The s42A report does not present any comprehensive analysis of E coli state, except to note (para 92) that: "*From 2012-2017, 85% of the Waipa (5 sites) and 86% of the Lower Waikato River (5 sites) water samples were unsatisfactory for swimming*". Perhaps by implication, most of the Mid and Upper Waikato sites were satisfactory for swimming, but no comment is made, and no reference is provided.

93. In respect of clarity, my assessment of current state (to 2016) is that around 60% of sites currently meet the 10 year targets (32 out of 53 sites with 2016 data):

Clarity	**Upper**	**Mid**	**Lower**	**Waipa**	**Total**
No of sites with 2016 data	17	9	15	12	53
No of sites meeting 10 year targets	11	6	7	8	32

99. The mainstem Waikato River sites all meet the ten year clarity targets, bar Waikato @ Ohakuri Tailrace. However, the current state may actually also meet the target. The s32 report says the current state is 3.4m while the latest Regional Council report shows 2.4m. If the latest report is taken then Waikato@Ohakuri Tailrace meets the target.

100. For those sites which do not currently meet the ten year targets, the gap is relatively modest. For example, at Waipa @ SH3 Otorohanga, current state is clarity 1.1m, relative to the target 1.2m.

101. Some sites, in particular the smaller soft-bottom tributary streams, do not currently meet the 10 year targets, and are well short of the 80 year targets for clarity for

swimming (minimum 1 metre), and likewise well short of the 80 year targets for E. coli for swimming (minimum 540).

102. Acknowledging the challenge, it is important that policy makers and catchment landowners understand the size and shape of the "gap" in each sub-catchment, preliminary to assessing the efficiency and effectiveness of provisions for meeting the ten year targets in the first instance.

103. To assist in this, I have identified the "worst" sites, relative to the swimming attributes (E coli, clarity) and reviewed individual site details on the LAWA website (Land and Water Aotearoa).

104. LAWA website for five sites shows:

- The worst site for clarity is Komakorau/Lower Waikato (current 0.1m). This site also features in the top three "worst' sites for ammonia.
- The worst site for E coli, by an order of magnitude, is Mangakotukutuku /Mid Waikato (95th% E coli 12,600); followed by Mangapiko/Waipa (95th% E coli 7,800).
- Three sites feature in the top ten "worst' sites for both clarity and E coli: Waitawhiriwhiri/Mid Waikato, Mangawara/Lower Waikato and Matahuru/Lower Waikato.

105. The LAWA data shows most of these sites exhibit marked seasonal patterns on clarity – higher clarity in summer, lower in winter. For *E.coli,* most sites show relatively infrequent but dramatic spikes. Accordingly, some of these sites may be achieving or close to achieving the swimming targets in summer but not in winter.

106. In my opinion, one key implication arising is the importance of Regional Council providing data to sub-catchment communities in something much closer to real-time - as distinct from reading about a spike a year or more after the event - to appropriately inform understanding and action.

107. The LAWA data also shows that some of the worst sites in the catchment are mixed urban/rural landuses. For example, Mangakotukutuku is visibly located in an urban area; and it is my understanding that the Mangapiko monitoring site (which I understand may have the highest N and P levels in the Waipa catchment) is located downstream of Te Awamutu and a dairy factory and waste water point source discharges.

108. In my opinion, the key implication arising is for integrated catchment management, appropriately informed by sub-catchment specific understanding of contributing sources.

109. A further implication arising is the importance of tools to help identify the sources of spikes, against the risk that PC1 provisions are not well targeted to the key contributors.

110. For example, Mangaone Stream is a mixed urban/dairy catchment with elevated *E. coli* – relatively low under base flow but much higher after heavy rainfall (spikes from 2,000 to 24,000). Notwithstanding the predominant landuses, in 2015 an ESR report identified wildfowl as a key contributor to *E.Coli* levels, both at baseflow and after heavy rain. In other streams, ruminant or human sources may predominate - the key point is utilising source tracking tools to help prioritise targeted interventions.[26]

111. Turning now to the secondary attributes, current state data is available for median ammonia and median nitrate. In respect of nitrate, my assessment of current state (to 2016) is that over 50% currently meet the 10 year targets (31 out of 59 sites with 2016 data):

Nitrate	**Upper**	**Mid**	**Lower**	**Waipa**	**Total**
No of sites with 2016 data	20	9	17	13	59
No of sites meeting 10 year targets	9	7	7	8	31

112. The top three 'worst" sites for nitrate are Whakapipi/Lower, Mangamingi/Upper, and Mangaone/Mid. Notably, all three catchments have mixed urban/rural landuses.

113. The top three "worst" sites for ammonia are Waiotapu/Upper (geothermal), Waitawhiriwhiri/Mid (also in the top ten "worst" for clarity and E coli), and Komakorou/Lower (lowest on clarity).

114. In summary: my analysis of the (available) current state data to 2016 indicates that around half may currently meet the ten year river targets and of the balance:

[26] The Institute of Environmental Science and Research Limited (**ESR**), 2015, Sources of faecal pollution in selected Waikato rivers, section 4.3

a. Most need only modest improvements to meet the 10 year targets;

b. And a tiny group of smaller (often soft-bottom) streams are at the bottom of the leader board; often on multiple rather than single attributes; and often located within mixed urban/rural catchments.

River Trends

115. I do not agree with the S42A Report at [90] that "trend data generally show that water quality is declining". In my opinion, this statement is not supported by the data presented in the most recent Regional Council region-wide trends report[27].

116. In my opinion, it is also a significant omission that regional council have not tabled an integrated state and trend report, specifically for the Waikato-Waipa Catchment.

117. This omission is compounded by the cursory summary presented in the s42A report at [93]-[95]. These paragraphs touch only on mainstem Waikato (not Waipa or the tributaries); refer only to 25 year trends, and not the more recent 10 year trends which are also presented in the Regional Council report; and present no analysis of the significance of the trends relative to current state.

118. The following paragraphs summarise my understanding of the wider findings in the latest Regional Council trends report. I record here that, as for analysis of current state, this was not a trivial task. The Regional Council trends report is not structured in the same way as the PC1 FMUs. Instead, readers must manually extract data from the appendices, and re-assemble it into PC1 FMUs, before assessing trends relative to each FMU.

119. It is perhaps partly for this reason that the s42A report neglects to provide any substantive data or analysis. Nevertheless, in my opinion, this is a significant omission and another illustration of the poor alignment currently between Regional Council policy and science arms.

120. Attach as **PLM7** is extracts from the Regional Council's 2018 Report, Trends in river water quality in the Waikato region, 1993-2017. Appendix 1 and 2 presents the source data from which the following tables are derived, ie, 25 year trends (1993-2017) and the more recent 10 year trends (2008-2017).

121. Regional Council distinguishes trends as being "important" if the change was +/_ 1% (albeit with the important caveat that this is a relatively arbitrary threshold) and I

[27] WRC, 2018, Trends in river water quality in the Waikato region, 1993-2017

follow that convention below, identifying sites with "important" changes. These sites are illustrated in PLM7 as important improvements (shown in bold) and important deteriorations (shown in bold underlined). Sites with "slight" or no change are not recorded in the tables following.

122. I have assessed trends for the two primary swimming attributes (E coli, clarity) and additionally for secondary attributes (chlorophyll, Total Phosphorus, Total Nitrogen).

123. First the catchment-wide totals. The following table, structured by attribute, shows that – where there are "important" trends - more were deteriorating than improving over the 25 year period, whereas significantly more are improving and less deteriorating in the more recent 10 year period:

No of important trends	25 yr trends 1993-2017		10 yr trends 2008-2017	
	improving	deteriorating	improving	deteriorating
E coli	8	3	7	3
Clarity	6	18	26	3
Chlorophyll	6	0	4	0
TP	27	4	32	5
TN	5	38	7	14
TOTAL	52	63	76	25

124. The Regional Council trends report does not present trends for the earlier 1993-2007 period. Nevertheless the results above indicate that trends in the earlier period may have exhibited stronger deteriorations relative to more marked improvements in the recent period, and I have requested Regional Council to supply that analysis if it is available.

125. The next table presents the same information, structured this time by FMU and again showing consistent evidence of more improvements and less deteriorations in the period 2008-2017 for all four FMUs:

No of important trends	25 yr trends		10 yr trends	
	Improving[28]	deteriorating	improving	deteriorating
Upper	11	30	14	18
Mid	20	5	25	2
Lower	12	18	21	4
Waipa	10	10	16	1

[28] The 25 year improvement column does not reconcile to the table structured by attribute. The discrepancy is one site which does not materially affect the results.

TOTAL	**53**	**63**	**76**	**25**

126. The next table presents trends for the two primary swimming attributes, E. Coli and clarity – again illustrating significantly more improvements and significantly fewer deteriorations in the more recent period across all FMUs:

No of important trends	**25 yr trends Median E coli or clarity**		**10 yr trends Median E coli or clarity**	
	Improving	**deteriorating**	**improving**	**deteriorating**
Upper	**2**	**10**	**8**	**3**
Mid	**7**	**1**	**11**	**1**
Lower	**2**	**7**	**8**	**1**
Waipa	**3**	**3**	**6**	**1**
TOTAL	**14**	**21**	**33**	**6**

127. In summary: across the catchment, just six deteriorating trends are recorded in the recent period (three E coli, three clarity), one being the Waikato @ Narrows (change off a very low base, median E coli 38), one being Waipa @ Pirongia (clarity), and the balance 3 tributary sites (two upper Waikato, one lower Waikato).

128. In this context, I am confused by the statement in the s42A report (para 92) that: "Sediment levels in the lower reaches of both Waikato and Waipa Rivers have increased over the past 20 years". No reference is provided for this statement.

129. Waipa is the major tributary to the lower Waikato and the major contributor of sediment. Attached and marked **PLM 8** is Hydrology of the Waikato Catchment: From Chapter 3 of the Waters of the Waikato which indicates the Waipa contributes 65% of flow during floods.

130. **PLM 9** presents extracts from a Regional Council report published in 2013 which assessed sediment trends in the Waipa River[29]. In brief, this report indicates an increase in suspended sediment up to 2000 (highlighting the impact of the Tunawaea Landslip), and a decrease from 2000 through to at least 2010 (ascribing this to the success of river control works).

131. The Tunawaea Landslip occurred in 1991, forming a 70 metre high dam. The dam failed in 1992, generating around 9 million cubic metres of sediment. The suspended sediment is assumed to have moved downstream relatively quickly (within a few

[29] WRC, 2013, Suspended sediment time trends in the Waipa River and Waitomo Stream

years). The bedload sediment has been gradually working its way down the Waipa, raising the bed, and exacerbating bank and terrace erosion as it goes. In the period since the landslip, river terraces have eroded back around 20 metres, releasing an estimated 200,000m³ of additional sediment into the Waipa.

132. Based on the findings of this Regional Council report, the statement in the s42A report appears to be not well-founded; and the specific findings, in my opinion, are witness to the importance of understanding the specific context behind the observed trends.

133. Turning now to chlorophyll: Regional Council reports record steady improvements over recent years. For example, Regional Council monitoring reports show median chlorophyll at Waikato @ Tuakau has halved since 2003 (all values 5 year medians for the preceding period):

- 2003: 22 mg/m3
- 2006: 19 mg/m3
- 2011: 14 mg/m3
- 2017: 10 mg/m3

134. The following table confirms consistent improvements through both time periods:

No of sites with important trends	**25 yr trends Median Chlorophyll**		**10 yr trends Median Chlorophyll**	
	improving	**deteriorating**	**improving**	**deteriorating**
Upper	**1**	**0**	**0**	**0**
Mid	**2**	**0**	**2**	**0**
Lower	**3**	**0**	**2**	**0**
Waipa	n/a	n/a	n/a	n/a
TOTAL	**6**	**0**	**4**	**0**

135. The next table presents trends for Total Phosphorus, again showing consistent improvements through both time periods[30]:

No of important trends	**25 yr trends Median TP**		**10 yr trends Median TP**	
	improving	**deteriorating**	**improving**	**deteriorating**
Upper	**8**	**1**	**6**	**3**
Mid	**8**	**1**	**8**	**1**

[30] The WRC trends report cautions the longterm TP results may not all be reliable and are provisional pending further investigation.

Lower	5	2	10	1
Waipa	6	0	8	0
TOTAL	27	4	32	5

136. The following table for Total Nitrogen shows a significant slowdown in the number of deteriorating trends, although deteriorating trends are still more than improving:

No of important trends	**25 yr trends Median TN**		**10 yr trends Median TN**	
	improving	deteriorating	improving	deteriorating
Upper	0	19	0	12
Mid	3	3	4	0
Lower	1	9	1	2
Waipa	1	7	2	0
TOTAL	5	38	7	14

137. The Regional Council trends report (page 12) notes that: "If the observed declines in total phosphorus are real, then the reductions in chlorophyll in the river are likely to be associated with this; noting that at the same time, concentrations of total nitrogen have typically increased, implying that phytoplankton growth in the river is less dependent on the availability of nitrogen". I agree.

138. In short, I have assessed trends for the two primary swimming attributes (E coli, clarity) and additionally for secondary attributes (chlorophyll, Total Phosphorus, Total Nitrogen). Catchment wide there is a 76 improving trends and only 25 deteriorating trends in the recent 10 year period. Only N has more deteriorating trends than improving trends however the data shows that deteriorating trends of N have gone down from 38 to 14. It is acknowledged that algae growth is less dependent on N.

GROUNDWATER STATE & TRENDS

139. The s42A report at [98] notes there are 60 long term monitoring sites in the PC1 area, that 8 of the 60 sites (13%) exceed the drinking water guideline; and that of the "nitrate monitoring sites", about a third showed increasing trends and a third showed decreasing trends.

140. This paragraph is not referenced but I assume the source must be the most recent Regional Council groundwater state and trends report[31], which analyses state and trends through to 2013.

141. I reiterate that it is a significant omission that the last five years of data are not available.

142. The following table presents data from the Regional Council groundwater report (while noting that, as for rivers, there is an unfortunate disjunct between the monitoring reports and the PCI FMUs which makes it difficult to reconcile to the s42A report and the totals are accordingly marked with a question mark:

Groundwater Nitrate	**No of sites**	**No of sites > 11.3g/m3**
Upper		
- **South Waikato**	**9**	**1**
Mid		
- **Waikato**	**12**	**3**
Lower		
- **Franklin**	**15**	**3**
Waipa		
- **Otorohanga**	**3**	**1**
- **Waipa**	**11**	**1**
- **Waitomo**	**5**	**0**
TOTAL	**55?**	**9?**

143. Of the nine sites above, the two with the highest readings (around 19 g/m3) are both shallow wells (4m, 7m), and both in urban areas (one Waipa, one Waikato).

144. Most of these 60 odd sites are monitored only annually and Regional Council at [3.6] that "*there are few records available to indicate longterm nitrate trends*". However, a subset of 18 wells (the "nitrate sub-network") is monitored quarterly, including to assess trends.

145. The following table shows the trends in the nitrate sub-network reported in Table 18 of the Regional Council groundwater report it is important to note the trend period is not clear in the Regional Council report, making it difficult to assess whether these are more recent or more historic trends:

[31] WRC 2013, Groundwater Quality Monitoring 2012-13

Groundwater Nitrate Trends	No of sites	No of sites with no trend	No of sites improving trend	No of sites deteriorating trend
Upper				
- **South Waikato**	**2**	2	0	0
Mid				
- **Waikato**	**3**	0	3	0
Lower				
- **Franklin**	**5**	0	1	4
Waipa				
- **Otorohanga**				
- **Waipa**	**8**	4	3	1
- **Waitomo**				
TOTAL	**18**	6	7	5

146. As above, four of the five deteriorating trends are clustered in the Franklin district. The one other (well 70-74) is located in an urban area in the Waipa catchment.

147. The s42A report[32] discuss another data set comprising over 500 wells. In my opinion, the table presented is confusing and poorly referenced, and I am especially confused that it apparently purports to report nitrate state and trends for over 500 wells in the PC1 area.

148. Reference is made to a summary prepared for TLG, but the primary source appears to be a report prepared by GNS[33]. In my opinion, the methodology in the GNS report is less than transparent but it does usefully confirm (Table 5.1) that: "*relatively few wells have suitable data for trend analysis; analysis of data has not been completed, eg, well depth; and capture zones of wells have not been delineated*".

149. As best I understand the GNS report, it appears any and all well records over recent decades (in excess of 500) were assembled, perhaps setting aside the more robust protocols employed in the Regional Council nitrate sub-network. From there, as I understand, if any well at any point recorded median values >11.3g/m3, then the whole sub-catchment was flagged to that effect.

150. Appendix 4 of the GNS report sets out the sub-catchment details and one example may perhaps suffice to illustrate the approach as I currently understand it.

[32] At [99] page19
[33] GNS, 2015, Groundwater resource characterisation in the Waikato River Catchment

151. The Mangaone subcatchment/mid Waikato is recorded as having 24 wells with chemistry data spanning the period 1987-2015 with median nitrate values ranging from 0.1 to 24.3g/m3. It is perhaps not coincidental that dairy factory wastewater was irrigated to land adjacent to the Mangaone stream through the 1980s and 1990s, with concomitant groundwater monitoring from 1982-1994. The nitrate loadings were very high in the early years (average 1200kg/ha from 1985-1993) with concomitantly high groundwater and stream nitrate levels (up to 20mg/L downstream of the irrigation area) at that time.

152. In my opinion, these historic readings should not be presented in the s42A report purporting to be a "*summary of groundwater chemistry in sub-catchments*".

OVERDELIVERING ON SHORT TERM TARGETS

153. Under this heading I provide support that PC1 provisions are designed to deliver significantly more than 10% reductions in N/P/S/E coli. A key finding in the PC1 Simulation report[34] is:

> Table 5 shows an **overwhelming improvement in water quality** brought about by the proposed policy mix, relative to the 10% step…
>
> For example, **the lowest median improvement in an attribute**, in the absence of iwi land development i**s 31**%....
>
> [PC1 is] "predicted to achieve **greater than 10% movement in 99% of the cases**"
>
> …
>
> The **only** sites that fail to meet 10% steps exist in **Upper Waikato**, as the policy mix does not provide for sufficient mitigation effort to offset substantial amounts of **N in groundwater** that will **eventually** start to express itself in surface waters.
>
> Nevertheless these breaches affect only N attributes and do **not** have a predicted impact on chlorophyll levels, due to the dominant influence of **phosphorus** on algal growth

154. Reviewing the more specific data from the report confirms that improvements are well over the 10% mark[35]:

> TP median improvement **31%**, nitrate **65%**, E coli **69%**, clarity **175%**

155. In conclusion PC1 will deliver much greater than 10% reductions in N, P, Sediment and *E.Coli*. In 99% of cases short term targets will be exceeded and many by a large margin.

COLLABARATIVE STAKEH0LDER GROUP

[34] TLG, 13 July 2016, Simulation of the proposed policy mix, Pg 28
[35] Table 5 at page 30.

156. The CSG was a group of stakeholders and community representatives tasked with intensively considering and deliberating on technical and policy information, informed by the views of their sector, communities and Māori interests in the catchment. The CSG made policy and other recommendations to the Healthy Rivers Wai Ora for the purpose of preparing PC1.

157. FFNZ is grateful for the contribution of the CSG members who gave up their time and brought the region to the point where PC1 was notified. The CSG members had to act often under time constraints and with the information and assumptions provided to them. FFNZ thanks the members of the CSG.

158. However it is not helpful for the S42A report in response to a submitter's concerns to say that the CSG would have considered the matter and therefore the CSGs decision stands. If the CSG decision cannot be justified or there are better way or solutions to give effect to the RMA and Vision & Strategy then the CSG should not be followed.

159. The CSG took the first step in the Schedule 1 process of preparing the Healthy Rivers plan, now it is the part of submitters and this hearing panel to take the CSGs decisions, critical examine them and change them where necessary to improve PC1. CSG decisions are not sacrosanct or unchallengeable. There are several reasons for this amongst others:

    a. The CSG used assumptions in their decisions.

    b. The CSG was constraint by the information and knowledge available at the time. As an example, the Economic Impact Report on PC1 highlighting significant negative impacts was received on 2 September 2016 (although dated August 2016) which is two months <u>after</u> CSG signed off on PC1.

    c. The members of the CSG did not agree on all the decisions.

    d. Schedule 1 process requires that the public and those effected get an opportunity to persuade and change the provisions of PC1 through their submission.

    e. The members of CSG are **not** the only persons with good ideas or solutions. Submitters may have better ideas and solutions and these should not be ignored simply because the submitter was not a member of the CSG.

    f. The CSG are made of humans and accordingly they are individually and collectively able to make mistakes.

g. The information, data and science relied on by the CSG is now 4 years out of date.

160. I consider that the CSG members can be proud of their work but it does not mean PC1 should not be taken further and improved.

Economic and social impact

161. It is uncontroversial that the projected economic impact of PC1 on the individual landowners, and the regional and national economy is going to be enormous. I attach and mark **PLM10** an impact report commissioned by the TLG.[36] It paints a sombre picture of the impact PC1 will have on the regional and national level economics. The conclusion is:

> Model output shows that the proposed policy mix will have a significant negative impact on income, employment, and exports within agricultural industries in the Waikato region and those sectors that provide services to them. These impacts are further magnified when connections with industries across the nation are considered.

162. Below I paraphrase Table 6 of the Report using scenario A:

Table 6 Total economic impacts of PC1 across NZ

Industry	Value Added ($)	Employment (MECs)	International exports ($)
Horticulture and fruit growing	-4,000,000	-80	-1,000,000
Sheep, beef & grain	-24,000,000	-196	-1,000,000
Dairy farming	-80,000,000	-769	-1,000,000
Forestry	7,000,000	68	1,000,000
Other Primary	1,000,000	0	0
Agriculture and forestry support	-4,000,000	-78	0
Meat and meat product manufacturing	-4,000,000	-37	-11,000,000
Dairy product manufacturing	-28,000,000	-105	-119,000,000
Wood and paper manufacturing	8,000,000	69	14,000,000
Other Manufacturing	-8,000,000	-83	-4,000,000
Utilities	-2,000,000	-5	0
Construction	0	5	0
Wholesale and retail trade	-8,000,000	-142	0
Transport	-5,000,000	-54	0
Professional and administrative services	-8,000,000	-127	0
Local and central government	-3,000,000	-36	0

[36] WRC, Regional and National-level economic impacts of the proposed Waikato Regional Plan Change 1, 30 August 2016

Other services	-33,000,000	-311	0
Total Loss relative to baseline	**-193,000,000**	**-1,880**	**-120,000,000**

163. Accordingly the report shows a loss of $193 million to value added, a loss in employment of 1,880 and $120 million loss in international export.

164. Unfortunately I consider the economic impact modelled underestimate the hardship that will be caused by PC1. I attach as **PLM11** a report on FEP case studies. The FEP case study project that FFNZ commissioned in collaboration with other industry bodies (as well as WRC) identified that the costs to individual farmers for complying with the mitigations are likely to be significant, with the costs for one farmer ranging from $300,000 to $785,000 (depending on how the stock exclusion requirements are interpreted) and $0 to $500,000 for other farmers in the case study. These significant costs have not been factored in.

165. The economic modelling has acknowledged the devastating effects of PC1 on employment as well as effects on loss of farm profitability. Economic effects can have a social dimension – e.g. employment and income effects and the consequences of falling farm values and high debt levels together.

166. FFNZ will under the relevant topics provide economic support for its alternative provisions which was to achieve the water quality desires of Vision and Strategy at the least possible economic costs and social upheaval. The hearing panel will also hear from many individual farmers and the impact of proposals in PC1 on them. These are the people in the community being asked to carry the costs of PC1.

Alternative approaches and flexibility

167. Referring to the S42 A report at [149] the reporting officer opines that allowing even a minor increase in some areas, for whatever reason, inevitably means that reductions in losses in other areas need to be even greater. The Officer uses this to dismiss any alternative approach of management of contaminants.

168. I have several concerns about this remark which I address below:

a. As set out previously such an absolutist approach lose sight of the desired outcome. We consider there should be flexibility within a NOF band.

b. An absolutist approach (all contaminants need to reduce everywhere all the time) is not applied for point source discharges. Point source discharges resource consent is continued to be granted that increase discharge of contaminants.

c. I have set out my analysis of the state and trend data that shows that the short term targets will be overshot. Accordingly, it is not a zero sum game where the Regional Council have to take from Peter to pay Paul.

APPENDIX