Memo - Response to Hearings Panel questions

Date:	5 July 2019
To:	Hearings Panel - Proposed Plan Change 1: Waikato and Waipā River Catchments
From:	Matthew McCallum-Clark, Section 42A lead author
Subject:	**Questions to Waikato Regional Council Officers**

Purpose

1. The purpose of this memo is to provide responses to questions from the Hearings Panel to Section 42a lead author, Matthew McCallum-Clark, during Block 1 and 2 of Hearings and listed in the minute from the Hearings Panel dated 7 June 2019.

Introduction

2. This memo has been prepared by Matthew McCallum-Clark, with input (noted at commencement of response to each question) from Edmund Brown, Ruth Lourey, Alana Mako, Gerard Lanning, Jon Palmer, Mark Gascoigne, and Mike Scarsbrook.

3. In preparing these responses the authors have complied with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014.

Responses to Hearings Panel Questions

Question 1: WRC Water Quality Monitoring Programme

4. What is the extent of Waikato Regional Council's current Water Quality Monitoring programme and any proposed amendments to it that are relevant to the Waikato and Waipā river catchments? (12 March)

Response (Edmund Brown)

The extent of WRC's River Water Quality Monitoring Network

5. As at July 2018, WRC's regional river water quality monitoring network included a total of 100 regional sites (including sites outside the PC1 area) and 10 Waikato River main stem sites sampled monthly for a suite of water quality parameters. This monitoring network has been relatively consistent since 1993.

6. The Office of the Auditor General in 2011[1] reviewed water quality monitoring by four regional councils, including WRC. It found:

"*The results of NIWA's analysis showed that each of the four regional councils:*

a. *has well-planned and well-operated network for assessing the current state and long-term trends in the physical and chemical quality of freshwater;*
b. *has monitoring networks with sites that are distributed throughout their regions reasonable representatively;*
c. *is monitoring a comprehensive suite of relevant physical, chemical, microbiological, and biological variables suitably often; and*
d. *generally has adequate quality assurance, quality control, and data storage procedures.*"

7. The annual costs of the WRC's 110 water quality monitoring sites are $705,000 made up as follows:

- Laboratory Services $250,000
- Direct costs (vehicles, accommodation, materials) $215,000
- Labour (~3.5 FTEs) $240,000.

8. Water quality is measured, as part of the WRC regional network, at 62 of the 74 sub-catchments listed in PC1. Water quality in a further two sub-catchments is measured by NIWA.

[1] Office of the Auditor-General. Performance Audit Report, September 2011. Managing freshwater quality: Challenges for regional councils. Downloaded from www.oag.govt.nz on 23/04/2019 – paragraph 3.27.

9. The 64 monitored sub-catchments provide coverage across the four river FMUs, with 21 sites in the Upper Waikato FMU, 10 in the Middle Waikato FMU, 16 in the Waipā FMU and 17 in the Lower Waikato FMU.

10. WRC started monitoring the remaining 10 sub-catchments[2] in September 2018. The 10 new sites have been incorporated into the existing runs for the other 110 sites.

11. The addition of the 10 new sites has been relatively low cost. Generally, water quality monitoring sites have no infrastructure and require little in capital expenditure. At some sites steps are installed for safe access. The majority of expenditure relates to direct costs including labour, transport and laboratory analysis. A request for an additional $15k for laboratory analysis was approved in the 2018 Long Term Plan ("LTP") process. The other direct costs for labour and transport are relatively low being a small increase on the existing workload.

River attributes monitored by WRC in relation to PC1 and NPSFM requirements

12. The following attributes are monitored on a monthly basis across the 120 sites:
    - Nitrogen
    - Phosphorus
    - *E. coli*
    - Clarity (with some exceptions due to safety issues if flows are high)
    - Nitrate-N
    - Ammonia
    - Chlorophyll *a* (measured only at the ten Waikato River main stem sites).

13. The list of attributes above includes three of the four contaminants, (total nitrogen, total phosphorus and microbial pathogens - E.coli) identified in PC1 as discharges to be managed. Sediment is not measured as part of the routine monthly sampling. However, clarity is measured and is specified as the attribute in Table 3.11-1.

14. For rivers, PC1 and the NPSFM require the monitoring of the following water quality parameters:

[2] Mangarama Stream @ Gadsby Rd bridge, Mangarapa Stream @ Old Te Kuiti Road Bridge, Upper Puniu River @ Wharepapa Rd, Waikato River @ Karapiro tailrace, Moakurarua Stream @ SH39, Firewood Creek @ Waingaro Rd Bridge, Waipa @ Confluence of Waipa and Waikato River, Lake Waahi outlet @ Harris Rd/Te Ohaki Rd bridge, Waikato River @ Rangiriri, Lake Waikare outlet north.

Attribute	Required by:		WRC routine monthly monitoring
	PC 1	NPSFM	
Chlorophyll	Y	Y	At the 10 Waikato River sites – not other sub-catchments.
Total Nitrogen	Y	N	All 74 sub-catchments
Nitrate	Y	Y	All 74 sub-catchments
Ammonia	Y	Y	All 74 sub-catchments
Total phosphorus	Y	N	All 74 sub-catchments
E. coli	Y	Y	All 74 sub-catchments – partial exception is for NPSFM – Appendix 5 surveillance monitoring.
Clarity	Y	N	All 74 sub-catchments – exceptions during times of unsafe flow
Periphyton	N	Y*	No
Dissolved Oxygen	N	Y (below point source discharge)	All 74 sub-catchments but not to frequency required under the NPSFM
Cyanobacteria	Not for rivers	Y (Lake fed rivers)	All the FMUs with lake fed rivers are covered by the existing monitoring at 5 Waikato River locations by WRC, Hamilton City Council and Watercare

* *While periphyton is in the NPSFM the note to the attribute table states "if the freshwater management unit does not support, and could not support, conspicuous periphyton consider the nitrogen and phosphorus criteria…".*

15. From the table above it can be seen that WRC is measuring the listed attributes in Table 3.11-1 under existing monitoring programmes. There are some gaps in monitoring against attributes of the NPSFM. Attributes not yet measured by WRC are dissolved oxygen (below point source), periphyton and E.coli as required under Appendix 5 of the NPSFM – Surveillance monitoring of E. coli at primary contact sites. These are discussed in more detail below.

<u>NPSFM attributes requiring further monitoring effort by WRC</u>

Dissolved oxygen

16. There are two sites (Hamilton in the Middle Waikato FMU and Tuakau in the Lower Waikato FMU) where WRC has deployed equipment (sondes) to continuously measure dissolved oxygen, pH, temperature and chlorophyll a (Tulagi 2015b). These two sites can be used to assess dissolved oxygen state as per the NPSFM (e.g. summer period 7-day mean minimum). Dissolved oxygen monitoring is also required in the remaining two river FMU's.

Periphyton

17. WRC currently undertakes simple periphyton presence or absence reporting at the regional water quality sites on a monthly basis.

18. It would be difficult to find representative, wadeable, hard bottom sites within each FMU. The recommended methods involve accessing multiple points across a river to gain a representative sample. This would be very difficult except in shallow streams and at times of low flows. Each river FMU is dominated by either the main stem of the Waikato or Waipā Rivers which are too deep and fast flowing for sampling.

E.coli – Appendix 5: Surveillance monitoring of E.coli at primary contact sites

19. In addition to the monthly *E. coli* monitoring at 120 sites across the Region, WRC also operates nine river recreational monitoring sites for *E. coli* on a weekly basis over the summer months.

20. When results are over 260 *E.coli*/ 100ml for any of the nine sites the frequency of monitoring may increase from weekly to daily, but only after consultation with the relevant Health Board. This has been in place for a number of years but with some changes in locations monitored. I am not aware of any instance in the last three years when the Health Boards has requested an increase to daily sampling.

21. Six of the nine sites are within PC1 river FMUs:
    - Lower Waikato River FMU (Tuakau Bridge),
    - Middle Waikato River FMU (Ngāruawāhia Bridge, Wellington Street Beach),
    - Upper Waikato River FMU (Lake Karāpiro boat ramp),
    - Waipā River FMU (Kaniwhaniwha Stream - Limeworks Loop Bridge, Waipā River at Ōtorohanga).

22. The NPSFM in its Appendix 5 requires *E.coli* monitoring, similar to the existing summer recreational bathing beach *E. coli* monitoring, at representative primary contact sites in each FMU. For the period of the year specified when a site will be used for primary contact WRC needs to undertake as a minimum weekly sampling. This automatically increases to daily sampling when 260 *E.coli*/100ml is reached. Locations for this NPSFM surveillance monitoring are yet to be determined but some are likely to be at the same locations as currently monitored during summer.

23. To provide for the potential daily monitoring of *E.coli*, funding has been secured through the 2018 LTP process to cover laboratory and labour costs for one representative site in each river FMU. This is planned to commence in July 2020. At this stage the monitoring will occur all year-round as it is assumed that recreation should be able to occur all year. The cost is estimated at $75k per annum[3] for four sites. It is uncertain how often sampling will escalate from weekly to daily, but an estimate of escalation is based on analysis by Mr Bill Vant of monthly data and likelihood of exceedance.

24. To improve timeliness of reporting to the public and to provide greater coverage across all the sub-catchments, WRC is looking at a similar method to that used by Auckland Council of modelling *E.coli* and reporting warnings based on this. It is envisaged the model output will be based on site-specific relationships between *E.coli* and other variables (e.g. flow, turbidity, clarity) to design a cost-effective surveillance monitoring model to supplement the field measurements. If successful, this would enable a smaller number of actual monitored sites while providing information to the public for many or all sub-catchments. A proof of concept is currently in development.

Lake Monitoring

25. Lake monitoring is currently conducted on a small sub-set of lakes in the catchment. Compared to rivers and streams, lakes are poorly represented by monitoring and will require the greatest increase in effort under PC1. Eighteen shallow lakes have been monitored and reported on by WRC[4].

26. To ensure representative monitoring across the four lake FMUs a detailed analysis is being undertaken by WRC's Lakes Scientists and will be discussed with each of the Waikato River Iwi. This is expected to be ready by late 2019. Due to the large number of lakes in the Waikato and Waipā catchments any monitoring network will only be of a small subset.

27. Preliminary work shows that at least monthly sampling is required and that at least 38 lakes will need to be sampled to provide regional representativeness. However,

[3] *E. coli* analysis is $21 per sample, assuming sites exceed the limit 60% of the time and one FTE staff at $55k per annum.

[4] see https://www.waikatoregion.govt.nz/Environment/Environmental-information/Environmental-indicators/Lakes/lake4-report/

a significantly greater number of lakes would need to be sampled to provide representativeness within each of the four Lake FMUs due to the diverse range in lakes' characteristics (chemistry, geography etc.).

28. Monitoring of the 38 lakes is a time-consuming manual activity. Samples are typically taken from near the middle of each lake and from different depths depending on the lake's stratification. Sampling requires two staff to meet water safety requirements. Staff are investigating alternative approaches to reduce sampling time including the use of helicopters and drones. In the LTP 2018 two additional field staff were provided primarily to undertake this lake sampling at $110k per annum. Laboratory services will be in the order of $115k per annum.

29. In addition, recreational surveillance *E.coli* monitoring under the NPSFM will require additional effort and is yet to be determined. Within the FMUs, WRC currently monitors 5 lakes for *E.coli* and cyanobacteria:

- Lake Te Koutu (Riverine FMU)
- Lake Rotokauri (Peat FMU)
- Lake Kainui (Lake D) (Peat FMU)
- Lake Ngaroto (Peat FMU)
- Lake Puketirini (Riverine FMU).

30. Further work, to be completed by July 2020, is required to determine how many more lakes will be monitored to meet NPSFM *E.coli* – Appendix 5: Surveillance monitoring of *E.coli* at primary contact sites.

Summary

31. I consider monitoring of the 74 river sub-catchments and four river FMU's is achievable with a moderate additional investment in labour and laboratory resources. Greater effort is required for the Lake FMUs. To enable this, funding for the rivers and lake monitoring, including two additional staff, has largely been secured through the 2018 LTP.

Secured monitoring in 2018 LTP by WRC	**Costs**

Rivers 10 new water quality sites sampled monthly for a wide suite of attributes	$15,000 laboratory Labour captured as part of new staff for lakes monitoring
E. coli (surveillance monitoring as per NPSFM) for 4 locations	$20,000 laboratory $55,000 labour
38 Lakes monitored monthly for a wide suite of attributes (currently provided in 2018 LTP by WRC)	$115,000 laboratory $110,000 labour (2 new staff employed since July 2018)

Question 2: Iwi Management Plans

32. What provisions of any relevant Iwi Management Plans need to be considered in relation to PC1? Please ensure commentary of the Hauraki Iwi Environmental Management Plan is included in this analysis. (12 March)

Response (Alana Mako/Matthew McCallum-Clark)

33. During development of PC1, each River iwi's environmental management plan was assessed.[5] A high level summary of the relevant matters is set out below

Waikato-Tainui	• Te Ture Whaimana prevails in any resource management, use and activity within the Waikato River catchment in the Waikato-Tainui rohe. • Freshwater (Wai ora, wai Māori, wai kino, wai mate). • The relationship between Waikato-Tainui and the water. • Water quality. • Wetland restoration and protection. • Historical significance of fisheries taonga to Waikato-Tainui • The importance of Tuna to Waikato-Tainui. • Waikato-Tainui aspires to have waters that are drinkable, swimmable, and fishable with the water quality at least at the level Kiingi Taawhiao would have expected in his time.
Raukawa	• Water is not separate from people, is not separate from its surrounds and therefore cannot be separated, or assessed in isolation, from the environment as a total entity. • Regard all water as a connected and living entity, such as constituent parts, intrinsic values and meta-physical being. • All water bodies are significant within the Raukawa Takiwa, and the mauri and mana of our waterbodies and all catchments are sustained and enhanced for present and future generations. • Ecosystems and riparian margins are healthy, diverse and resilient.

[5] GMD Consultants. (2015). *Collaborative Stakeholder Group Values and Uses - Gaps analysis*. Document 3431297 – A full copy is in Appendix A.

	• Waterbodies are accessible and safe to swim in, and take food from, all year round. Identification of mahinga kai species.
Te Arawa	• Rejuvenate and restore the mauri of the Waikato River, to be progressive and innovative in our approach, to work collaboratively, and to hold steadfast to those things that are important and make us unique. • Support Te Arawa collectively and individually to assert mana awa and improve the health and wellbeing of the Waikato river, tributaries and environments. • Enable participation in the restoration and protection of the water and implement measures to restore and protect the water. • Interests and values of the Waikato River to Te Arawa are recognised. • Ensure the health and wellbeing of the Waikato River provides for: Mahinga kai; freshwater fisheries and customary resources; access for customary use, protection of riparian margins, wetlands, lakes and mahinga kai resources. • Ensure there is enough freshwater for drinking, land use, recreational and cultural use, while sustaining associated ecosystems • Identification of customary taonga species, non-taonga species and unwanted fish in the Waikato River, between Atiamuri Dam and Huka Falls including all tributaries. • Swimming is regarded as part of re-invigorating the relationship between the iwi and the streams and rivers
Maniapoto	• Freshwater (Wai ora, wai Māori, wai kino, wai mate) • Restoration of mauri and protection of te mana o te wai • Restoration and maintenance of healthy populations of indigenous aquatic life. • Management of allocation ensures restoration and protection of the water quality. • Healthy ecosystems, management of sediment, natural form and character are restored and protected. • The relationship between Maniapoto and the water is enhanced and protected. • The mauri and mana of the water provides sustenance, including physical and spiritual nourishment. • Recognise and protect Maniapoto access to and ability to undertake traditional activities and uses. • Wetland restoration and protection

Ngāti Tūwharetoa	• Assert and exercise rangatiratanga and kaitiakitanga over waters within the Tūwharetoa rohe. • Protect and enhance the mauri for future generations. • Advocate the protection of mauri of water through effective policy and planning instruments. • Prohibit all discharge of human waste directly into waterways and promote effluent treatment acceptable to ngā hapū. • Encourage the implementation of land-based disposal systems e.g. dairy farm effluent. • Support proposals that seek hapū involvement to improve water quality and promote efficient use of water quantity. • Protection and enhancement of fisheries in accordance with tikanga and kawa. • The ability to swim safely is important.
Ngāti Tahu-Ngāti Whaoa	• Iwi have rights to/ over water including groundwater, rivers, lakes, tributaries and beds of waterways • The Waikato River should not be expected to absorb any further degradation and it should be swimmable and support healthy kai along its whole length • Ensure iwi involvement in monitoring, consents, plans and restoration projects, including rangatahi wherever possible. Management should be integrated and reflect the Māori world view. • Protect headwater and strengthen linkages to the Waikato River. • Reinstate ecosystems and natural processes, protect sites of significance and traditional activity as well as enhancing water quality. Waterways each have their own mauri and should not be mixed; human sewage should not enter waterways • Vegetated riparian margins should be reinstated. • Wetland restoration and protection. Access and harvesting rights are important to enable iwi to make use of wetland and freshwater resources. • Ensure involvement in managing commercial fishing and customary takes, to ensure sustainable kai resources are available. • Water storage can make more water available for use without affecting low flows, but care is required to maintain aquatic ecological connections.

34. The Ngāti Haua Iwi Environmental Management Plan came into effect in September 2018 and therefore was not included in the earlier analysis which identified relevant matters. Key matters raised in the Ngāti Haua IMP are:

Ngāti Haua	• A more integrated holistic and collective approach to sustainable land use development and management. • The health and wellbeing of freshwater resources is inherently connected to the health of the whenua and the health and wellbeing of the community. • Ensure the mauri of freshwater is restored and protected. Ensure water is plentiful and clean enough for drinking, swimming and sustaining mahinga kai.

	• Water allocation is sustainable and consistent with the natural limits of the rivers, streams and aquifers. Water should be allocated fairly and used efficiently and responsibly. • Waterways are accessible for customary use. • Recognition of Ngāti Haua values, interests and mātauranga in relation to freshwater planning and management. • Protection and revitalisation of traditional knowledge and practices, regarding rivers, streams, aquifers and freshwater fisheries. • Work collaboratively to ensure a holistic and integrated approach is taken to restoring the mauri of freshwater. • Protect, restore and enhance the mauri of wetlands. • Ensure freshwater fisheries are restored, sustainable managed and enhanced. • Restore and protect identified/mapped sites and areas of cultural significance. • Recognition of culture and traditions associated with ancestral lands, water, sites, waahi tapu and other taonga.

35. Extensive engagement with Iwi was undertaken through the Collaborative Stakeholder Group (CSG) and consultation with WRC. Through the CSG process Iwi were invited to present to the CSG on the values held by iwi for the river. Each River iwi presented their history and values, challenges they have faced, the outcomes they are working towards and achieving their environmental management plans.

36. River iwi were also invited to provide feedback on a working list of values by the CSG. River iwi staff organised a values hui to develop this feedback which was presented to the CSG on the 5th of March 2015. Feedback provided by River iwi included:

- The visibility of the Vision and Strategy appeared to be missing and suggestions were provided on how to connect with the Vision and Strategy including:
    - An appendix setting out in table form how each CSG value aligned to which V&S and NPS values.
    - Expanding on the social/cultural identity theme, where social identity includes mental, health, medicinal, and other values, not just swimming.
- Suggest Te Mana O Te Wai as an overarching value (e.g if water is swimmable and fishable that means the mana is there)
- There is also the Mana Atua Mana Tangata framework that shows the interconnected relationship between spiritual, intrinsic and use values
- Values are interconnected and the relationships between them are important – many values will be about relationships.

- With regard to Mātauranga Māori and knowledge frameworks, the Technical Leaders Group worked on identification of the five River iwi values and coherence between them
- The river should be central
- Suggestion to re-sort the CSG list into values and uses and rename 'uses' as 'use values'
- Noted inconsistencies in the values developed by the CSG (i.e. farming and electricity appear to have more descriptive information which may imply these values are more important than the other values)
- Re-word descriptions to focus on why the river is important for that use rather than just trying to justify that use
- Values should be the same across the whole catchment but how they are given effect to can be different in different locations
- Values are not individual – they are interconnected and relationships between them are just as important

37. The Hauraki Iwi Environmental Plan was made available in March 2004 and the purpose of this plan is to sustain the mauri of the natural environment and cultural heritage of the Hauraki rohe over the next 50 years. The objectives identify resource, geo-graphic and process-based issues of concern to Hauraki Whanui and to develop action orientated programmes and working models for kaitiakitanga. It takes a strategic approach and intends on sustaining the environment and its heritage for mokopuna yet unborn. Issues, objectives and outcomes are set for each resource of concern and importance to the Hauraki Iwi. Key matters raised in the Hauraki IMP are:

Hauraki Iwi	• Kaitiakitanga is important to achieve actions valued by Hauraki Whanui. • Protect and restore wetland habitats and ecosystems • Riparian margins of rivers and streams are restored and protected. • Ancestral taonga are protected from the impacts of growth. • Sustainable land use and energy efficiency practices is standard practice. • Promote and encourage sustainable water use practices. • Restore and increase inanga spawning. Increase populations of fisheries, birds and plant resources. Tuna is an important food source for Hauraki Whanui. • It is important to have places for the gathering of food, collection and preparation of rongoa and weaving materials.

	• Monitor fisheries health and recovery and ensure improved water quality. • Waahi tapu and cultural heritage sites are being protected from use and development.

38. The Hauraki Iwi Environmental Management Plan was considered through Variation 1 to PC1 which was notified in April 2018. The Section 32 report outlines the consultation with Hauraki Iwi that occurred and the identification of any resource management issues and important values and uses to Iwi of Hauraki. The Hauraki Iwi Environmental Plan was a source for identifying values and uses and enabled WRC to consider whether there were any gaps in PC1. From the analysis of the IMP and consultation with Hauraki iwi it was identified that there were gaps in the list of values and uses and key additions to these were:

- Amendments to reflect inclusiveness of all iwi, and the relationship that iwi have with rivers, wetlands and springs.
- Additions to reflect values such as Whanaungatanga, Te taura tangata, tupuna, kaitiakitanga and wai kino.

39. Whilst these gaps were identified through consultation, they still needed to go through Te Rōpū Hautū (Project steering group), Healthy Rivers Wai Ora Committee and the Council process for agreement. Subsequently, these gaps were agreed upon for inclusion into PC1 and amendments were made to reflect these through the Variation 1 process.

Question 3: 75th percentile

40. How did the CSG arrive at the 75th percentile and why was another number not used? (20 May)

Response (Ruth Lourey/Matthew McCallum-Clark)

41. The CSG proposed the 75th percentile of nitrogen as the definition of a high discharging property. The CSG did not consider a different percentage threshold. The policy mix report (Doole et al, 2016) modelled the CSG chosen policy package so the 75th percentile calculated by FMU was modelled. Officers understand that the modelling showed that reducing this top quartile, along with everybody else 'at worst' only maintaining losses, would be consistent with achieving a 10% reduction in N over the 10 year duration of PC1.

Question 4: Non-complying activity status

42. Was change of land use such as large-scale conversion to cropping considered for the Non-complying Activity Status? If so, where were they considered, is there 'typical' N loss rates for these kinds of activities? The Panel questioned whether other activities should be captured by this rule but are not specifically mentioned within the non-complying activity rule. (20 May)

Response (Matthew McCallum-Clark/Mark Gasquoine)

43. The intent of the land use change rule was to capture specified land use changes that were considered to represent significant intensification. Officers understand that there was a conscious decision by the CSG to exclude cropping as an activity that would be considered to be intensification for some and or all of the four contaminants.

44. There is no "typical" nitrogen loss for cropping. There are a range of factors that influence the variability in the risk of discharges including climate, soils, vegetation, rainfall, and drainage and farm management. In some instances, there may not be an increase in nitrogen losses from a land use change to cropping. For example, converting pasture to crop by spraying and direct drilling seeds may have lower nitrogen losses but increases in discharges of other contaminants (such as sediment) when the crop is grazed.

45. Overseer scenarios have been run for a range of representative soil types for the various FMU's (Pumice, Granular, Allophanic, Organic and Brown). These showed a range of N losses from different systems, such as:

- 22kg/N/ha/yr to 66kgN/ha/yr from maize silage within a dry stock system (lamb finishing);
- less than 20kgN/ha/yr for maize grain;
- milking sheep ranged from 13kgN/ha/yr to 19kgN/ha/yr;
- losses from fodder crop areas of 46kgN/ha/yr and 38kgN/ha/yr;
- kiwifruit ranged from 5kgN/ha/yr to 19kgN/ha/yr

46. The outcome from running these scenarios was indeed that there is not a "typical" nitrogen loss for cropping or any description. The major drivers of N loss from these systems are the same as those already measured such as dairy, dry stock and commercial vegetable production.

47. Overall, while some cropping practices are riskier than others in terms of their potential discharges (for example, grazing of winter forage crops on steep slopes). These are managed through the requirements of Schedule 1.

Question 5: Slope

48. How can slope actually be established for the purposes of the rules? Is there a need, in order to provide guidance, to start providing information such as what distance the slope is measured? Is it an average slope? Is it a maximum slope? Is it a minimum slope? Regarding the definition of slope – WRP definition insufficient – does it need a 'start- point', plus a distance etc? Is a different test needed for different rules e.g. for erosion management than for stock exclusion? (20 May)

Response (Matthew McCallum-Clark/Mark Gasquoine)

49. Practically, there are two ways of measuring slope for the purposes outlined in PC1. The first approach is the most simplistic and rudimentary and is the use of an inclinometer. This will inevitably require a 'start point', such as the bed of the river and a 'sighting point'. Several readings will normally be taken at different points across a slope to establish an average. Modern smart-phones and other devices typically include an inclinometer.

50. The second way to measure slope is making use of Digital Elevation Models (DEMs). However, the quality of maps derived from these models depends on the quality of the DEM's representation of the Earth's surface. In many cases, errors in this representation are neither measured nor estimated. Owing to the complexity of the land surface and volume of data, the result will often be too detailed to be used pragmatically for setting rules and for managing land – to be practical, some 'smoothing' is required. For example, traditional field mapping techniques inherently group slopes into contiguous dominant slope regions as for datasets such as the New Zealand Land Resource Inventory, Land Use Classification (LUC) where dominant slope is grouped into eight discrete classes as determined by field observations. In time, the full region will be digitally mapped using LiDAR, and with that good quality information, slope will be able to be mapped at appropriate representative scales.

51. Until that time, the former, rudimentary method of using an inclinometer is recommended. The slope definition will need a 'start point and a measuring distance' and some form of averaging. There may also need to be a subtle difference for

cultivation and waterway setbacks, acknowledging that for both, critical source area management under a FEP will be critical. Such a definition could be:

Slope: The steepness of the land surface. Slope is measured in degrees and to an accuracy no less than that achieved by a hand held inclinometer or Abney level. For the purposes of Chapter 3.11, for cultivation and grazing, slope shall mean the average slope over any 20m distance (measured along the ground surface); and for stock exclusion requirements, shall mean the average slope, measured from the edge of the bed of a waterbody to a distance of 20m perpendicular to that waterbody, averaged for the paddock.

Question 6: Permitted activities and section 70

52. Appropriateness of s70 –Whether a Permitted Activity discharge Rule can satisfy Section 70 in this catchment given section 70 clearly includes cumulative effects? If the panel come to the view that they agree that cumulatively, agricultural discharges have an effect on aquatic ecosystems – should it be written into the rule 'thou shalt not have a cumulative adverse effect on aquatic life' as a precondition to the PA rule even though it is understood no one can satisfy that? (20 May)

Response (Gerald Lanning/Matthew McCallum-Clark

53. Rule 3.11.5.8, as recommended in the s42A report, provides as follows:

The diffuse discharge of nitrogen, phosphorous, sediment and/or microbial contaminants from farming onto or into land in circumstances that may result in a contaminant entering water that would otherwise contravene section 15(1) of the RMA is a permitted activity, provided the following conditions are met:

1. *the land use activity associated with the discharges authorised under Rules 3.11.5.1 to 3.11.5.7; and*
2. *the discharge of a contaminant is managed to ensure that after reasonable mixing it does not give rise to any of the following effects on receiving waters:*
    - *(a) any conspicuous oil or grease, films, scums or foams, or floatable or suspended materials; or*
    - *(b) any conspicuous change in the colour or visual clarity; or*
    - *(c) the rendering of fresh water unsuitable for consumption by farm animals; or*
    - *(d) any significant adverse effects on aquatic life*

54. The matters described in subclause 2 of the above rule reflect the requirements of section 70(1) of the RMA, which places a limit on the Regional Council's ability to permit discharges[6]. Under section 70, before a regional council can include a regional plan rule that allows as a permitted activity a discharge of a contaminant or water into water, or a discharge of a contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water unless it is satisfied that:

a) no "significant adverse effects on aquatic life";
b) are likely to arise in the receiving waters;
c) after reasonable mixing;
d) as a result of the discharge of the contaminant (either by itself or in a combination with the same, similar or other contaminants).

55. The question raised by the Panel only relates to "any significant adverse effects on aquatic life" (section 70(1)(g)). But in any event, the discussion below would apply to any of the adverse effects listed in section 70(1).

56. The starting point is that the Panel (on 'behalf' of the Council) must undertake the analysis required by section 70(1) to determine whether the proposed permitted activity is lawful (in terms of section 70(1)). Before discussing that analysis, it is important to acknowledge that, as with other effects assessments required under the RMA, a 'realistic' and 'real world' approach should be adopted. This is particularly relevant when considering the meaning of "significant" in the term "significant adverse effects on aquatic life". In my view, when determining what is "significant" it is necessary to consider the relevant circumstances e.g. a discharge of E. Coli may be more "significant" in a pristine receiving environment compared with one that is degraded. In this regard, I note the following context for the Rule:

a) It is generally accepted that the contaminants at issue can be appropriately controlled through land use rules; and, at least in the case of farming, this is appropriate because the land use consents will 'run with the land' i.e. they cannot be transferred.
b) The Waikato River and Waipā River (the "receiving waters" under section 70(1)) are currently adversely affected, to various degrees by the discharge of

[6] Although I note that it does not include section 70(1)(e): "emission of objectionable odour", which reflects the fact that there is no prospect of this effect arising.

contaminants from existing (and past) land uses. For example, the section 42A report says:

c) In the absence of the proposed rules this (generally declining) situation is likely to continue.

d) The general approach of the proposed land use rules is to maintain and, in some cases reduce, current nutrient loads entering the Rivers. If so, the adverse effects (including those listed in section 70(1)) of the discharges will reduce over time.

e) Accordingly, this is not a case of simply permitting discharges with no control over their effects. In many ways Rule 3.11.5.8 is not a 'normal' permitted activity rule because it requires compliance with other rules, which address the effects of the discharge. It is intended to address the 'technicalities' with hybrid rules and avoid the need for applicants to seek separate resource consents for the discharges. This is an important point (the discharge is only permitted if the land uses generating the discharge are managed in accordance with the land use controls) when considering:

- the ‘effects’ of the permitted discharge; and
- whether significant adverse effects are “likely to arise”.

57. Returning to the analysis required by section 70(1), the Panel must assess whether:

(a) the adverse effect:

- "as a result of the discharge" ie assuming the land uses generating the discharges will be managed in accordance with the land use rules;
- that are "likely to arise";
- by itself or in combination with other contaminants;
- on “aquatic life”;
- in the "receiving waters";

(b) are "significant", taking into account the context discussed above.

58. The section 70 analysis is difficult in the circumstances of this case and, in particular, given the diffuse nature and wide scale of the discharges; and the extent and complexity of the receiving environment. One could argue that section 70 is only intended for discrete ‘point source’ discharges – but section 70 is not, on its face, limited in this way.

59. In this case, based on the above commentary the effects of the discharges will be, overall, reduced. Compared with the existing environment (and the likely future

environment in the absence of the rules) it may be open to the Panel to conclude that "significant adverse effects on aquatic life" will not arise by permitting discharges where the land uses generating the adverse effects are managed by land use rules. But, again, I acknowledge that the analysis in the circumstances of this case is not straight-forward.

60. However, this issue does not arise if the land use and discharge rules are combined into a 'hybrid' rules. Such an approach would be consistent with the fact that the effects of the discharges are being managed by controlling land use. In that regard, as counsel for Fish & Game noted, a hybrid rule would "[reflect] practical reality"[7]. On this basis, Officers will recommend reverting to a 'hybrid' rule framework in their final recommendations.

61. Finally, in my view, it is not appropriate (in this case) to 'cover off' the section 70(1) test by incorporating it as a condition of the permitted activity rule. In particular, it would not be appropriate to include a condition requiring there to be no 'cumulative effect of aquatic life' – as this would be too unworkable and uncertain for a permitted activity rule.

Question 7: Land use intensification

62. Is there an intermediate position where a forestry block is converted to a low intensity sheep and beef farm within 3.11.5.2 where there might be an increase but clearly at a smaller scale? Are the standard 'land use intensification non-complying activities' missing from Rule 3.11.5.2? (20 May)

Response (Matthew McCallum-Clark)

63. Yes, there possibly is a gap in the rule framework, which could allow an intermediate position of low intensity farming. This can be remedied by inserting the standard 'land use intensification non-complying activities' into Rule 3.11.5.2. Officers will include this in their final recommendations at the close of the hearing.

[7] Paragraph 6.5. Similar comments were made by counsel for OjiFS and HFM, paragraph 4.16 - who refers to separating the rules as being an "artificial construct".

Question 8: Policies on groundwater quality

64. Is it an omission that there are no policies on groundwater quality and does something need to be done to fill that gap? Is scope to do so provided by submissions? (20 May)

Response (Matthew McCallum-Clark/Ruth Lourey)

65. Groundwater is part of the scope of PC1. The content scope of the Healthy Rivers Wai Ora (HRWO) was to: "Promote the reduction, over time, of sediment, bacteria and nutrients (nitrogen and phosphorus) entering waterways (and groundwater) in the Waikato and Waipā river catchments…."[8]

66. Groundwater is an integral part of the HRWO modelling and the mitigations included in the modelling are those that reduce leaching, and therefore the contribution of these contaminants to groundwater. For setting the attribute targets for nitrogen, the contribution of nitrogen to groundwater both historically and from current land uses was taken into account. The intent of PC1 is no further degradation of water and improving water quality where it is degraded, over time. Groundwater improvements are implicit in the catchment scale approach of PC1.

67. The water budget information contained in the groundwater report TR2018/33 by White et al shows that each FMU (and nearly all of the sub-catchments within them) are hydrologically-closed systems. That is, the groundwaters within them emerge as surface waters before their outlets (rather than bypassing them). The FMUs therefore include all waterbodies within them – surface waters and groundwaters. This was an important component of the HRWO modelling that linked mitigations on land, to reductions in leaching to groundwater, to reductions in surface waters. Improvements in groundwater are therefore implicit in catchment scale approach of PC1.

68. In addition, one of the four fundamental issues identified in the Vision and Strategy is: "…The natural processes of the Waikato River have been altered over time by physical intervention, land use and subsurface hydrological changes. The cumulative effects of these uses have degraded the Waikato River…"

69. The Waikato Regional Plan (WRP) has specific objectives, policies and rules related to groundwater quality, for example Objective 3.1.2(m) and (o). Other provisions specific to groundwater can be found in the in Chapters 3.3 Water Takes, 3.4 Efficient

[8] http://waikatoregion.govt.nz/assets/PageFiles/28959/2/40%20-%203037840.pdf Page 4 doc #3037840

Use of Water, 3.5 Discharges, 3.9 Non-point source discharges, 5.2 Discharges onto into land, and 5.3 Contaminated Land.

70. In addition, the definitions of water (and water bodies) in the RMA and WRP refer to surface water and groundwater. There are also statements in PC1 regarding groundwater, for example:

- Explanatory statement on page 8
- Use values – Water supply (reference to subsurface water), Full achievement of the Vision and Strategy on page 15
- Schedule 1(2)(c)(v), (2)(e) and (2)(f)
- Explanatory note to Table 3.11-1
- Consequential amendments to 3.3.3 Policy 4(f) and 3.5.3 Policy 5(b).

71. These statements confirm the intent that groundwater is addressed by PC1. However, there are no specific references to groundwater policies in PC1. Reflecting on this, Officers are of the view that a specific reference to groundwater within Policy 1 would be appropriate.

72. While the submissions in relation to groundwater are limited, there is some ability to better recognise groundwater and the risk of contamination from land use activities based on the submissions of Te Aroha Federated Farmers and Oji.

Question 9: Stocking rate

73. How would stocking rate be defined? The Panel would find it helpful if there was a definition of stocking rate or amendment in each rule to determine per hectare of what? Are different tests required for different purposes (eg erosion protection compared to stock exclusion)? (20 May)

Response (Jon Palmer/Matthew McCallum-Clark)

Stock Unit Measure Definition

74. In brief, the stock unit (SU) concept was first reported in 1929 as a means to assess economic performance in agriculture. In 1954, SUs were defined for measuring the carrying capacity of farms. Subsequently these standardisation factors were used to assess the productivity of different pastoral areas in New Zealand. In 1965 the "standard ewe" was described - upon which the SU system is now based.

75. Since then livestock in New Zealand have been commonly given a “stock unit” value or measure. The basic unit (one SU) is one breeding ewe that weighs 55kg and bears one lamb. The amount of feed consumed by this ewe over a year is approximately 550 kg of dry matter (this includes the feed consumed by her lamb up to weaning at 3.5 months. “Average” feed quality is assumed.

76. A heavier ewe, or a ewe that produces more lambs, will have a higher SU value, because of increased feed consumption. For example, ewes that weigh 65 kg and wean 120% of lambs, have a value of 1.2 SU.

77. Other livestock are measured by the same standard, e.g., a beef breeding cow is commonly given a value of 6 SU. In other words, a beef cow (with calf to weaning) consumes approximately six times the amount of feed as a “standard” ewe, over the space of a year. Likewise, dairy cattle are also given a SU value.

78. Stock Units are conventionally calculated for winter tally at 1 July each year. The so-called “stocking rate” of a farm can be calculated by dividing the total stock units wintered by the effective grazing area of the farm, e.g. 3000 s.u. ÷ 300 ha = 10 s.u./ha. This is reflected in the evidence of some hill-country farmers who refer to the stocking rate being the winter carrying capacity of the farm.

Definition – Revised Stock unit

79. The definition of a Revised Stock Unit (RSU) means the quantity of feed required by an animal per year, expressed in terms of energy. The standard is 6,000 megajoules (MJ) of metabolisable energy (ME) per year. If pasture has an average annual ME of 10.8 megajoules, then 555 kilograms of pasture is required to provide the 6,000 MJME.

80. The greater the pasture quality the less needs to be eaten to provide the animal’s required energy. Because the energy content of most pasture does not change annually (as farmers will ensure that correct nutrient inputs are applied to maintain quality), then the energy requirement can be used as a measure of Stock Unit.

81. One stock unit remains as one 55 kg ewe bearing one lamb – that will require 6,000 MJME in energy. A beef cow requires 6 times the energy of one 55 kg ewe bearing one lamb (36,000 MJME), so is rated as 6 stock units.

82. RSU is influenced by the type of animals (breed, class, sex etc), the weight of the animals (feed required to maintain a given weight), the weight gain of the animals (feed required to maintain AND increase weight) and age of the animals. RSU is also influenced by whether the animal is pregnant or lactating because of the additional

energy demands of breeding. On this basis, the RSU is better suited to an 'annual average', rather than just the winter stock carrying capacity.

83. Stock unit measures apply to the effective grazed areas of a farm (pasture and crops). Stock unit obviously does not apply to non-effective areas of a farm including riparian areas, forestry, laneways, and sheds because stock do not graze these areas.

84. Another way of looking at the definition of effective area is the areas that stock have access to for grazing (so would not include fenced off riparian areas and forestry etc).

How Stocking Rate is used in Overseer

85. The reported stocking rate shows the total revised stock units (RSU) and estimated RSU per hectare for each enterprise (sheep, beef, deer, dairy etc). A revised stock unit (RSU) enables the carrying capacity of dairy and non-dairy systems to be compared, based on feed intake.

86. The OverseerFM reporting outputs shown for each enterprise are:

- Total farm: Total stocking rate estimated as total RSU divided by total farm area (RSU/ha)
- Grazed area: Stocking rate on grazed pasture estimated as total RSU divided by grazed area (pastoral blocks).
- Total: The total carrying capacity as RSU.
- Pasture eaten: Carrying capacity based on pasture intake (ME of pasture consumed by animals). This is pasture consumed on all block types. As the amount of supplements fed out increases, 'Pasture eaten' RSU decreases as a proportion of total RSU.
- Time on pasture: RSU estimated from feed consumed while on pastoral blocks. Includes ME supplied from pasture together with supplements and crops fed on pastoral blocks. As the amount of supplements directed to structures increases, 'Time of pasture' RSU decreases as a proportion of total RSU.

87. Overseer calculates RSU from the stock that are entered, their weight, weight gain, or age (where animals are assigned a national default weight gain), their breed, class, and breeding status.

88. Overseer then calculates (from RSU) the total energy requirements of the stock present and then calculates the pasture growth required.

- If crops are grown on farm then the MJME provided by the crop is accounted for in the total energy requirements and then the predicted pasture growth for the pasture on the rest of the farm.
- If supplements are grown and sold off farm, Overseer will increase the predicted pasture growth to predict the requirement for the RSU (or stock entered).
- If supplements are imported onto the farm then Overseer will decrease the predicted pasture growth to predict the balance requirement for the RSU (or stock entered).
- If pasture quality is altered in the model, predicted pasture growth will also be changed to the model "balance" feed demand (governed by RSU) to feed grown.

89. For more information, see the Stock Unit Calculator (Appendix B) and Overseer Animal Report User Guide (Appendix C).

90. On this basis, Officers consider 'stocking rate' is the stock units per hectare averaged for the year and for the property. As detailed above, the hectares considered for the averaging are the hectares actually used for grazing, so an area used for forestry or a harvested arable crop would not be counted. Appropriate definitions and clarity where 'stock units' or 'stocking rate' is used in the rules will be included in the final recommendations from the Officers.

Question 10: Non-point source discharges

91. How are non-point source discharges dealt with such as road-runoff, in PC1? (20 May)

Response (Matthew McCallum-Clark)

92. The management of non-point source discharges in PC1 focusses on farming. Other sources of non-point source discharges, such as from urban areas or road run-off are dealt with in other sections of the Waikato Regional Plan.

93. Runoff from roads and from subdivisions are addressed primarily through Permitted Activity Rule 3.5.11.4, which allows the discharge of stormwater to water or Rule 3.5.11.5 which provides for the discharge of stormwater to land. If these rules cannot be complied, with the activity typically becomes a discretionary activity.

94. NZTA and territorial authorities are now getting discharge consents for most new roads as the roads cannot comply with the permitted activity conditions. Many

territorial authority roading projects now have comprehensive resource consents for road stormwater runoff and have treatment for contaminants in place to protect water quality.

95. These provisions will soon be reviewed under the wider Regional Plan review project, currently underway.

Question 11: Rule 3.5.5.1

96. Does the notified consequential change to Rule 3.5.5.1 work given that the performance standards refer to volume per hectare? (20 May)

Response (Matthew McCallum-Clark)

97. Rule 3.5.5.1 is a rule that permits "the discharge of contaminants onto land outside the Lake Taupo Catchment from the application of farm animal effluent (excluding pig farm effluent)." This is the rule that permits discharges to land containing farm effluent, mostly dairy shed effluent and wash-down.

98. The changes proposed in PC1 are to amend the beginning of the rule so that it reads "the point-source discharge of contaminants…" and to include a new advisory note clarifying that diffuse discharges are managed under Chapter 3.11. The reason for these changes was to distinguish the management of point-source discharges under Rule 3.5.5.1 from the management of diffuse discharges under Chapter 3.11 (introduced by PC1).

99. The WRP defines both point-source and diffuse discharges as follows:

- Diffuse discharge means the discharge of contaminants that results from land use activities including cropping and the grazing of livestock and includes non-point source discharges.
- Point source discharge means discharges from a stationary or fixed facility, including the irrigation onto land from consented and municipal wastewater systems.

100. Officers consider there is a clear distinction between diffuse discharges and point-source discharges, as the latter originate from a stationary or fixed facility. In this context, the condition restricting loading rates is appropriate.

Question 12: Upper Waipā River

101. Where does the Upper Waipā River fit in the categorisation of water quality monitoring showing sediment levels? It is noted in the S42A report that monitoring of sediment levels are low to moderate in the Upper Waikato River? (20 May)

Response (Matthew McCallum-Clark)

102. The routine water quality network looks at turbidity and clarity and this is supplemented with a dedicated network looking at sediment from flood events.

103. There is variation in clarity in the upper Waipā. In the headwaters of the Otewa for example, the movement of sediment is more episodic and driven by flood events which provide more energy to carry the larger particle sizes. The Tunawaea slip is an example of such a process and additionally sediment deposition has led to consequential erosion along the river banks as the bed had aggraded. Clarity in the Waipā at Otewa is over 2.0 m (median black disk 2010 – 2014), meaning relatively good clarity under baseflow conditions. Other upper catchment tributaries, such as Waitomo, and Mangapu, have finer particles that are carried at a wider range of flows and therefore reduced water clarity (median black disk approx. 0.6m over 2010 - 2014) over a wider range of flows.

104. Figure 1 from 'Visual clarity of the Waikato and Waipā Rivers' TR 2015/13R shows the situation over the two catchments:

Question 13: E. Coli in hill country streams

105. What is the evidence base for there being an E. coli problem in hill country streams? Please specify any relevant technical reports or references to this issue and in particular any evidence of monitoring data exceeding national bottom lines for E. coli. Hill country farmers make the point that almost all monitoring points are in effect down on flats and aren't actually measuring hill country water quality. (20 May)

Response (Mike Scarsbrook)

106. Research carried out at Whatawhata Research Station in the mid-1990s to mid-2000s has demonstrated E. coli problems in small headwater streams in Waikato hill country. Below is a summary of relevant papers based on this research.

Donnison, A., Ross, C. & Thorrold, B. (2004). Impact of land use on the faecal microbial quality of hill-country streams. *New Zealand Journal of Marine and Freshwater Research, 38:5*, 845-855.

- This study assessed hill-country streams in the Whatawhata district that were impacted by pastoral farming, indigenous forest, or Pinus radiata forest by measuring E. coli bacteria at 14 sampling sites fortnightly for 2 years. E. coli concentrations were highest in streams flowing through grazed pasture.
- The percentage of samples in which water quality was satisfactory for contact recreation was 32% for pastoral streams, 56% for indigenous forest streams, 69% for 7-year pine streams, and 89% for New Pine-streams after planting. On the remaining sampling occasions the water was categorised as either poor or very poor and its use for recreation would not be recommended.

Collins, R. & Rutherford, K. (2004). Modelling bacterial water quality in streams draining pastoral land. *Water Research, 38(3)*, pp.700-712.

- This study developed a dynamic bacterial water quality model that couples catchment and in-stream processes for grazed hill-country catchments in New Zealand (calibrated against Whatawhata data).
- A daily record of grazing livestock is used to estimate E. coli inputs to a catchment, and transport of bacteria to the stream network is simulated within surface and subsurface flows. Deposition of E. coli directly to streams is incorporated where cattle have access to them, and areas of permanent saturation ('seepage zones') are also represented.

Collins, R., Elliott, S. & Adams, R. (2005). Overland flow delivery of faecal bacteria to a headwater pastoral stream. *Journal of Applied Microbiology, 99(1)*, pp.126-132.

- This paper outlines an experimental rainfall simulator study at Whatawhata. The results from this study indicate that overland flow can transport substantial levels of faecal bacteria upon steep pastoral land, delivering them directly to the stream network.
- The statistical relationships derived in this study indicate that levels of E. coli in pastoral streams will reflect, in part, the stocking history of the contributing catchment.

107. Officers acknowledge that many of Waikato Regional Council's monitoring sites are in the lower parts of catchments and that this does not necessarily reflect water quality

in the hill country. However, there is considerable evidence to suggest that run-off from hill country and direct stock access are important sources of E. coli in hill country streams. Council staff have suggested to those farmers that they undertake their own sampling at what they consider to be more representative sites but believe that the results are likely to show similar patterns to those established at Whatawhata.

Question 14: Inanga spawning maps

108. Are inanga spawning maps, held by WRC, able to be used in PC1? (In response to Kathryn McArthur's evidence)? (20 May)

Response (Matthew McCallum-Clark/Ruth Lourey)

109. WRC has been provided with some locations of recorded inanga spawning sites by NIWA. These are a few dozen sporadic points in the lower catchment. Kathryn McArthur's evidence (and the DoC submission) suggests there is some predictive modelling available. On investigation, this is quite crude and covers extensive areas (see extract in Appendix D). This is not as targeted as the modelling described in the submission (as was undertaken for Canterbury).

110. Officers do not recommend including either the known sites or the outcomes of the predictive modelling. In part, this is based on the limited scope to include mapping, certainly of extensive areas and the more restrictive rule implications that may result. The relevant part of the DoC submission states:

New Policies

Īnanga spawn in the lower Waikato River, amongst riparian vegetation at the upper tidal extent during high spring tides. Early records suggest that this occurs on the Waikato River downstream of Tuakau, although modelling of the MHWS90, LiDAR data and any recent spawning records held by WRC would better predict the available spawning habitat for īnanga, similar to methods used by Canterbury Regional Council.

The Director-General is aware that some work has already been completed for Lakes Waahi and Whangape and the lower Waikato River (footnote 9 - https://www.waikatoregion.govt.nz/services/publications/technical-reports/tr/tr201424).

Policies and rules are needed to protect īnanga spawning sites.

Relief sought

The Director-General considers that additional policies and rule(s) are required to protect spawning habitat.

111. Officers consider that the kind of mapping anticipated in the submission does not presently exist, and is therefore more appropriate for a future plan change.

Questions 15 and 16: Māori-owned land in PC1

112. What is the percentage of land in PC1 that is Māori-owned land? What percentage of that is undeveloped? (20 May)

113. What is the approximate relationship in terms of relativity of the area of undeveloped Māori land and underdeveloped non- Māori land? (20 May)

Response (Ruth Lourey/Matthew McCallum-Clark)

114. Overall the percentage of land of Māori owned land in the PC1 catchment is estimated at 9%. This represents 105,176 ha of 111,1287 ha in the catchment (Data source #3751348 spreadsheet). This is all land identified as Māori owned, and is a higher percentage than land to which Policy 16 would apply.

115. For the purpose of this analysis, developed farm types are assumed to be horticulture, dairy and lifestyle blocks. Under-developed farm types are defined as drystock, forest or other. Seventy eight percent (39,000 ha) of Māori owned farmland in Land Use Classes 1-4 is under-developed, compared with 45% (215,000 ha) of non- Māori owned farmland. Refer to Table 1 below.

Table 1: Developed and under developed Māori Owned land and non-Māori owned land

	Māori Owned		**Non- Māori owned**	
Land-use class	**Hectares under-developed***	**% under-developed**	**Hectares under-developed**	**% under-developed**
1	53	55%	10,785	51%
2	1,074	47%	52,803	35%
3	11,237	72%	59,312	42%
4	23,483	84%	92,215	54%
Total (1-4)	**35,847**	**78%**	**215,115**	**45%**

*Developed farm types are assumed to be horticulture, dairy and lifestyle blocks. Under-developed farm types are defined as drystock, forest or other.

Data Source: Farm type is from Agribase and the landuse data is form Land cover data base (from LCDBv4).

Question 17: Modelling developed ancestral land

116. Does the modelling show an 'over-shoot' if Tangata Whenua ancestral land can be developed so that the outcomes of Scenario 1 can still be achieved? Does it follow that the policy package in PC1 is more restrictive than necessary to achieve the Table 3.11-1 numerical values? (20 May)

Response (Matthew McCallum-Clark/Ruth Lourey)

117. Yes, the policy mix modelling shows an apparent 'over-shoot' relative to the short-term targets of PC1 (as distinct from the long-term outcomes of Scenario 1). This is one of the reasons why those short-term targets can still be met with the simulated level of development of Tangata Whenua ancestral land. The other reason is that potential losses under these development scenarios are small compared to overall losses because the level of development simulated is small relative to the already developed land in the Waikato-Waipā catchment (about 1%), the affected land is dispersed across the catchment (so its effect is 'diluted' rather than concentrated in a sub-catchment) and the development is subject to PC1 policy requirements such as fencing, farm environment plans, and operating at less than the 75th percentile N leaching limit.

118. The policy mix modelling shows a range of predicted outcomes with the potential for an 'over-shoot' in the short-term targets for the contaminants in most locations. However, there is an important – that is, the model predicts water quality outcomes when PC1 mitigation actions are all fully implemented and when those mitigations become fully effective and fully reflected in surface water quality. These conditions will not be met during the period of PC1. The variables associated with implementing the tailored FEPs - that is, which actions will be implemented where at what time, and with what response time before being evident in the water—means that it is not possible to quantitatively determine the time path of water-quality improvement arising from the policy mix, only the expected end-point. Suffice to say that the mitigation actions contemplated by PC1 will likely improve water quality at most locations beyond the 10% step towards Scenario 1 as presented in Table 3.11.1, but that such an overshoot is unlikely to be widespread within the period of the plan.

Question 18: Ancestral lands

119. Is there an issue with the PC1 definition of Tangata Whenua ancestral lands in relation to 'returned'? And does it apply to Wairarapa Moana? The Panel noted they received land through settlement in the catchment however it is arguably not ancestral land returned as they are an iwi from Wairarapa. (20 March)

Response (Matthew McCallum-Clark)

120. Section 6(e) of the RMA states that all persons shall recognise and provide for the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga. The definition of tangata whenua ancestral lands in PC1 gives effect to Section 6(e) as land that has been returned through Treaty of Waitangi settlement processes. This provides for the relationship Māori have with their ancestral lands and does not apply to Wairarapa Moana as the settlement land they received is not ancestral land that has been returned. Also, Wairarapa Moana are not tangata whenua of the Waikato and Waipā River Catchments. Officers understand CSG and WRC made a deliberate decision on this point, and therefore the existing definition aligns with this decision.

Question 19: Policy 10

121. Can Policy 10 be read as a Controlled Activity Rule policy? If that's not the intention, can clarification of the correct intention be provided? (20 May)

Response (Matthew McCallum-Clark)

122. That is one possible interpretation of Policy 10. In the Officers' opinion, "provide for" does not mean "permit" or "always grant", although it is accepted that it has quite an enabling implication. An alternative wording, considered during drafting of the s42A report, was to reduce this positive implication in the chapeau of Policy 10. At the time, on-balance, it was considered that the existing wording was better supported by the RPS. However, the RPS is not particularly directive on this matter. A revised wording, which may also have the appropriate balance is 'new' infrastructure or industry was to be included, could be:

When deciding resource consent applications for point source discharges of nitrogen, phosphorus, sediment and microbial pathogens to water or onto or into land, ~~provide for~~ have regard to the benefits of:

a. Continued operation of regionally significant infrastructure; and

b. Continued operation of regionally significant industry.

Question 20: Numeric value for the 75th percentile

123. At what point in time would the information be able to be made available to derive the number for the 75th percentile? How do the dates for the 75th percentile, the NRP and the staging of the priority sub-catchments align? (20 May)

Response (Matthew McCallum-Clark)

124. Three timelines are attached in Appendix E. These show the complete set of timelines for NRPs, priority catchments dates, stock exclusion etc. The first is for the notified plan (as amended by Variation 1), the second includes the dates in the s42A report, and the third is the Officers' current thinking regarding dates to recommend at the close of the hearings process, assuming that a 2026 'deadline' was to be maintained.

References

Collins, R., Elliott, S. & Adams, R. (2005). Overland flow delivery of faecal bacteria to a headwater pastoral stream. *Journal of Applied Microbiology, 99(1)*, pp.126-132.

Collins, R. & Rutherford, K. (2004). Modelling bacterial water quality in streams draining pastoral land. *Water Research, 38(3)*, pp.700-712.

Donnison, A., Ross, C. & Thorrold, B. (2004). Impact of land use on the faecal microbial quality of hill-country streams. *New Zealand Journal of Marine and Freshwater Research, 38:5*, 845-855.

Doole et al (2016). Simulation of the proposed policy mix for the Healthy Rivers Wai Ora process. Waikato Regional Council Technical Report 2018/59

GMD Consultants. (2015). Collaborative Stakeholder Group Values and Uses - Gaps analysis. Document 3431297.

White et al (2015), Groundwater resource characterisation in the Waikato River catchment for Healthy Rivers project. Waikato Regional Council Technical Report 2018/33

Appendix A: Collaborative Stakeholder Group Values and Uses: Gap Analysis

2015

Collaborative Stakeholder Group Values and Uses

GAP ANALYSIS

GMD CONSULTANTS

PURPOSE

To identify if there are any values and uses missing from the Collaborative Stakeholder (CSG) list of values and uses. An overview of the gap analysis is to be reported to CSG13 on 2/3 July.

AIM

To contribute to the CSG recommendation on the values and uses to the Healthy Rivers Wai Ora Committee in August 2015.

BACKGROUND

The CSG has been working on a list of values and uses as required by the NPS for Freshwater Management for some time. The values will ultimately be used as a basis on which to develop resource management policy to manage adverse effects. These values and uses may be added to or amended over the development period of the project, however it is has been considered desirable for CSG to recommend their values and uses to the Health Rivers Wai Ora Committee in August 2015.

SCOPE

Scope is limited to values and uses related to water quality, and using the list of resources provided by the Project Manager for Healthy Rivers Wai Ora as follows:

- Waikato-Tainui Environmental Management Plan, August 2013.
- Raukawa Environmental Management Plan, 2015.
- Te Arawa Environmental Management Plan, 2015.
- Maniapoto Draft Environmental Iwi Management Plan, 30 April 2015.
- Ngāti Tūwharetoa Environmental Iwi Management Plan, 2003.
- Ngati Tahu-Ngati Whaoa Iwi Environmental Management Plan - Rising Above the Mist.
- Raukawa Charitable Trust presentation to CSG.
- Waikato River Authority presentation to CSG.
- Powerpoint from CSG9, Tim Manukau, Waikato-Tainui.
- Waikato-Tainui Presentation to CSG, Waikato-Waipa Fisheries Taonga.
- Farm Plans - Presentation to CSG, Beef and Lamb NZ.
- Te Awa - The Great New Zealand River Ride - Presentation to CSG.
- Hamilton and Waikato Tourism - presentation to CSG,.Kiri Goulter.
- Fish and Game New Zealand - presentation to CSG.
- Pukekohe Vegetable Growers Association - presentation to CSG.
- Waikato and Waipa River Iwi Values Document Review – Waikato Economic Joint Venture study
- Literature review: Mātauranga Māori workstream - Healthy Rivers Plan for Change: Waiora He Rautaki Whakapaipai

METHODOLOGY

An existing list of values was used as the basis on which to identify gaps (the 'short list'). The short list provides overarching value and use themes, and is complemented by a more detailed breakdown of the specific values that sit within the overarching value (the 'long list'). Both lists are found in **Attachment Two**. Values identified in the documents listed above have been assessed against the values of the short list, however the long list provided assistance in determining what the short list value consisted of. Gaps were determined on the basis that they were not a component that was clearly captured by the short list.

SUMMARY OF GAP ANALYSIS

A small number of potential gaps have been identified, and the CSG may which to consider whether:

1. The value identified as a gap is added to the list of values and uses as an overarching theme (short list); or
2. The value identified as a gap is covered by one of the overarching themes in the short list, but should be added to the long list to make it clear that the overarching theme includes this aspect.

Potential gaps in values and uses that have been identified are:

Accessibility	The existing short list identifies accessibility for collection of mahinga kai as an overarching value. However the gap analysis has identified a broader scope of accessibility values, particularly associated with public access for amenity and recreational purposes. CSG may wish to consider broadening the scope of accessibility as a value.
Clothing	In a statement of significance in the Te Arawa River Iwi Trust Fish Plan (captured in the Maatauranga Maori Literature Review), Te Arawa describe the Waikato River as a source of clothing. No further detail is provided. CSG may like to research this value further to determine if it should be included.
Protection (security)	In a statement of significance in the Te Arawa River Iwi Trust Fish Plan (captured in the Maatauranga Maori Literature Review), Te Arawa describe the Waikato River as a source of protection. No further detail is provided, and this may not be connected to water quality. CSG may like to research this value further to determine if it should be included.
Tradable goods	In a statement of significance in the Te Arawa River Iwi Trust Fish Plan (captured in the Maatauranga Maori Literature Review), Te Arawa describe the Waikato River as a source of tradable goods. No further detail is provided, but this matter could include mahinga kai or water supply. CSG may like to research this value further to determine if it should be included.

Relevant sections of the resources provided, and linkages to existing values, or gaps, is found in **Attachment One**.

Attachment One

Community Values Freshwater Quality Review

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
Waikato-Tainui Environmental Management Plan, August 2013. **Waikato-Tainui.**	**Natural Resources and Environmental Management Objectives: Te Ture Whaimana - The Vision and Strategy for the Waikato River** **Te Ture Whaimana prevails** Te Ture Whaimana prevails in any resource management, use and activity within the Waikato River catchment in the Waikato-Tainui rohe.	• General link – Vision and Strategy to prevail	None, if all values considered to be embodied by the Vision and Strategy are considered to be captured in the short/long list.
	Section D19 – Freshwater Summary of the Waikato-Tainui view of water, and regard for its use can be broadly noted as the following: (a) **Wai Ora** – Life giving and sustaining. These waters are generally regarded as pristine, sanctified water, primarily used for "higher" purposes such as ceremonial use, blessings, cleansing of chiefs etc. These waters are generally spring waters (puna), or in areas specifically designated for higher purposes. These waters must be protected. (b) **Wai Maaori** – Useable for general purposes. These are waters that can be used for general purposes such as drinking, recreation, sustenance,	• Wai tapu • Mahinga kai • Human health for recreation • Water supply • Commercial, municipal and industrial use • Ecosystem health	Accessibility

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	economic use and provision for food gathering. Waters used to sustain the marae functions should be protected for marae use. Waters used for general purpose should be managed in a way that ensures the future of the tribe can be sustained. (c) **Wai Kino** – Waters of limited use. These waters can still be used generally, but may have limited ability to sustain life or to be safely used due to poor water quality, accessibility, or other limiting factors. These waters require greater management to ensure safe and optimal use. (d) **Wai Mate** – Waters that have exceeded the ability to properly sustain life. These waters are regarded as not fit for human or certain productive use. To some they are identified as 'dead' waters, but to Waikato-Tainui, no water is regarded as being 'dead', as all things, including water, have mauri. Therefore, these waters must be better managed and restored to a higher quality. **19.1.3** The classification of water into the above 'states' of water should be determined by whaanau, marae, hapuu, and iwi who are kaitiaki and/or exercise mana whenua over part or all of a water body, and be incorporated in the future of water management.		
	The relationship between Waikato-Tainui and Water	• General link – Historical connections with the Waikato River	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	19.3.2 The regard that Waikato-Tainui has for the Waikato River cannot be understated. Historically, through tikanga and kawa, Waikato-Tainui learned how to manage water bodies to ensure their capacity to sustain the tribe. Over many generations, successive governments, and the development of plans and policies that dictate the management of all water bodies, the ability of Waikato-Tainui to actively manage its waters diminished.		
	Water Quality **19.3.4** The quality of water determines the relationship that the tribe has with its waters. Environmental degradation, at a national level, has occurred at a large cost and the physical, chemical, and biological quality of water has deteriorated as a result of both point source pollution (discharges into a body of water at a single location), and non-point source pollution (contamination from diffuse sources). The waters of the Waikato region have been modified to support economic gains, and the impacts of previous poor management practices are increasingly being seen. As a result, human impacts from such uses as farming/agriculture, wastewater discharges, damming, horticulture, urban development, alterations to the natural hydrology (straightening) of rivers and streams, and forestry conversions have modified natural water flows and increased the degree of contaminants that a water body receives resulting in a decrease in water quality of rivers and streams, and forestry conversions have modified natural water flows and the degree of	• Ecosystem health • Natural form and character	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	contaminants that a water body receives resulting in a decrease in water quality.		
	Objective – water quality **19.4.2** Water quality is such that fresh waters within the rohe of Waikato-Tainui are drinkable, swimmable and fishable in all places (with water quality to the level that Kiingi Taawhiao could have expected in his time).	• Water supply • Mahinga Kai • Human health for recreation	
	Section D20 – Wetlands **20.1.2** For Waikato-Tainui, the lower Waikato wetlands are areas of huge significance. Due to the concealing nature of wetlands, people would store and preserve taonga within them, thus ensuring the safety of those taonga. Key wetlands continue to conceal the *koiwi* of Waikato-Tainui tuupuna who lost their lives during the battles of Rangiriri and Meremere in 1863.	• Wai tapu	
	20.1.3 Wetlands are an integral component within the whakapapa of Waikato-Tainui rivers and lakes. They provide important spawning grounds and habitat for fish and other taonga species. They also provide important ecosystem services such as reducing peak flood flows, increasing low flows, and trapping and removing sediments and nutrients	• Ecosystem health	
	Historical Significance of fisheries taonga to Waikato-Tainui	• Mahinga Kai	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
Waikato-Tainui Presentation to CSG, Waikato-Waipa Fisheries Taonga. **Nick Manukau,** **Waikato Tainui.**	• Abundant, found in all waterways, easily caught and highly nutritious • Ancestors obtained 90% of protein and essential fatty acids from freshwater shellfish/fish, in particular tuna • History of Waikato-Tainui and tuna are intertwined - Stories, songs, carvings, battles and sites associated with tuna • Guardians of the Kiingitanga		
	The importance of Tuna to Waikato-Tainui "...the Waikato River, with its tributaries, was the most celebrated in New Zealand for its Paa-tuna and the quantities of eels found there. The Mangatawhiri, the Maramarua, the Whangamarino, the Mangawara, the Waipa, the Awaroa, the Oopuatia, and the two lakes Waikare and Whangape, all in the middle Waikato, were famed for their eels…" Downes (1918)	• Mahinga kai	
Raukawa Environmental Management Plan 2015. **Raukawa Charitable Trust.**	We consider that water is not separate from people, is not separate from its surrounds and therefore cannot be separated, or assessed in isolation, from the environment as a total entity. We regard all water as a connected and living entity, including: constituent parts (i.e. surface, banks, bed, flood plains etc.), intrinsic values, and meta-physical being.	• Ecosystem health • Natural form and character • Mahinga kai • Human health for recreation	Accessibility

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	All water bodies are significant within the Raukawa takiwā, and the mauri and mana of our waterbodies and all catchments are sustained and enhanced. Ecosystems and the riparian margins of waterbodies are healthy, diverse, and resilient. Waterbodies are accessible and safe to swim in, and take food from, all year round.		
	Objectives • The mana and mauri of water is safeguarded for present and future generations.	• Ecosystem health • Natural form and character	
Raukawa Charitable Trust presentation to CSG. **Stephanie O'Sullivan, Raukawa Charitable Trust.**	Discussion on the following points: • How might Raukawa see values? Will we use a different set of values for water quantity? Same values apply from Raukawa perspective • Mana atua: Mauri, mana, wairua Ecosystems, fish, natural character. Note: Mana atua values have precedence in Vision and Strategy by Objective I. • Mana whenua – cultural/spiritual uses • Mana Tangata – mahinga kai, ara haere, recreation. • Noted that targets and limits get set on the attributes not on values. • The indicators that mean that the value is present and enhanced were discussed. Land and water is inseparable. Not simply a matter of pulling water out of the river and using it. Can't just look at it as a use. Growers are proud of the fact they produce food.	• Ecosystem health • Natural form and character • Mahinga kai • Wai tapu • Human health for recreation • Water supply • Geothermal	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	• Discussion on what are the values of the rivers to be enhanced to achieve this use? What values with the water will not change over time. Agree with what is core to the business of the CSG are the values of water that impinge on water quality. For the hydro company the river has changed its shape – how that relates to water quality is a question – the form of the environment has change. • Are the values in the Vision and Strategy clearly articulated so we can apply them to water quality? (Swimmable, safe to take food from are values clearly stated in the Vision and Strategy for whole catchment) • Does the Vision and Strategy take pre-eminence over values (national values) in the NPS-FM? Yes the Vision and Strategy has precedence. Are they consistent? Values consistent but attribute levels may not be e.g. NPS-FM/NOF stipulates 'wadeable' Vision and Strategy requires swimmable • How might Raukawa see values? Will we use a different set of values for water quantity? Same values apply from Raukawa perspective. Raukawa have modified the Mana Atua Mana Tangata framework being used nationally. Kaumatua from Raukawa suggested also including Mana Whenua as a category of values. Mana atua includes natural character, biodiversity, ecosystem. Our values have captured this. Mana whenua includes spiritual		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	and cultural uses. Some of the mana whenua values are sort of in there. Mana tangata are use values for people. • Geothermal is a natural asset not a value in itself. • A lot of mātauranga Māori has been lost over the last 150 years. Raukawa are going through a process to work through this issue. All river iwi are at a different phase at being able to do this. There are some fundamental objectives in the Vision and Strategy that will be consistent across river iwi. • Part of the problem is taking it as one part of the project rather than as part of the whole picture. Given the interrelationship – do we need some wider debate around the whole picture? • Tautoko the health and wellbeing of the Waikato River being the paramount overarching value. • The Vision and Strategy looks at the whole catchment, including the tributaries. • Are different parts of the river are valued for different uses? If your baseline indicators are ok, safe to take food from and safe to swim in throughout, then many other values are also protected. • Values from Raukawa are the same for both water quality and water quantity. • Note the wording in the Vision and Strategy is 'Safe to take food from' – not 'fishable'		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
Waikato River Authority presentation to CSG. **Phil Gurnsey.**	Summary of discussion: • They would like to see the values and uses distinct. Values include underlying aspects such as mana, mauri, wairua. • They anticipate seeing a process where values are identified, then the development of limits and targets and then asking what do those limits and targets mean in terms of the activities and uses for the rivers. • The Vision and Strategy is the overarching guiding document. Vision and Strategy should give a clear guidance in terms of what the values should be. The words restore and protect are emphasised in the Vision and Strategy. • Mana atua model from LAWF should also provide some ideas in terms of values for water. NPS values should give a good steer. • Suggest that river iwi could contribute to the values before we start to move into the uses of the river. • What are the intrinsic values associated with water for its own sake. We don't see farming as a water value, would see it as a use to take into account. • Need the health of the water to sustain values. • Wouldn't see geothermal as a value in its own right. • Look at uses that will be impacted upon, at end. • Settlement legislation has the requirement for improvement of water quality throughout the catchment over a long period of time. Every	• Ecosystem health • Wai tapu • Natural form and character	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	action that is being undertaken needs to improve the condition of the river to a state that it can be swum in. Looking for an opportunity for protection and restoration through every resource consent. Very clearly articulated in a recent environment court decision. Puke Coal ltd v Waikato Regional Council. 2014 Environment Court 223. Court taken some time to note the Vision and Strategy. Maintain might not achieve the Vision and Strategy objectives. • Policy selection criteria needs to contain this from Vision and Strategy.		
Te Arawa Environmental Management Plan 2015. **Te Arawa River Iwi Trust.**	Our aspirations are to rejuvenate and restore the mauri of the Waikato River, to be progressive and innovative in our approach, to work collaboratively, and to hold steadfast to those things that are important and make us unique. **Our Vision:** To support Te Arawa River Iwi collectively and individually to assert mana awa and improve the health and wellbeing of the Waikato river, tributaries and environs.	• General link – aspirations and vision	
	Our Strategic Objectives: **Mana Tangata:** Enabling our people to participate in the restoration and protection of the Waikato River, tributaries and environs	• General link – strategic objectives	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Mana Taiao: Implementing measures to restore and protect the Waikato tributaries and environs		
	Objectives: Our Aspirations for Water - The interests and values of Te Arawa River Iwi associated with the Waikato River and its tributaries are acknowledged and reflected in resource management policy, processes and decisions - The health and wellbeing of the Waikato River and its tributaries is restored and enhanced so that: a. Water is clean enough for mahinga kai, drinking and swimming b. Freshwater fisheries and customary resources are protected c. Waterways can be accessed for customary use e.g. food gathering d. Riparian margins, wetlands, lakes and mahinga kai resources are protected and restored - There is enough freshwater for drinking, land use, recreational and cultural use, while sustaining associated ecosystems.	• Mahinga kai • Ecosystem health • Human health for recreation • Water supply • Reference to 'land use' which could include: commercial, municipal and industrial use • Primary production	Accessibility
Maniapoto Draft Environmental Iwi Management Plan, 30 April 2015. **Maniapoto Maori Trust Board.**	**Freshwater Introduction** Maniapoto have a deep felt obligation and desire to restore, maintain and protect all of the waters that flow into and form part of Ngā Wai o Maniapoto, whether the waters are above, on or underground. Te Mana o Te Wai (the quality and integrity of the waters) is paramount. To maintain the integrity of Ngā Wai o Maniapoto, water and wastewater must	• Ecosystem health • Wai tapu • Mahinga kai • Human health for recreation • Water supply • Commercial, municipal and industrial use	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	remain within its catchment of origin, in order to protect the mauri of the water. The table below is a summary of the different states and uses of water for Maniapoto. **Wai ora** Life giving and sustaining. These waters are regarded as pristine and for higher purposes such as ceremonial use and blessings. These waters must be protected. **Wai Maori** General purpose use. These waters are available for drinking, swimming, recreation, economic use and provision for food gathering. Waters used to sustain the marae functions should be protected for marae use. These waters must be managed to sustain Maniapoto whānui. **Wai kino** Limited use water. These waters can be used for general purposes but will have limited capacity to sustain life or to be used safely due to poor water quality and other limiting factors. These waters must be managed to ensure safe and optimal use. **Wai Mate** Not fit for human consumption or productive use. These waters are considered to be unsuitable for human consumption and use and must be protected		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	from further degradation. The restoration of these waters must be managed to restore water quality and to ensure safe use.		
	Objective **Maintaining the integrity of Ngā Wai o Maniapoto** To restore the mauri of the water and protect te mana o te wai	• General link – restoration of mauri and protection of mana	
	Policy Water allocation is managed in a way that ensures the restoration and maintenance of the quality and integrity of ngā wai o Maniapoto, while contributing to long-term environmental, social, cultural and economic wellbeing.	• General link – Reference to contributing to long term environmental, social, cultural and economic wellbeing' could include: ○ Wai tapu ○ Mahinga kai ○ Human health for recreation ○ Water supply ○ Commercial, municipal and industrial use ○ Ecosystem health ○ Electricity generation	
	Policy Healthy populations of indigenous aquatic life are restored and maintained.	• Ecosystem health	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Policy Water quality supports healthy ecosystem functioning.	• Ecosystem health	
	Policy Sedimentation is managed to protect and restore the mauri of water.	• Ecosystem health	
	Policy Physical characteristics of ngā wai o Maniapoto are maintained and/or restored.	• Natural form and character	
	Objective **Water Quality, Quantity and Allocation** The relationship between Maniapoto and Ngā Wai o Maniapoto is protected and enhanced	• Wai tapu	
	Policy Te Mana o Te Wai continues to provide sustenance to Maniapoto (including physical and spiritual nourishment) and maintains the quality and integrity of Maniapoto whānau, hapū, marae and iwi.	• Wai tapu • Mahinga kai • Water supply • Human health for recreation	
	Objective **Water Quality, Quantity and Allocation** Ngā wai o Maniapoto are accessible to Maniapoto.		Accessibility
	Policy Recognise and protect Maniapoto access to and ability to undertake traditional activities and uses.	• General link – Reference to 'traditional activities and uses' could include: ○ Wai tapu	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
		○ Mahinga kai ○ Water supply ○ Human health for recreation ○ Transport	
	Objective **Wetland Mauri** Wetlands within the rohe are protected and restored.	• General link – protection and restoration of wetlands	
	Policy The quality and extent of existing and historic wetlands in the Maniapoto rohe is maintained and restored.	• Ecosystem health • Natural form and character	
	Objective **Wetland Mauri** The relationship between Maniapoto and wetlands is maintained, and enhanced through the restoration of wetlands, and access for cultural purposes is safeguarded	• General link – protection and restoration of wetlands, and access for cultural purposes, which could include: ○ Mahinga kai ○ Human health for recreation ○ Water supply	Accessibility
	Policy Use, management and restoration of wetlands provides opportunities for improving the wellbeing of Maniapoto through their relationships with and use of wetlands.	• General link – Reference to 'relationships with and use of wetlands' could include: ○ Wai tapu ○ Mahinga kai ○ Water supply	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
		○ Human health for recreation ○ Transport	
Ngāti Tūwharetoa Environmental Iwi Management Plan 2003. **Ngāti Tūwharetoa Maori Trust Board.**	**Te Waipuna Ariki** **Water** **Goals** Ngāti Tūwharetoa assert and exercise rangatiratanga and kaitiakitanga over waters within the Tūwharetoa rohe. Protect and enhance the mauri for future generations. **Policies/baselines** Advocate the protection of mauri of water through effective policy and planning instruments. Prohibit all discharge of human waste directly into waterways and promote effluent treatment acceptable to ngā hapū. Encourage the implementation of land based disposal systems e.g. dairy farm effluent. Support proposals that seek hapū involvement to improve water quality and promote efficient use of water quantity.	• Ecosystem health	
	Tauranga Ika **Fisheries** **Goals**	• Ecosystem health • Mahinga kai	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	The protection and enhancement of fisheries within Tūwharetoa rohe in accordance with the tikanga and kawa of ngā hapū o Ngāti Tūwharetoa. **Policies/baselines** Protect and enhance the mauri of the fisheries resource in accordance with the tikanga and kawa of ngā hapū o Ngāti Tūwharetoa.		
Ngati Tahu-Ngati Whaoa Iwi Environmental Management Plan - Rising Above the Mist. **Ngati Tahu-Ngati Whaoa Runanga Trust.**	**Statement of Significance** …. The Waikato River and its catchment is a resource of great cultural, historical, traditional and spiritual significance to the people of Ngāti Tahu-Ngāti Whaoa, Ngāti Kearoa Ngāti Tuara and Tūhourangi Ngāti Wāhiao. Our relationship with the Waikato River and its tributaries, and our respect for it, gives rise to our responsibilities to protect the River and all it encompasses, and to exercise our mana whakahaere in accordance with long established tikanga to ensure the wellbeing of the River…..	• General link – Reference to 'cultural, historical, traditional and spiritual significance' could include: • Wai tapu • Mahinga kai • Water supply • Human health for recreation • Transport	
	Tūranga whakahaere - Principles for Management of this Resource • Iwi have rights to/ over water including groundwater, rivers, lakes, tributaries and beds of waterways – as set out in the Statement of Significance in the Deed of Settlement for the Waikato River	• Ecosystem health • Mahinga kai • Human health for recreation • Wai tapu • Natural form and character • Water supply	Accessibility

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	• The Waikato River should not be expected to absorb any further degradation • The river should be swimmable and support healthy kai along its whole length • Waterways should be protected, but the iwi should not have to bear the economic cost of returning them to health (e.g. through development restrictions on returned tribal land in forest cover) • Ensure iwi involvement in monitoring, consents, plans and restoration projects, including rangatahi wherever possible • Management should be integrated and reflect the holistic, spiritual and inter-generational Māori world view • Protect headwaters (e.g. Tutukau Forest is important as a source for Mangatoetoe stream) • Strengthen linkages to the Waikato river (e.g. fenced waterways to create corridors) • See the whole picture – reinstate ecosystems and natural processes, protect sites of significance and traditional activity as well as enhancing water quality • Waterways each have their own mauri and should not be mixed; human sewage should not enter waterways • Vegetated riparian margins should be reinstated as they have multiple positive benefits for cooling the water, reducing sediment, returning birdlife and fish, and reinstating original plants; planting should use native species wherever possible, including those with traditional cultural uses. Riparian management is a necessary but insufficient step towards restoring		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	waterways – other actions are also required to address nutrients and other contaminants • Wetlands are precious and need to be protected and reinstated. Stock should be kept out of wetlands • Access and harvesting rights are important to enable iwi to make use of wetland and freshwater resources • The iwi must be involved in managing commercial fishing and customary takes, to ensure sustainable kai resources are available • Water storage can make more water available for use without affecting low flows, but care is required to maintain aquatic ecological connections (e.g. migratory pathways)		
Powerpoint from CSG9 **Tim Manukau, Waikato-Tainui.**	• Suggest Te Mana O Te Wai as an overarching value eg if swimmable and fishable (attributes) that means the mana is there (core value). • There is also the Mana Atua Mana Tangata Framework that shows the interconnected relationship between spiritual, intrinsic values and use values. • Values are interconnected and the relationships between them are important. Many of the values will be about relationships. • Suggest Te Mana O Te Wai as an overarching value eg if swimmable and fishable (attributes) that means the mana is there (core value). • There is also the Mana Atua Mana Tangata Framework that shows the interconnected relationship between spiritual, intrinsic values and use values.	• Human health for recreation • Mahinga kai • Wai tapu	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	• Values are interconnected and the relationships between them are important. Many of the values will be about relationships. • With regard to Mātauranga Māori and knowledge frameworks, TLG are working on identification of the five River iwi values and coherence between them.		
Farm Plans - Presentation to CSG. **Beef and Lamb NZ.**	Key elements: • Systems approach with data • Enable planned development • Ultimately achieve environmental and profitable outcomes – E.g. Fencing subdivision – contour, waterways • Farmer-driven and step-through levels • Continuous Improvement & Innovation • Compliance in the future Opportunities: • Productivity • Intensification in right areas • Improved efficiency • Other income streams	• Primary production	
Te Awa The Great New Zealand River Ride - Presentation to CSG.	Celebrating the Waikato River by linking community, culture and ecology through active experiences. **For The Environment**		Accessibility

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	By creating access to and along, the Waikato River, Te Awa will encourage the protection and restoration of our region's greatest landmark. **Creating access** Many sections of the river's edge are inaccessible, completely overgrown and under private ownership. The strong relationships held by Te Awa, are a vital first step to opening the doors that currently prevent most members of the community from accessing these sites.		
Hamilton and Waikato Tourism - presentation to CSG. **Kiri Goulter.**	**Value of Tourism to Waikato Region** $1.7b Waikato region visitor economy - International $400m - Domestic $1.3b Hamilton & Waikato $1b - International $200m - Domestic $800m Great Lake Taupo $400m - International $135m - Domestic $265m Coromandel $315m - International $65m - Domestic $250m **Waikato, Coromandel & Taupo Regions** • Visitor sector key contributors to regional economies • Well located for visitor flow & populations	• Commercial, municipal and industrial use • Human health for recreation	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified

	• Diverse tourism offer – abundant with natural resources - coastline, rivers, lakes, mountains, forests & pasture
	• Visitors want to engage and experience our environment
	• Provides an opportunity for recreation, learning, appreciation & sharing stories
	• Supports commercial activity
	• Quality of the visitor experience critical for
	  ○ Enjoyment
	  ○ Reputation
	  ○ Value for money
	  ○ Word of mouth		

Fish & Game New Zealand - presentation to CSG. **Corina Jordan.**	Promote integrated catchment of land and water resources to ensure the sustainable management of freshwater to provide for healthy ecosystems and recreational and amenity values.	• Natural form and character • Ecosystem health • Human health for recreation	
Pukekohe Vegetable Growers Association - Presentation to CSG.	For growers, the land, soil and water are the fundamental elements of their livelihoods that allow them to intensively and sustainably grow fresh vegetables. There is no doubt that any negative impact on any of these key elements would have a detrimental impact on their businesses. The PVGA works closely with our grower members to help ensure that we are proactive and looking for ways to continually improve the way we manage the resources entrusted to us. We see ourselves as "tenants" of the land, with which comes the	• Primary production	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	responsibility of ensuring the land is looked after and maintained for future generations of growers.		
Waikato and Waipa River Iwi values document review – Waikato Economic Joint Venture study. **Waikato Regional Council**	**Ngāti Tūwharetoa** **Taonga Tuku Iho** Lake Taupō and its rivers, tributaries and waters and the Waikato River are taonga of Ngāti Tūwharetoa. Lake Taupō and the Waikato River embody the mana and rangatiratanga of Ngāti Tūwharetoa (Tūwharetoa Māori Trust Board, 2010). Whakapapa links Ngāti Tūwharetoa to these taonga tuku iho with a commitment to nurture and protect the mauri of these taonga (Ministry for the Environment, 2009). **Mana whakahaere** Ngāti Tūwharetoa exercise the authority of mana whakahaere over their waters. As part of implementing the *2020 Taupō-nui-ā-Tia Action Plan: An Integrated Sustainable Development Strategy for the Lake Taupō Catchment*, Ngāti Tūwharetoa have partnered with community and local and central government agencies. **Mahinga kai** Tūwharetoa Māori Trust Board has a responsibility to manage access to native fisheries for customary use and the protection of mahinga kai (Tūwharetoa Māori Trust Board & Environment Waikato, 2004). Depletion of species is a concern.	• Wai tapu • Ecosystem health • Mahinga kai • Human health for recreation • Commercial, municipal and industrial use	Accessibility

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Economic There is also acknowledgement that Lake Taupō is an internationally renowned trout fishery and the tourism industry is based on the Lake's natural features and hydropower schemes (Ngāti Tūwharetoa Māori Trust Board, 2002). For Ngāti Tūwharetoa it was always intended by their, "tūpuna that Taupō Moana would provide both tangible and intangible sustenance for [the iwi]" (Tūwharetoa Māori Trust Board, 2010b, p. 14). With the establishment of the Taupō Waters Trust, the trust has the responsibility to protect, enhance and advance Taupō Waters for and on behalf of Ngāti Tūwharetoa. The strategy for the Taupō Waters Trust focuses on key objectives, including: • Best practice asset management of Taupō waters; • Commercial return on assets; • Financial prudence in decision-making; and • Positive relationships developed with users of Taupō waters. **Recreation** Recreational value is recognised as well as the potential for other recreational opportunities (Ngāti Tūwharetoa Māori Trust Board, 2002).		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Swimming was the main recreational activity identified by hui participants in the WRISS study. Places mentioned included Lake Aratiatia, Lake Whakamaru, Lake Atiamuri, streams and other parts of the Waikato River. Though swimming was still valued, many commented about not swimming in areas any more, for various reasons such as weeds, effects of dams, and erosion.		
	Te Arawa River Iwi Trust **Kaitiakitanga** One of the aims in establishing Te Arawa River Iwi Trust was to assist the three Te Arawa River Iwi to exercise kaitiakitanga over the Waikato river and its tributaries. **Mahinga kai** Loss of staple foods and kai species is a concern for Te Arawa River Iwi. Species identified included tuna, whitebait, kōura, kākahi, pīharau, kōkopu, kereru and watercress to name a few (NIWA, 2010c; Te Arawa River Iwi Trust, n.d.). Comments made by Te Arawa River Iwi hui participants as part of the WRISS study held at Mātārae marae reiterated the present scarcity of many kai species with the main causes attributed to the effects of dams, some geothermal activity and effects of farming practices. There was a desire to replenish stocks, not only for kai but to restore mana of the tribe.	• Wai tapu • Mahinga kai • Geothermal • Primary production • Human health for recreation • Commercial, municipal and industrial use	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Significant sites Numerous significant sites are located within the Te Arawa River Iwi rohe. The construction of dams and flooding associated with hydro-electric development resulted in the loss of many of these sites including whare, pā, kāinga, urupa, geothermal springs and the displacement of Te Arawa river people from their homes at Orākei Kōrako. **Economic** Te Arawa River Iwi own extensive areas of land. Much is multiply owned Māori land that includes (Te Arawa River Iwi Trust, n.d.): • Dairy farming of 4,000+ dairy cows • Sheep and beef with ownership of a sheep and beef station on the river • Geothermal power (Tauhara North No. 2, Ngāwapurua) and • Forestry and horticulture Te Arawa River Iwi aim to be the best farmers in the catchment in terms of cultural, environmental and economic sustainability. This includes conducting environmental audits, and the development and implementation of environmental plans for major land trusts (Te Arawa River Iwi Trust, n.d.) **Recreation** Iwi participants in the WRISS study discussed swimming, waka ama, camping and boating activities. Though it was noted that some areas		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	were unsuitable for swimming, it was deemed suitable in other areas. Lake Ohakuri was described as a place suitable for a range of recreational activities such as swimming, camping and waka ama (NIWA, 2010c).		
	Raukawa **Kaitiakitanga** Raukawa are kaitiaki of the Waikato river within their tribal boundaries and continue to exert the rights and responsibilities of kaitiakitanga. For Raukawa, "the Waikato awa has provided a source of spiritual, cultural, social, and physical sustenance for [their] people and in turn [the] role as kaitiaki embraces respect and an inter-generational responsibility" (Raukawa, 2009, p. 8). Raukawa, as kaitiaki within their rohe, "hold a unique and special responsibility under tikanga to preserve, protect and manage sustainably natural, physical and historical resources. The tribal aspiration is a future where cultural, social, environmental and economic objectives are balanced not only for tribal members but those people living within the tribal rohe" (Raukawa Settlement Trust, 2010, p. 1). **Cultural Landscapes, Landmarks and Significant sites.** The Waikato River and its catchment forms a significant element of the Raukawa cultural	• Wai tapu • Makinga kai • Natural form and character • Human health for recreation	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	landscape. Within this landscape are many individual sites of importance. Raukawa have a rich association and relationship with the Waikato River. “The River runs through the centre of their rohe, and many sites within, and alongside, the River are important to them. Waka landing sites, food and material gathering sites, blessing and sacred sites are associated with the Waikato River” (Raukawa, 2009, p. 3). **Mahinga kai** Along with other sources of kai, the management of freshwater fisheries is of importance to Raukawa as confirmed in their Fisheries Plan (Raukawa Charitable Trust, 2012). Freshwater fish used to be plentiful and has been a significant food source for Raukawa. However, the fisheries have been negatively impacted by dramatic changes to the rivers caused by, “urbanisation, hydro development, introduction of exotic species, and the modification and intensification of land use” (Raukawa Charitable Trust, 2012, p. 4). **Recreation** The main recreational activities identified by iwi members at the WRISS hui (NIWA, 2010b) included: swimming, fishing, waka ama, boating and picnicking. Various locations were identified such as Lake Atiamuri, Lake Whakamaru, Lake Arapuni, and tributaries off Lake Karapiro and Lake Maraetai.		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Maniapoto *The essence and wellbeing of the Waipa is Waiwaia. Waipa she is the life blood of the people. Waipa she is the life blood of the land, verily she is! Indeed she is the unfailing spring of the earth!* *To Maniapoto the Waipa River has mana and in turn represents the mana of Maniapoto.* *The Waipa River is a single indivisible entity that flows from Pekepeke to its confluence with the Waikato River and includes its waters, banks, bed (and all minerals under it) and its streams, waterways, tributaries, lakes, fisheries, vegetation, floodplains, wetlands, islands, springs, geothermal springs, water column, airspace and substratum as well as its metaphysical elements with its own mauri.* **Kaitiakitanga** Integral to the mana of Maniapoto is the principle of kaitiakitanga. This is central to: • restoring the relationship of Maniapoto with the wai; • restoring and maintaining the ability to provide for and practice manaakitanga; • recognising and respecting kawa, tikanga, and kaitiakitanga of marae, whānau, hapū and iwi of Waipa river; and encouraging active involvement by Maniapoto in regard to their kaitiaki responsibilities.	• Wai tapu • Mahinga kai • Ecosystem health • Human health for recreation	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Te mana tuku iho o Waiwaia Refers to the obligation of Maniapoto to take care for and protect te mana tuku iho o Waiwaia. It is the ancestral authority handed down from generation to generation in respect of the spiritual guardian of the Waipa river – Waiwaia (Maniapoto Māori Trust Board, 2010). This requires developing an understanding amongst Maniapoto and Waipa river communities about the history of Waiwaia. **Te mana o te wai** Of significance to Maniapoto is the quality and integrity of the waters. Historically the waters provided, "sustenance to Maniapoto including physical and spiritual nourishment that has over generations maintained the quality and integrity of Maniapoto marae, whānau, hapū and iwi. **Mahinga kai** For Maniapoto, "the pollution, degradation and development of the Waipa River have resulted in the decline of its once rich fisheries and other food sources which had for generations sustained the people and their way of life and their ability to meet their obligations of manaakitanga; and that the decline has been a source of distress to Maniapoto" Maniapoto aspire to have more consistent access and availability of waterbased kai, e.g. eels, kaio (Maniapoto Māori Trust Board, 2007). Species identified included pīharau, tuna, kōura, kāeo,		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	kōaro, whitebait, mullet, mussels and pipi, many of which have disappeared or declined significantly. The Waipa River was also used for kānga wai, and kotero (Kowhai Consulting Ltd, 2002). **Taonga species** Numerous species have been acknowledged within the Waipa River catchment such as: whio, kaka, bats and native frogs at Mangatutu. Raupō reedlands located at Ruahoanga and, "moa bones, long tail bats, caves and king ferns at Te Raumauku... and native fish in many of the tributaries" (Kowhai Consulting Ltd, 2002, p.31). Other species include pūkeko, kāhu, ruru and kumarahou (a medicinal plant). One of the aspirations of Maniapoto is the regeneration of native bush and healthy waterways with abundant freshwater environments (Maniapoto Māori Trust Board, 2007). **Recreation** Swimming was described as the main recreational activity however as commented in one report: *As a result of pollution of the waters, the local hapū can no longer trust the safety of allowing their children to swim in the stream, or their families to catch eels from the stream for food.* *(Kowhai Consulting Ltd, 2002).*		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Though this comment was specific to Mangaokewa stream, the same sentiments were also mentioned of the Waipa River. *...if we are to regain some of the environmental health from the time of our tūpuna we must all herald a change in our own ways... we must give way to a new sound philosophy of responsibility or kaitiakitanga, one that ensures that a healthy, balanced and natural environment is paramount and that true wealth is to be found there.* *(Kowhai Consulting Ltd, 2002).* **Economic** Although Maniapoto are not opposed to development they view the detrimental effects to the environment due to agriculture, tourism, forestry, industry and urbanisation over time as unacceptable (Kowhai Consulting Ltd, 2002).		
	Waikato Tainui *To Waikato-Tainui, the Waikato River is a tūpuna (ancestor) which has mana (prestige) and in turn represents the mana and mauri (life force) of the tribe. Respect for te mana o te awa (the spiritual authority, protective power and prestige of the Waikato River) is at the heart of the relationship between the tribe and their ancestral river.*	• Wai tapu • Ecosystem health • Natural form and character • Human health for recreation • Mahinga kai	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Te Mana o te Awa – tikanga, whanaungatanga, kotahitanga, manaakitanga, mana whakahaere In recognition of the principle of te mana o te awa mentioned above, the concept of a Korowai is promoted representing a protective cloak laid over te awa tupuna (ancestral river), to respect and care for the River. The strands of the Korowai reflect the whakapapa uniting iwi with their River and with one another (Waikato-Tainui, 2009): *The whenu (shoulder sash), which tie the korowai are held by the representatives of the Houses of Pōtatau and Te Heuheu. Thus the Korowai concept is tikanga based, giving effect to the tikanga of mana, whanaungatanga (kinship, relationship), kotahitanga (unity), manaakitanga (hospitality, to care for) and mana whakahaere (authority, control) under the leadership of Kīngitanga.* The Korowai represents the responsibilities, and obligations of all for the restoration and preservation of a whole and healthy Waikato River Given the importance of fresh water to Waikato-Tainui, the tribe aspire to have water quality that is, "drinkable, swimmable and fishable in all places (with water quality to the level that King Tāwhiao could have expected in his time)" (Waikato-Tainui, 2013, p. 156). In recognition that water creates and sustains life marae were established alongside or		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	near water bodies. Water sustains the functions of the marae, hapū, and people (Waikato-Tainui, 2013). **Sites of significance including wahi tapu and landmarks** To Waikato-Tainui wāhi tapu are those sites of significance that have cultural, historical, archaeological and tribal importance (Waikato-Tainui, 2013): • Cultural importance includes areas for cultural and spiritual purification, cleansing and/or ceremonial purposes, activities, natural places, fisheries and food gathering sites;.. **Customary practices** Due to the unique historical relationship Waikato-Tainui has with both the land and waterways there are many customary practices undertaken. **Hauanga kai (Mahinga kai)** Along with other sources of kai the fisheries were a core food source for Waikato-Tainui. The fisheries also played a spiritual role in recognition of taniwha (spiritual beings) (Waikato-Tainui, 2013). Taonga fish and shellfish freshwater species identified by Waikato-Tainui include: tuna, whitebait species, smelt, pīharau (lamprey eels), kanae, pātiki, kōura, and kākahi (Waikato-Tainui, 2013).		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Waikato-Tainui regard the mauri of the wetlands as linked to the overall ecological health and well-being of their whakapapa (i.e. to the native fauna and flora found in those systems). **Recreation** Recreation and tourism is important and, "Waikato-Tainui supports sustainable and respectful recreation and tourism activities" (Waikato-Tainui, 2013, p. 250). The recreational activities identified by WRISS hui participants included: swimming, waka ama, rowing, picnics, boating, and walking tracks. **Economic** As well as cultural and social aspects, economic advancement is important to Waikato-Tainui. Whakatupuranga Waikato-Tainui 2050 is the blueprint for cultural, social and economic advancement for Waikato-Tainui people. It is a long-term development approach to building the capacity of Waikato-Tainui marae, hapū, and iwi. Whakatupuranga 2050 will be Waikato-Tainui's legacy for the tribe's future generations. In the changing global environment the world in future will be significantly different to the present. The approach for moving forward is one that embraces change and focuses on developing Waikato-Tainui people. With this in mind, there are three critical elements fundamental to equipping the tribe with		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	the capacity to shape their own future: (a) A pride and commitment to uphold their tribal identity and integrity; (b) A diligence to succeed in education and beyond; and (c) A self-determination for socio-economic independence to grow tribal assets.		
Literature review: Mātauranga Māori workstream - Healthy Rivers Plan for Change: Waiora He Rautaki Whakapaipai. **Waikato Regional Council**	**Ngāti Tūwharetoa** *Protecting the life giving energy of the waters of Lake Taupo and the Waikato River are part of the kaitiakitanga of tangata whenua over this taonga* (Ngāti Tūwharetoa Maori Trust Board, 2002, p. 61) *Ngāti Tūwharetoa hold manawhenua and kaitiakitanga over the central plateau rohe and have a rohe boundary that has been supported by the Native Land Court in 1886, subsequently called the Taupo-nui-ā-Tia block. As kaitiaki, ngā hapū o Ngāti Tūwharetoa have an intrinsic duty to ensure that the mauri and therefore the physical and spiritual health of the environment is maintained, protected and enhanced.*(Ngāti Tūwharetoa Maori Trust Board, 2002, p. 10) **Mahinga kai species** In terms of their fisheries, key goals for Ngāti Tūwharetoa include being able to*:* *Assert and exercise tino rangatiratanga and kaitiakitanga of ngā hapū o Ngāti Tūwharetoa over fisheries within the Tūwharetoa rohe.*	• Wai tapu • Mahinga kai • Human health for recreation	Accessibility

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	Protect and enhance fisheries within the Tūwharetoa rohe in accordance with the tikanga and kawa of ngā hapū o Ngāti Tūwharetoa. (Ngāti Tūwharetoa Maori Trust Board, 2002, p. 30). **Swimming** Being able to swim safely is important to Ngāti Tūwharetoa…. The concern now however, was that these areas were considered not as safe as they used to be (NIWA, 2010d). The pressures on safe swimming included poor water quality, loss of access, hydro dams effecting flow, presence of weeds, and bank erosion.		
	Te Arawa River Iwi Trust *The Waikato River and its tributaries is the source of identity for Te Arawa River Iwi. The resources collected from the river and its surroundings sustained the people through nourishment, protection and clothing, as well as providing goods that were traded with neighbouring Iwi.* *(Te Arawa River Iwi Trust Fish Plan, 2015, p. 10)* **Mahinga kai species** In their recently released Fisheries Plan, Te Arawa River Iwi identify customary taonga species, non-taonga species and unwanted fish in the Waikato	• Wai tapu • Mahinga kai • Human health for recreation	Clothing Protection (security) Tradable goods

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	River, between Atiamuri Dam and Huka Falls including all tributaries. **Swimming** For Ngāti Kearoa-Ngāti Tuara, swimming is regarded as "part of re-invigorating the relationship between the iwi and the streams and rivers" (Ngāti Kearoa-Ngāti Tuara, n.d., p. 24). It is considered that if children value the waters they swim and play in now they will more likely want to protect in the future.		
	Raukawa *"...people are inextricably linked to the environment. Our physical, spiritual and economic welfare is dependent on the welfare of the environment – first and foremost we must acknowledge and protect the natural environment and uphold the values, mātauranga and tikanga of our tūpuna. Within this context we can provide for our spiritual, cultural, social and economic needs.* *From these first principles stems our vision where the natural environment and our people are nurtured and supported to enable them in turn to nurture and support each other. Achieving this requires acknowledging connections and interdependencies in the natural world and restoring and protecting these relationships and balance; including our whakapapa and kaitiaki responsibilities to each other and all species, including those yet to be born."* (Raukawa Charitable Trust, 2014)	• Wai tapu • Ecosystem health • Mahinga kai • Human health for recreation	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	In regard to water Raukawa consider water as not separate from people, not separate from its surrounds and therefore cannot be separated out and assessed in isolation from the environment as a total entity: "All water is a connected and living entity, including; constituent parts (i.e. surface, banks, bed, flood plains etc.), intrinsic values and meta-physical being" (Raukawa Charitable Trust, 2014, p. 36). **Mahinga kai species** In the WRISS study (NIWA, 2010b) with Raukawa tribal members they identified a variety of mahinga kai species including: tuna, kōura, kānga wai, māra, watercress, kōkopu, kākahi, manu, kereru, trout, pūhā, pīharau, cherries, strawberries, rīwai, kamokamo, kumara and wild ducks. Raukawa recognise and respect all native species as an important part of the environment. It is also acknowledged that "no species will survive without the habitat in which it lives and the food on which it feeds" (Raukawa Charitable Trust, 2012, p. 12). Therefore protection of whole freshwater ecosystems is important (Raukawa Charitable Trust, 2012). For Raukawa the following freshwater species were used as a source of food: tuna, koura, piharau, kokopu and koaro, kaeo/kakahi. Catfish, goldfish		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	and trout all introduced species also used as a source of food likely because of their abundance over native species. Traditionally pa tuna was utilised not only as food but also to exchange for other resources. In terms of being able to determine the health of a waterway Raukawa acknowledge that they: "...may not measure in accordance with recognised scientific methods, [but] the iwi has always been attuned to the state of the environment within the rohe" (Raukawa Charitable Trust, 2012, p. 13). Raukawa use "many factors and variables in making an assessment that just seems intuitive to many. These assessments rely on the senses – what we can see, hear, smell, taste and feel; rather than necessarily what we measure" (Raukawa Charitable Trust, 2012, p. 13). **Swimming** As part of the WRISS study, Raukawa hui participants talked about swimming as the main recreational activity.		
	Maniapoto *To Maniapoto, the Waipā River is a single indivisible entity that flows from Pekepeke to its confluence with the Waikato River and includes its waters, banks, bed (including all minerals under it) and its streams, waterways, tributaries, lakes, fisheries, vegetation, floodplains, wetlands, islands, springs,*	• Wai tapu • Mahinga kai • Human health for recreation	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	geothermal springs, water column, airspace and substratum as well as its metaphysical elements with its own mauri. *Waiwaia is the spiritual guardian of the Waipā River and the importance of Waiwaia to Maniapoto is boundless. The Waipā River, through Waiwaia, provides for its people the necessary instruments of life. The Waipā River, its tributaries, wetlands and springs are interwoven into the fabric of the Maniapoto people and their identity, tikanga, reo and wellbeing. (Maniapoto Māori Trust Board, 2014, p. 6)* **Mahinga kai species** With regard to the management objectives and actions in their fisheries plan Maniapoto make reference to rangatiratanga, kaitiakitanga, hononga and mātauranga. The table below outlines some of the methods referred to for each of the four management objectives. For Maniapoto customary fishing is for the holistic well-being of the iwi, "the health and well-being of the river encompasses both the fish stocks in the river and the well-being of the iwi" (Maniapoto Māori Trust Board, 2014, p. 23). Low fish stocks mean "less cultural and fishing engagement with the river, resulting in cultural disconnection and a negative impact of tikanga and knowledge relating to the river not being passed on to younger		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	generations" (Maniapoto Māori Trust Board, 2014, p. 23). **Swimming** Based on past recollections, the characteristics of a good swimming area (puna kaukau) included being able to clearly see the bottom of the river and a sandy or stony river bed. Currently however, the water is now viewed as dirty, has reduced water clarity and sediment.		
	Waikato-Tainui *Mana whakahaere entails the exercise of rights and responsibilities to ensure that the balance and mauri (life force) of the rohe is maintained. It is based in recognition that if we care for the environment, the environment will continue to sustain the people. In customary terms mana whakahaere is the exercise of control, access to, and management of resources within the Waikato-Tainui rohe in accordance with tikanga. For Waikato-Tainui, mana whakahaere has long been exercised under the mana of the Kiingitanga. Waikato-Tainui managed its resources, including the fisheries and lands, in a sustainable manner, guided by maatauranga, tikanga and kawa.* *The Waikato-Tainui rohe is home to approximately 170 indigenous bird, mammal, reptile, amphibian, and freshwater fish species. Indigenous animals include the tuatara, pekapeka (long tailed bat), matuku (Australasian bittern), tuna (eel), whitebait,*	• Wai tapu • Ecosystem health • Mahinga kai • Human health for recreation	

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	and very rare and endangered species such as native frogs. The rohe is also home to at least 900 known indigenous plant species. The indigenous plant and animal species found in the Waikato are valuable cultural resources, and in themselves serve as kaitiaki and natural indicators reflecting the health of the environment. **Mahinga kai species** *Waikato-Tainui traditions speak of when the lakes and wetlands teemed with large numbers of tuna (eel), koura, whitebait and kaeo (freshwater mussels).* (Waikato-Tainui 2013, p. 107) The fisheries are regarded as a taonga as "they sustain the Waikato-Tainui way of life, both physically and spiritually. In the physical sense, the fisheries provided a cornerstone food source for the tribe. It was plentiful during all seasons of the year, it was reliable, and it was respected. It sustained the tribe during the winter months, and provided energy during battle. The significance of the fishery resource to Waikato-Tainui cannot be underestimated" (Waikato-Tainui, 2013, p. 185). The spiritual role of the fisheries is told through stories and waiata. The taonga species are recognised as taniwha (spiritual beings). Taniwha "heed warnings to the tribe, provide protection and guidance to safety through times of trouble. The		

Document	Stated water quality values (including objectives)	Link to CSG existing thinking – short list	Potential gap identified
	taniwha that guided the Tainui Waka to Aotearoa have been described as fish species. The leader, Mawake-nui-o-rangi, has been described as a shoal of fish; the one who beat down the waves was Paneiraira, who was recognised as a freckle headed whale, while the mischief makers were Ihe and Mango-hiku-roa, possibly thresher sharks or dolphins" (Waikato-Tainui, 2013, p. 185). **Swimming** Waikato-Tainui aspires to have waters that are drinkable, swimmable, and fishable with the water quality at least at the level Kiingi Taawhiao would have expected in his time.		

Attachment Two

Values and uses for the Waikato and Waipa Rivers

Vision and Strategy for the Waikato River

"Our vision is for a future where a healthy Waikato River sustains abundant life and prosperous communities who, in turn, are all responsible for restoring and protecting the health and wellbeing of the Waikato River, and all it embraces, for generations to come."

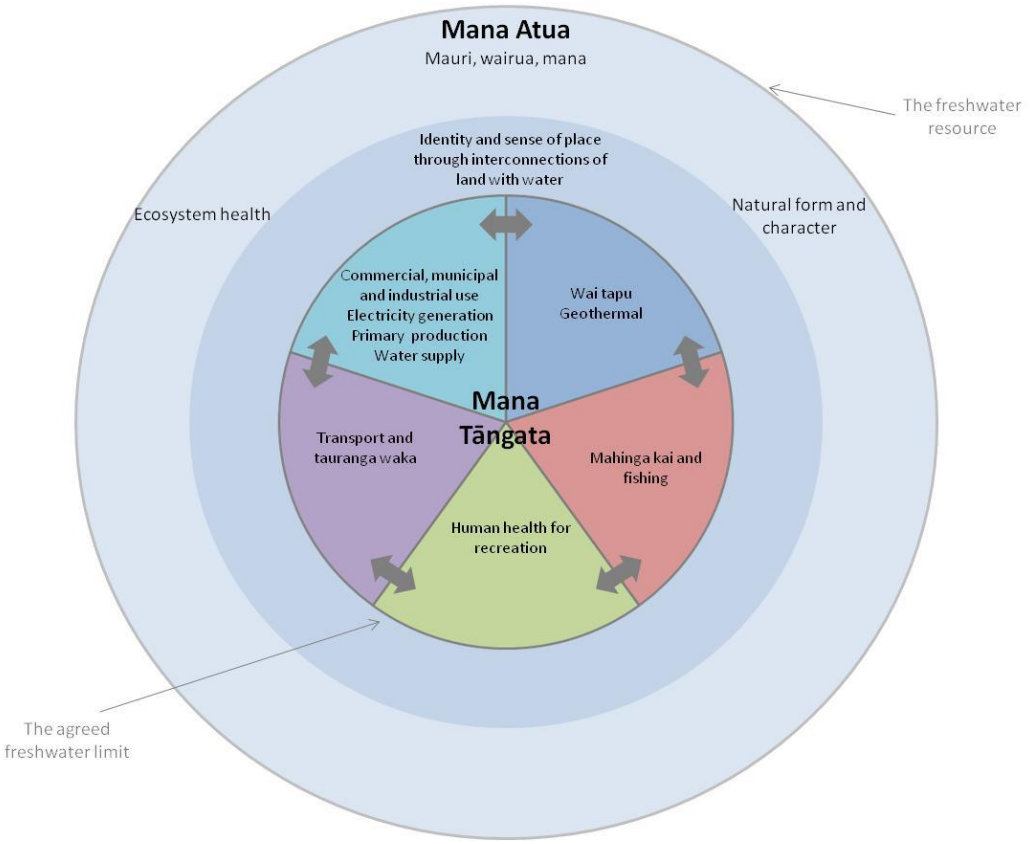
The Vision and Strategy is intended by Parliament to be the primary direction-setting document for the Waikato River and activities within its catchment affecting the Waikato River. Values and uses are intrinsic to, and embedded in the Vision and Strategy.

Te Mana o te Wai: Mana Atua, Mana Tāngata

The National Policy Statement Freshwater Management 2014 states that the aggregation of a range of community and tangata whenua values, and the ability of fresh water to provide for them over time recognises the national significance of fresh water and Te Mana o te Wai.

Values can be thought of in terms of Mana Atua and Mana Tāngata. Mana Atua represents the intrinsic values of water including the mauri, wairua and inherent mana of the water and its ecosystems in their natural state. Mana Tāngata refers to values of water arising from its use by people for economic, social, spiritual and cultural purposes.

A strong sense of identity and connection with land and water (hononga ki te wai, hononga ki te whenua) is apparent through the Vision and Strategy and the many values associated with the rivers. This is represented in the figure below as a unifying value that provides an interface between the Mana Atua and Mana Tāngata values.



Hononga ki te wai, hononga ki te whenua/

Identity and sense of place through the interconnections of land with water

- The rivers contribute to a sense of community and sustaining community wellbeing.
- The rivers are an important part of family life, holding nostalgic feelings and memories and having deep cultural significance.
- For river iwi, respect for the rivers lie at the heart of the spiritual and physical wellbeing of iwi and their tribal identity and culture. The River is not separate from the people but part of the people, "Ko au te awa, ko te awa ko au" (I am the river and the river is me).
- The rivers are a shared responsibility, needing collective stewardship: mahitahi – working together to restore the rivers. There is also an important inter-generational equity concept within Kaitiakitanga

Table Note - Values 'short list' on the left, and expanded 'long list' on the right

Mana Atua – Intrinsic values	
Te Hauora o te Wai / the health and mauri of water	
Ecosystem health	
The Waikato and Waipa catchments support resilient freshwater ecosystems and healthy freshwater populations of indigenous plants and animals.	• The value of clean freshwater to restore and protect the aquatic native vegetation so as to provide habitat and food for native aquatic species and for human activities or needs including swimming and drinking.

	• The value of freshwater in the restoration and protection of macro invertebrate communities for their intrinsic value, and as a food source for native fishes, native birds and introduced game species. • The value of freshwater supporting all native freshwater fish species. • The value associated with the protection and restoration of wetlands and floodplains which provides water purification, refuge, feeding, breeding habitat for aquatic species, habitat for water fowl and other ecosystem services such as flood control. • The value of freshwater contributing to unique habitats including peat lakes, shallow riverine lakes and the karst formations which all support unique biodiversity species and assemblages. • The value of the rivers and adjacent riparian margins as ecological corridors.
Te Hauora o te Taiao / the health and mauri of the environment	
Natural form and character	
Retain the integrity of the river corridor within the landscape and its aesthetic features and natural qualities for people to enjoy.	• The rivers have amenity and naturalness values, including native vegetation, undeveloped stretches, and significant sites. • People are able to enjoy the natural environment; it contributes to their health and wellbeing. • The rivers are an ecological and cultural corridor. • The rivers as a whole living entity.

Mana Tāngata – Use values	
Wai Tapu / Sacred Waters	
Wai tapu	
Area of water body set aside for spiritual activities, that support spiritual, cultural and physical wellbeing.	• The rivers are a place for sacred rituals, wairua, healing, spiritual nurturing and cleansing. • The rivers provide for cultural and heritage practices and cultural wellbeing, particularly at significant sites.
Ngāwhā/geothermal	
Geothermal	
A valued resource that is naturally gifted to sustain certain activities (meeting spiritual and physical needs).	• Geothermal areas of the river have natural form and character, and unique flora found only in the geothermal environment. • Geothermal areas are a special micro-climate. • Geothermal areas and resources were prized by tupuna for their many uses. Kokowai (red ochre)

	is part of the kawa and tikanga around cultural processes and was a trading commodity
Mahinga kai / food gathering, places of food	
Mahinga kai and fishing	
The ability to access the Waikato and Waipa and their tributaries to gather sufficient quantities of kai that is safe to eat and meets the social and spiritual needs of its stakeholders.	• The rivers provide for freshwater native species, native vegetation, and habitat for native animals. • The rivers provide for cultural wellbeing, knowledge transfer, intergenerational harvest, obligations of manaakitanga and cultural opportunities, particularly at significant sites. • The rivers should be safe to take food from, both fisheries and kai. • The rivers support aquatic life, healthy biodiversity, ecosystem services, flora and fauna and biodiversity benefits for all. • The rivers are a corridor. • The rivers provide resources available for use which could be managed in a sustainable way. • The rivers provide for recreation needs and for social wellbeing.
Te Hauora o te Tangata / the health and mauri of the people	
Human health for recreation	
The rivers are a place to swim and undertake recreation activities in an environment that poses minimal risk to health.	• The rivers provide for recreational use and social needs, are widely used by the community, and are a place to play, exercise and have an active lifestyle. • An important value for the rivers is cleanliness: the rivers should be safe for people to swim in.
He ara haere / navigation	
Transport and tauranga waka	
All communities can use the rivers to pilot their vehicles, waka and navigate to their destinations.	• The rivers provide for recreational use (navigation), and sporting opportunities. • The rivers are a corridor, mode of transport and mode of communication. • The rivers provide for culture and heritage, cultural wellbeing, and social wellbeing, particularly at significant sites.
Mahi māra / cultivation and primary production	
Primary production	
The rivers support regionally and nationally significant primary production in the catchment (agricultural, horticultural, forestry etc). These industries contribute to the economic, social and cultural wellbeing of people and communities, and are the major component of wealth creation within the region. These industries and associated primary production	• The rivers support a wide variety of primary production in the catchment, including dairy, meat, wool, horticulture and forestry. • Due to the economies of scale of these industries other services sectors are able to operate, such as agritech, aviation and manufacturing. • These industries combined contribute significantly to regional and national GDP, exports and employment.

also support other industries and communities within rural and urban settings.	• The rivers and the surrounding land offer unique opportunities for many communities and industries to operate, contributing to the lifestyle and sense of community in rural Waikato.
Wai māori / municipal and domestic water supply	
Water supply	
Domestic and municipal water from the catchment (both surface and subsurface) is of a quality that can be effectively treated to meet appropriate health standards for both potable and non-potable uses.	• The rivers provide for community water supply, municipal supply, drinkable broader water supply and health.
Āu Putea / economic or commercial development	
Commercial, municipal and industrial use	
The rivers provide economic opportunities to people, businesses and industries.	Freshwater is used for industrial and municipal processes which rely on the assimilative capacity for discharges to surface water bodies and: • Provide for economic wellbeing, financial and economic contribution, individual businesses and the community and the vibrancy of small towns. They are working rivers: they create wealth. • Those industries are important to the monetary economy of Waikato Region, enabling a positive brand to promote to overseas markets. • The rivers provide for domestic and international tourism. Promotion of a clean, green image attracts international and domestic visitors. • The rivers provide assimilative capacity for waste water disposal, and ecosystem services through community schemes or on site disposal.
Electricity generation	
The river provides for renewable hydro and geothermal energy sources and thermal generation securing national self-reliance and resilience. New Zealand's social and economic wellbeing are dependent on a secure and cost effective electricity supply system. Electricity also contributes to the health and safety of people and communities.	• Renewable, reliable, sources of energy contributing to New Zealand's self-reliance and internationally competitive advantage. • Existing Waikato Hydro Scheme, consisting of Taupo gates, Lake Taupo storage and cascade of 8 hydro dams and lakes, and 9 power stations. • Huntly Power Station plays a pivotal role in the New Zealand electricity system and is particularly significant when weather dependent renewable generation is not available. Freshwater is used for cooling and process water. • Existing and consented geothermal power stations located on five geothermal systems classified for development using freshwater for cooling, process water and drilling.

Appendix B: Stock Unit Calculator

The purpose of this calculator is to help calculate the total number of stock units per ha are currently being run on lifestye blocks and is annualised for properties between 4.1 and 20 ha to report there stock unit ratings under the PPC1 ***This is not***

Animal	Animal Description	SU value	Ha/ animal equivlents	Number of Animals	Months on grazing area	SU value / year
Dairy Bull	620 kg	6.1	1.02	1.00	12.00	6.1
Dairy Cow	450 kg Xbred 400 m/s	10.4	1.73	1.00	2.00	1.7
Dairy Heifer (1-2yr)	Xbred 200 - 420 kg	5.1	0.85	0.00	0.00	0.0
Dairy Heifer (calf)	weaned xbred 110 - 199 kg	1.6	0.27	0.00	0.00	0.0
Beef Bull	620 breeding	6	1.00	0.00	0.00	0.0
Beef cow	480 kg (with calving 96%)	7.5	1.25	0.00	0.00	0.0
Bull 1-2 years age	Friesian Bulls 209-535 slaughter wt	6.8	1.13	1.00	12.00	6.8
Steer (1-2 yr)	210-535 kg (slaughter wt)	5.8	0.97	0.00	0.00	0.0
Heifer (1-2 yr)	208-420 kg (slaughter wt)	5.7	0.95	0.00	0.00	0.0
Steer Calf <1yr	100 - 203 kg Dec - Jun	*2.7*	*0.45*	0.00	0.00	0.0
Bull calf <1yr	101 - 203 kg Dec - Jun	*2.7*	*0.45*	0.00	0.00	0.0
Heifer calf <yr	weaned 90 - 208 Dec - Jun	*1.6*	*0.27*	0.00	0.00	0.0
Ram	73 kg Romney 4.5 kg wool	1	0.17	0.00	0.00	0.0
Adult Ewe	63 kg Romney (126%) 4.5 kg wool	1.01	0.17	0.00	0.00	0.0
Sheep 1-2yr	Romney hogget 26-46kg 4 kg wool	0.9	0.15	0.00	0.00	0.0
Sheep <1yr	Romney weaned 26-46kg 2kg wool	0.5	0.08	0.00	0.00	0.0
Milking Ewe	70 kg 50 kg M/S	0.9	0.15	0.00	0.00	0.0
Buck & Doe<1yr	overseer® default	0.5	0.08	0.00	0.00	0.0
Angora doe	overseer® default	1.1	0.18	0.00	0.00	0.0
Feral doe	overseer® default	0.9	0.15	0.00	0.00	0.0
Feral Buck & Weathe	overseer® default	0.5	0.08	0.00	0.00	0.0
Milking goat	80 kg 140 kg M/S	1.8	0.30	0.00	0.00	0.0
Stag	red 200kg 4kg velvet	2.4	0.40	0.00	0.00	0.0
Stag 1-2 yr	red 55-159 >12 mth 2 kg velvet	2.3	0.38	0.00	0.00	0.0
Stag fawn	red 42-55kg 4 mths annulaised = 12	1.1	0.18	0.00	0.00	0.0
Hind Breeding	red 110 kg 86%	2.5	0.42	0.00	0.00	0.0
Hind 1-2 yr	red 53-75 kg	1.2	0.20	0.00	0.00	0.0
Hind Fawn weaned	red 37-53kg 4 mths annulized=12	1	0.17	0.00	0.00	0.0
Alpaca	overseer® default	0.8	0.13	0.00	0.00	0.0
Llama	overseer® default	1.6	0.27	0.00	0.00	0.0
Pony	overseer® default	6	1.00	1.00	12.00	6.0
Pony brood mare	overseer® default	8	1.33	0.00	0.00	0.0
Small Hack	overseer® default	8	1.33	2.00	0.00	0.0
Small Hack with foal	overseer® default	10	1.67	0.00	0.00	0.0
large Hack	overseer® default	12	2.00	0.00	0.00	0.0
Large Hack with Foal	overseer® default	14	2.33	0.00	0.00	0.0
Throughbred	overseer® default	12	2.00	0.00	0.00	0.0
Permitted Activity under PPC1			yes			**13.8** Total S/U for
				Farm Area in Ha		**2.31** Total allowed S/U

Appendix C: Overseer Animal Report User Guide

Guide to the Animal Reports in OVERSEER

May 2016

Prepared for OVERSEER Limited

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AgResearch Ltd.

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Table of Contents

1. INTRODUCTION

Animal reports have been progressively added to the Farm scenario report section of the OVERSEER application since OVERSEER 6.2.0 was released in April 2015 (Table 1).

Table 1: Animal reports added to the Farm scenario report.

Version (Release Date)	Reports added
6.2.0 (April 2015)	Location, Stocking rate, and Block pasture (RSU)
6.2.1 (Nov 2015)	Dry matter (DM) intake, Metabolic energy (ME) requirements and Excreta nitrogen (N)
6.2.2 (May 2016)	Diet (ME source), Diet (ME place), Diet (DM source) and Additional

Improvements have been made to the layout of all reports. This included combining the three reports released in November 2015 under one report tab called Additional.

1.1. Purpose

The reason to include the Animal Reports in OVERSEER is to help expert users to review farm system information entered into OVERSEER, diagnose problems described by error messages, and provide users with more insight as to how the model is operating.

The reports can be viewed before a full nutrient budget is produced because the outputs become available before the nutrient budget calculations are finished. Importantly, this allows users to view the animal reports if there is an error stopping nutrient budgets being produced.

1.2. How to access the Animal Reports

Animal reports are available on the ‘Animal reports’ page, located under ‘Farm scenario’. Each animal report is shown on a separate tab.

2. REPORT DESCRIPTIONS

There are seven animal reports available in OVERSEER. Each report is described in the sections below. Four of the seven animal reports use revised stock units (RSU) as a metric, which is defined as ‘1 RSU is equivalent to 6000 MJ ME intake per year’. RSU is similar to the standard stock unit or

ewe equivalent. RSU is based on ME intake, thus enabling stocking rates across different enterprises to be compared, and trading mobs to be easily integrated with breeding mobs.

2.1. Location

The location report describes where OVERSEER has assumed each animal enterprise is located on the farm in a given month, based on the information entered by the user.

The location report also displays:

- The percentage of animals within an enterprise that are fed in the milking shed, feed pad or wintering pad/animal shelter.
- The percentage of animals within an enterprise using the winter standoff pad.
- Whether animals on the block are eating pasture or crop. On crop blocks, animals on grazed pasture within a rotation are shown as on 'Pasture', whereas if they are consuming a crop 'in situ', they are shown as 'Crop'.
- Animals grazing pasture in-situ while also on the wintering pad/animal shelter (wintering pad + grazing option). This is indicated by the suffix 'g'.

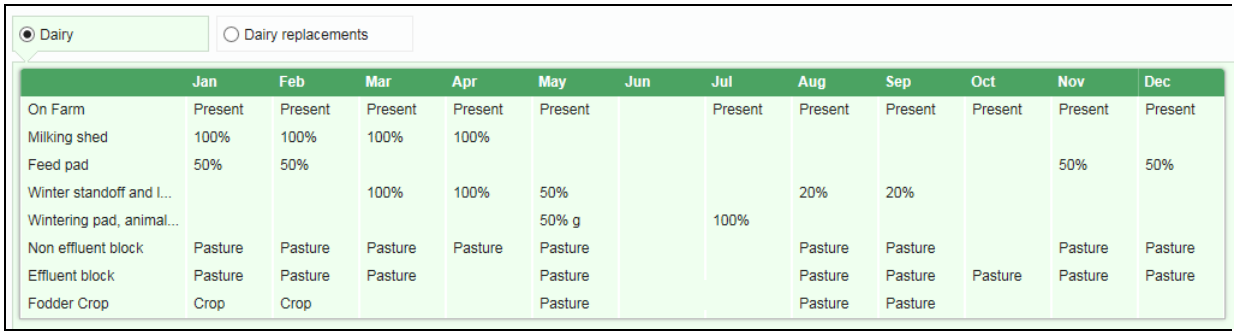
This report is useful to confirm that animals have been placed in the expected location, particularly when there is a mix of cropping and pastoral blocks with wintering pads and wintering off. This report can also be used to diagnose error messages addressing the placement of animals, and identify blocks and structures contributing to a feed error.

Interpretation of a Location report:

Figure 1 shows a location report for a hypothetical dairy farm. From this report we can see that there are no values under June, indicating that animals (dairy cows) are grazed off farm for the month of June. The farm has a feed pad, winter standoff pad and wintering pad, with feeding occurring in the milking shed. 100% of the herd is fed in the milking shed from January until April. The feed pad is used from November until February by 50% of the herd. The winter standoff pad is used in March and April (by 100% of the herd), in May (by 50% of the herd) and in August and September (by 20% of the herd). The cows are on the wintering pad in May (50% of the herd) and July (100% of the herd). The suffix 'g' following the percentage of animals on the wintering pad in the month of May, indicates that animals are grazing pasture in-situ while also on the wintering pad.

Figure 1 also shows us that while animals are present on farm, no animals grazed pasture in July because they are on the wintering pad. It also shows that dairy cows do not graze the Non-effluent

block in October and the Effluent block in April. Whether or not animals graze a block month by month is set in the Animals tab for each block. The summer crop on the Fodder Crop block is grazed in-situ in January and February. Dairy cows also graze this block in May, August and September while in permanent pasture.



Dairy | Dairy replacements

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
On Farm	Present	Present	Present	Present	Present		Present	Present	Present	Present	Present	Present
Milking shed	100%	100%	100%	100%								
Feed pad	50%	50%									50%	50%
Winter standoff and I...			100%	100%	50%			20%	20%			
Wintering pad, animal...					50% g		100%					
Non effluent block	Pasture	Pasture	Pasture	Pasture	Pasture			Pasture	Pasture		Pasture	Pasture
Effluent block	Pasture	Pasture	Pasture		Pasture			Pasture	Pasture	Pasture	Pasture	Pasture
Fodder Crop	Crop	Crop			Pasture			Pasture	Pasture			

Figure 1: Location report for a hypothetical dairy farm

2.2. Stocking rate

The purpose of the stocking rate report is to show the current carrying capacity of the farm. The estimated stocking rate (RSU per ha) of each enterprises on-farm, and total over all enterprises, is reported on a grazed area and total farm basis. The outputs shown for each animal enterprise on the farm are:

- Total farm: The stocking rate for each animal enterprise, estimated as total RSU of an animal enterprise divided by total farm area (RSU/ha), where total farm area is the entered total area, or the area of all block areas (whether grazed or not) and any non-productive areas.
- Grazed area: The stocking rate on grazed pasture of each animal enterprise, estimated as the total RSU of an animal enterprise divided by the grazed area (area of pastoral and fodder crops blocks – it excludes fodder crops grown on crop blocks).
- Total: The total carrying capacity, as RSU, of each animal enterprise.
- Pasture eaten: The carrying capacity based on pasture intake, estimated as RSU for each animal enterprise, based on ME of pasture consumed by an animal enterprise. This gives an indication of the carrying capacity of fresh pasture on all block types within OVERSEER. As the amount of supplements fed out increases, the difference between ‘Pasture eaten’ RSU and ‘Total’ RSU increases.
- Time on pasture: The RSU estimated from feed consumed while on pastoral blocks, including ME supplied from fresh pasture together with supplements and/or crops fed on

pastoral blocks. As the amount of supplements directed to feed or wintering pads increases, 'Time on pasture' RSU decreases as a proportion of 'Total' RSU.

In OVERSEER, stocking rates based on total farm area or grazed area tend to be similar unless there is another block type on the farm, such as crop, fruit or tree blocks. Hence, a farm with 50% trees may have a high stocking rate on the grazed area, but a low stocking rate based on total farm area. Cropping or fruit crop blocks that provide limited grazing can also result in higher estimated stocking rates per grazed hectare.

The outputs from the stocking rate report provide a means to assess and compare carrying capacity (based on intake) between farms, and to assess the contribution of different animal enterprises to the farm carrying capacity. As RSU is intake based, further analysis of RSU can be undertaken using the ME reports.

Note that RSU is a measure of intake, and pasture production is ME intake converted to DM intake and divided by utilisation. Utilisation can vary between farms, and under different management regimes. The ability to change utilisation, and hence change ME intake and production levels, should be considered when assessing future carrying capacities. The influence of utilisation on pasture production and the effect of changing utilisation on potential animal intake can be examined using the 'Pasture production' report.

Interpretation of a Stocking rate report:

A stocking rate report for a hypothetical dairy farm is shown in Figure 2. This farm has a total farm stocking rate of 22.0 RSU/ha. There are in total, 7,170 RSU on this farm during the reporting year. The 'Pasture eaten' total of 6,490 RSU is less than the total RSU (7,170). This indicates that this farm is feeding supplements to the dairy herd to maintain a greater carrying capacity than supported by the fresh pasture grown on the property. Reported values should coincide with expected carrying capacities; if not; stock numbers and production should be checked.

	Revised stock units/ha		Total revised stock units		
	Total farm	Grazed area	Total	Pasture eaten	Time on pasture
Dairy	20.1	20.5	6,546	5,868	5,950
Dairy replacements	1.9	1.9	624	622	624
Total	**22.0**	**22.4**	**7,170**	**6,490**	**6,574**

Figure 2: Stocking rate (expressed as RSU/ha or total RSU) report for a hypothetical dairy farm.

2.3. Block pasture RSU (revised stock unit)

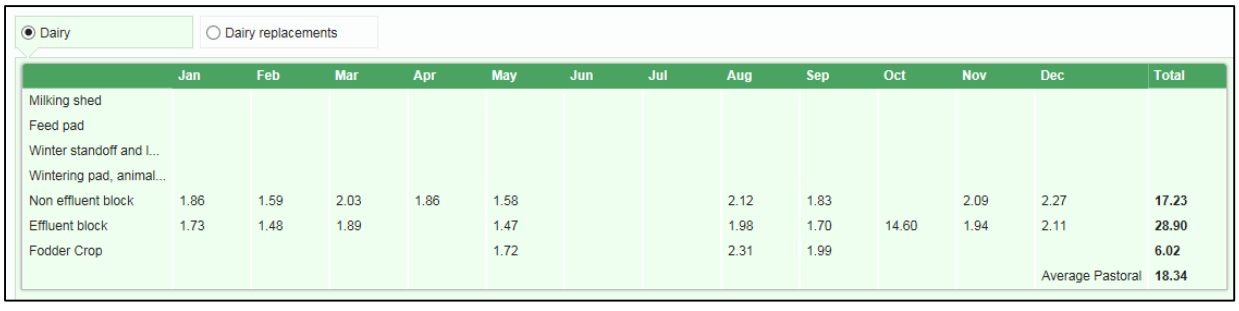
The purpose of the block pasture RSU report is to show the estimated carrying capacity (RSU/ha) on a monthly and annual basis for each enterprise on each block based on fresh pasture intake. This is derived from the fresh pasture intake of each animal enterprise present on the block. Note that the timing of intake may differ from pasture growth.

Interpretation of a Block pasture RSU report:

Figure 3 shows a block pasture RSU report for a hypothetical dairy farm. As expected, the report shows intake is lower in the non-lactating month of May. The high intake in the effluent block in October is due to all the animals consuming pasture on a block with a small area. This may indicate an error in inputs, such as the wrong block that the animal distribution was selected, or supplements not been fed in October.

'Average pastoral' in the bottom right section of the report, refers to the average RSU for all pastoral blocks and associated fodder crop areas rotating through them. If no supplements or crops are fed, the monthly pattern of a given block will be similar to the average pattern of the ME requirements of enterprises present on that block. The block's pattern will change as more and more supplements and crops are fed.

Relative productivity is reflected in the ratio of sum of total block pasture RSU for each pastoral block. The percentage pasture eaten is reflected in the ratio of total block pasture RSU for each animal enterprise on a given block. If 'Assume animals on all blocks eat pasture at the same ratio as farm intake (applies only to pasture blocks)' is checked, this ratio is the same for each pastoral block.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Milking shed													
Feed pad													
Winter standoff and l...													
Wintering pad, animal...													
Non effluent block	1.86	1.59	2.03	1.86	1.58			2.12	1.83		2.09	2.27	**17.23**
Effluent block	1.73	1.48	1.89		1.47			1.98	1.70	14.60	1.94	2.11	**28.90**
Fodder Crop					1.72			2.31	1.99				**6.02**
												Average Pastoral	**18.34**

Figure 3: Block pasture RSU report (RSU's/month) for a hypothetical dairy farm.

2.4. Diet (ME source)

The purpose of the diet (ME source) report is twofold. Firstly, it shows for each enterprise by month, the amount of feed consumed from each source. Sources of the diet consumed by animals include;

pasture, farm-grown supplements, brought-in fodder supplements (pasture based hays, silages and baleage), brought in other supplements including leftover supplements, and lastly crops. This is presented as the proportion of feed consumed (ME from a given source for that month divided by ME from all sources that month), the amount consumed as RSU and lastly as ME intake. These are expressed as percentage of total feed intake, RSU or MJ ME/month.

Secondly, this report shows for each enterprise by month the estimated proportion of animal ME requirements supplied by feed expressed as a percentage, and the estimated the estimated animal ME requirements expressed as, RSU or MJ ME/month.

Interpretation of a Diet (ME source) report:

Figure 4 shows a Diet (ME source) report for a hypothetical dairy farm. The report is showing that the majority of the dairy herd's diet is pasture (90%, ranging from 80.4 to 99.6% of the monthly diet). Notably, in the month of June, all sources are blank, i.e. zero, indicating that the dairy herd has been grazed off. During July, all the diet is supplied to the herd as fodder supplements (brought-in and fed out). Referring to Location Animal reports reveals these animals are on the wintering pad.

The final row in the report, 'Animal ME requirements' shows the ratio of ME intake from all sources divided by animal ME requirements because "% requirements" is selected. One hundred percent is reported for all but one of the month's animals are on farm. This occurs because animal ME intake not derived from supplements and crops is assumed to be from grazed pasture. However, when this is not the case, the reported value may differ.

An Animal ME requirements value greater than 100% (e.g. July) indicates that supplements and/or crops consumed by animals are in excess of their estimated requirements. Conversely, a value less than 100% suggests that supplements and/or crops consumed by animals are inadequate to meet their estimated requirements while animals do not have access to pastoral blocks. A buffer of about 20% is in place when matching intake to feed requirements. Therefore, the model will provide reports when the feed supply is within 20% of animal requirements. Hence, scenario and blocks reports are available for this hypothetical dairy farm.

◉ Dairy ○ Dairy replacements

◉ % requirements ○ RSU ○ MJ ME/month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	% diet
Pasture	80.4	80.4	96.2	96.2	99.6			99.6	99.6	99.6	94.0	94.0	90
Farm supplements	0.4	0.4	0.4	0.4	0.4			0.4	0.4	0.4	0.4	0.4	
Fodder supplements	7.8	7.8	3.4	3.4			100.0				5.6	5.6	8
Other supplements													
Crops	11.5	11.5											2
Animal ME requirements	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**		**106.5**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100**

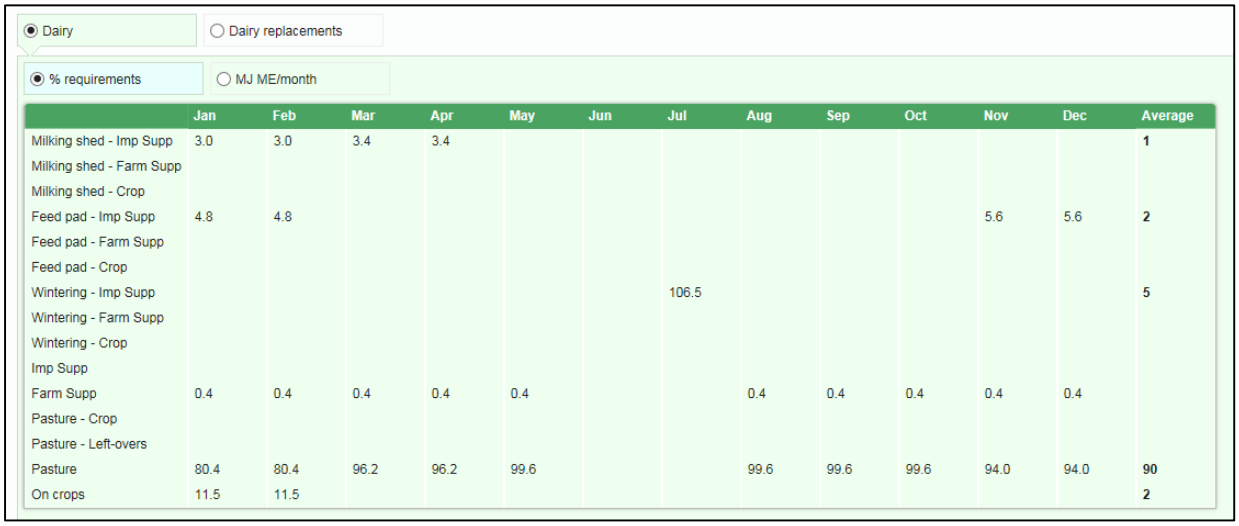
Figure 4: Diet (ME source) report based on % requirements for a hypothetical dairy farm.

2.5. Diet (ME place)

The purpose of the Diet (ME place) report is to show for each enterprise by month where on-farm feeds from various sources are consumed. Places (or locations) where the diet is consumed may be; milking shed, feed pad, wintering pad, pasture or on crops. This is further broken down to describe the place where feed is consumed whether it be imported supplements, farm-grown supplements, cut and carry crops, left-over supplements, fresh pasture or crops grazed in-situ. Estimates may be expressed either as a percentage of feed or MJ ME/month from each source.

Interpretation of a Diet (ME place) report:

Figure 5 shows a Diet (ME place) report based on percentage requirements for a hypothetical dairy farm. The average column shows the amount of feed from each source consumed at various locations as a percentage of animal requirements throughout the year. This report shows that the dairy enterprise is predominantly grazing on fresh pasture, with the remainder of feed consumed on the feed pad (imported supplements), when grazing crops in-situ and in the milking shed (imported supplements). During July, all animals are fed imported supplements on the wintering pad to which slightly more feed is supplied than is needed to meet animal requirements.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Milking shed - Imp Supp	3.0	3.0	3.4	3.4									1
Milking shed - Farm Supp													
Milking shed - Crop													
Feed pad - Imp Supp	4.8	4.8									5.6	5.6	2
Feed pad - Farm Supp													
Feed pad - Crop													
Wintering - Imp Supp							106.5						5
Wintering - Farm Supp													
Wintering - Crop													
Imp Supp													
Farm Supp	0.4	0.4	0.4	0.4	0.4			0.4	0.4	0.4	0.4	0.4	
Pasture - Crop													
Pasture - Left-overs													
Pasture	80.4	80.4	96.2	96.2	99.6			99.6	99.6	99.6	94.0	94.0	90
On crops	11.5	11.5											2

Figure 5: Diet (ME place) report based on % requirements for a hypothetical dairy farm.

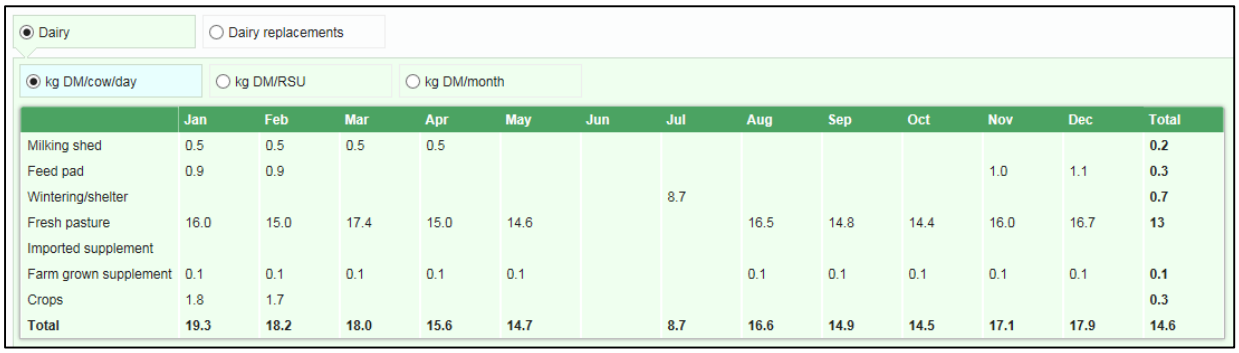
2.6. Diet (DM source)

The purpose of the Diet (DM source) report is to show the approximate DM intake for each enterprise by month. Locations describing where animals are fed are the milking shed, feed pad and, wintering pad/animal. Sources of feed, fed elsewhere on-farm are fresh pasture, imported supplement, farm-grown supplement and crops. Note: this report does not show DM offered, which will be higher. The

monthly dry matter intake (kg DM/month) of each animal enterprise present is reported either on a per milking cow basis (dairy only), a per RSU basis, or as total intake.

Interpretation of a Diet (DM source) report:

Figure 6 shows a Diet (DM source) report based on kg DM/cow/day for a hypothetical dairy farm. The total row shows the monthly total from each source for the year. The total column shows the monthly average and the yearly monthly average from each source for the year. Figure 6 shows that the greatest source of DM intake is fresh pasture, followed by DM consumed on the wintering pad (month of July). Lesser amounts of feed are grown and fed out on-farm, consumed in the milking shed, on the feed pad, or as crops grazed in-situ.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Milking shed	0.5	0.5	0.5	0.5									**0.2**
Feed pad	0.9	0.9									1.0	1.1	**0.3**
Wintering/shelter							8.7						**0.7**
Fresh pasture	16.0	15.0	17.4	15.0	14.6			16.5	14.8	14.4	16.0	16.7	**13**
Imported supplement													
Farm grown supplement	0.1	0.1	0.1	0.1	0.1			0.1	0.1	0.1	0.1	0.1	**0.1**
Crops	1.8	1.7											**0.3**
Total	**19.3**	**18.2**	**18.0**	**15.6**	**14.7**		**8.7**	**16.6**	**14.9**	**14.5**	**17.1**	**17.9**	**14.6**

Figure 6: Diet (DM source) report based on kg DM/cow/day for a hypothetical dairy farm.

2.7. Additional

The additional report tab displays information on estimated monthly metabolic energy requirements (MJ ME), DM intake (kg DM) and excreta N (urine + dung kg N/month) of the different animal enterprises present on the farm. Each report includes a table and graph. These depict changes throughout the year for each enterprise enabling the monthly pattern of a particular enterprise to be viewed and compared with other enterprises on the same farm.

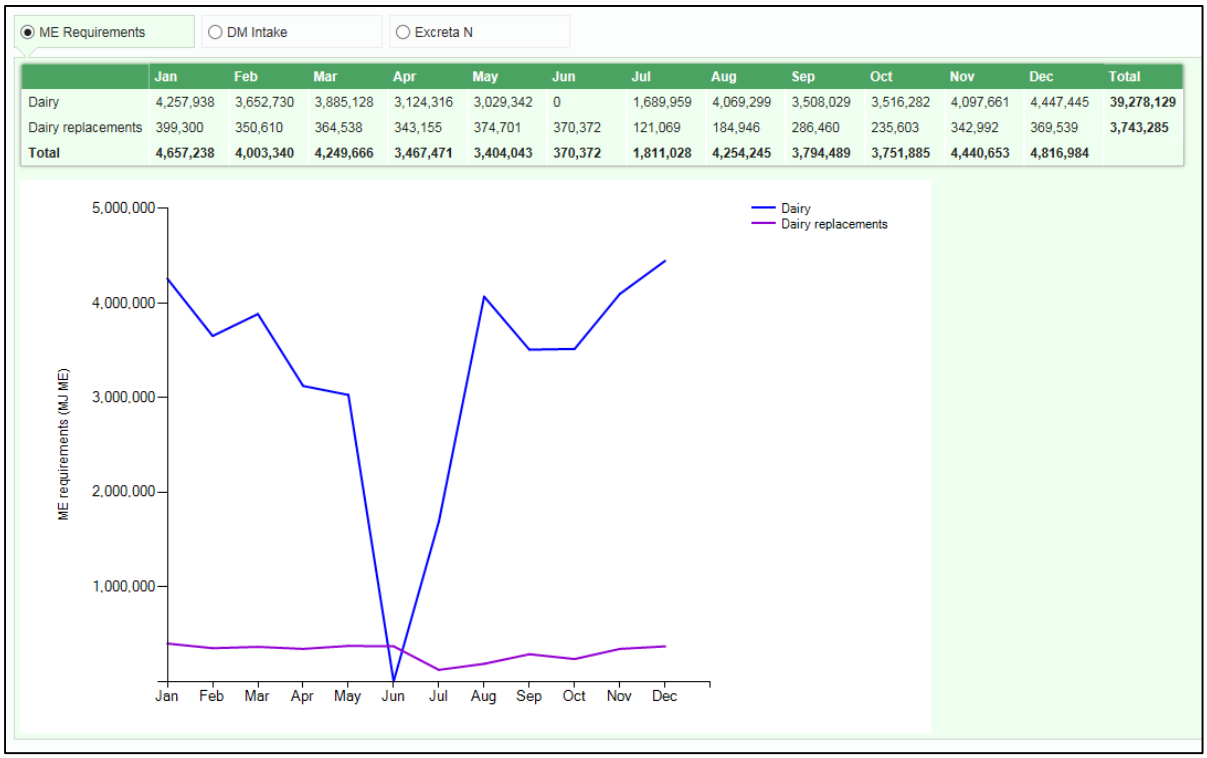
2.7.1. Metabolic energy requirements

The purpose of the Metabolic energy (ME) requirements report is to provide an indication of the estimated monthly ME requirements (MJ ME) of animal enterprises present on the farm. Animal ME requirements are estimated using the monthly ME requirement sub-model (Wheeler, 2015b). The monthly metabolic sub-model estimates the amount of energy animals require for maintenance, to produce milk, wool, velvet, for live weight gain and for pregnancy. The total ME intake requirement each month is determined for each class of animals, based on the following attributes of those animals: sex, age, weight, and whether they are gestating or lactating. Thus, the calculated ME

requirements are dependent on stock class, stock numbers and animal production (Wheeler *et al*., 2013). The ME requirements of each mob/herd within an enterprise (e.g. breeding ewes, lambs, rams) are then added together to give total animal ME requirements for the enterprise. OVERSEER assumes that pasture ME intake is the difference between animal ME requirements less ME supplied by supplement and/or crops. The amount of supplement and crop brought in or fed out is supplied by the user. (Wheeler *et al*., 2013).

Interpretation of a Metabolic energy requirements report:

Figure 7 shows a ME requirements report for a hypothetical dairy farm. The pattern over the year shown in blue is typical of a seasonal supply dairy herd in that ME requirements are lower in winter when cows are not lactating and culls are frequently sold. In June when the dairy herd is grazed off-farm there is no ME requirement, hence it is zero. Dairy replacements shown in purple are on farm all year. Note that the difference in dairy replacements between July and June reflects the difference between the beginning and end of the reporting period (July – June). ME requirements change as animal numbers and production change.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Dairy	4,257,938	3,652,730	3,885,128	3,124,316	3,029,342	0	1,689,959	4,069,299	3,508,029	3,516,282	4,097,661	4,447,445	**39,278,129**
Dairy replacements	399,300	350,610	364,538	343,155	374,701	370,372	121,069	184,946	286,460	235,603	342,992	369,539	**3,743,285**
Total	**4,657,238**	**4,003,340**	**4,249,666**	**3,467,471**	**3,404,043**	**370,372**	**1,811,028**	**4,254,245**	**3,794,489**	**3,751,885**	**4,440,653**	**4,816,984**	

Figure 7: ME requirements (MJ ME/month) report for a hypothetical dairy farm.

2.7.2. Dry matter intake

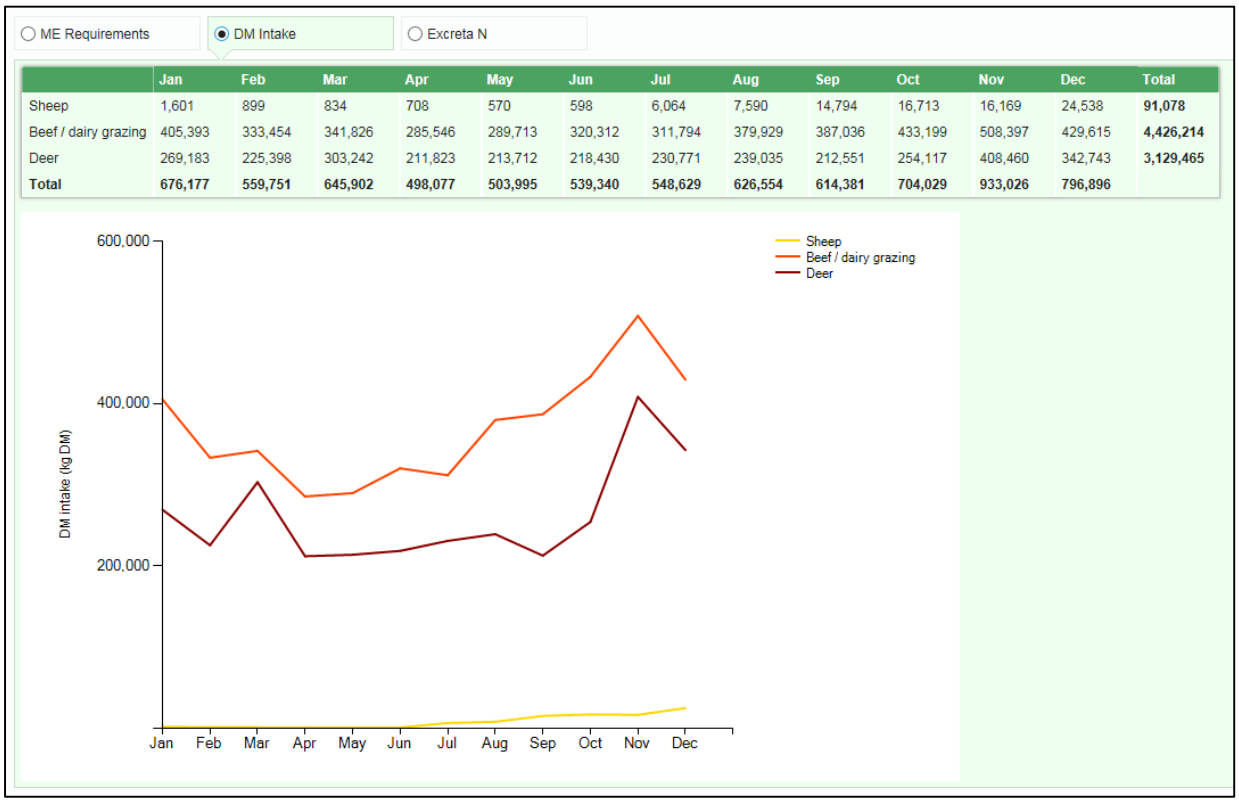
The purpose of the DM intake report is to provide an indication of the DM intake of animal enterprises present on the farm. This report provides the monthly DM intake (kg DM/month) of each animal

enterprise present on the farm and the total (annual) DM intake of each enterprise (kg DM/year). Note that pasture production is pasture intake divided by utilisation.

In OVERSEER, pasture DM intake is calculated as ME intake required from pasture divided by the ME content of the pasture component of the diet. The user may enter pasture ME content. If not, default values are used (Wheeler 2015a). The ME content of the pasture component of the diet is the average pasture block ME, weighted by the amount of pasture intake from each block. Supplement and crop DM intake are estimated from user inputs. Pasture DM intake and supplement and crop DM intake are then added to give the total animal DM intake (Wheeler *et al*., 2013).

Interpretation of a Dry matter intake report:

Figure 8 is the DM intake for a hypothetical sheep/beef/deer farm. The farm predominantly grazes beef and deer. The few sheep on farm left the farm in December. The DM intake of beef and deer differ with intake from beef increasing from July to November whereas deer increased rapidly from September. Intake declined thereafter. DM intake may change as the quality of the feed changes, for example, if animal numbers and production remain constant, increasing the ME content of feed results in a decrease in DM intake.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sheep	1,601	899	834	708	570	598	6,064	7,590	14,794	16,713	16,169	24,538	**91,078**
Beef / dairy grazing	405,393	333,454	341,826	285,546	289,713	320,312	311,794	379,929	387,036	433,199	508,397	429,615	**4,426,214**
Deer	269,183	225,398	303,242	211,823	213,712	218,430	230,771	239,035	212,551	254,117	408,460	342,743	**3,129,465**
Total	**676,177**	**559,751**	**645,902**	**498,077**	**503,995**	**539,340**	**548,629**	**626,554**	**614,381**	**704,029**	**933,026**	**796,896**	

Figure 8: DM intake (kg DM/month) report for a hypothetical sheep and beef farm.

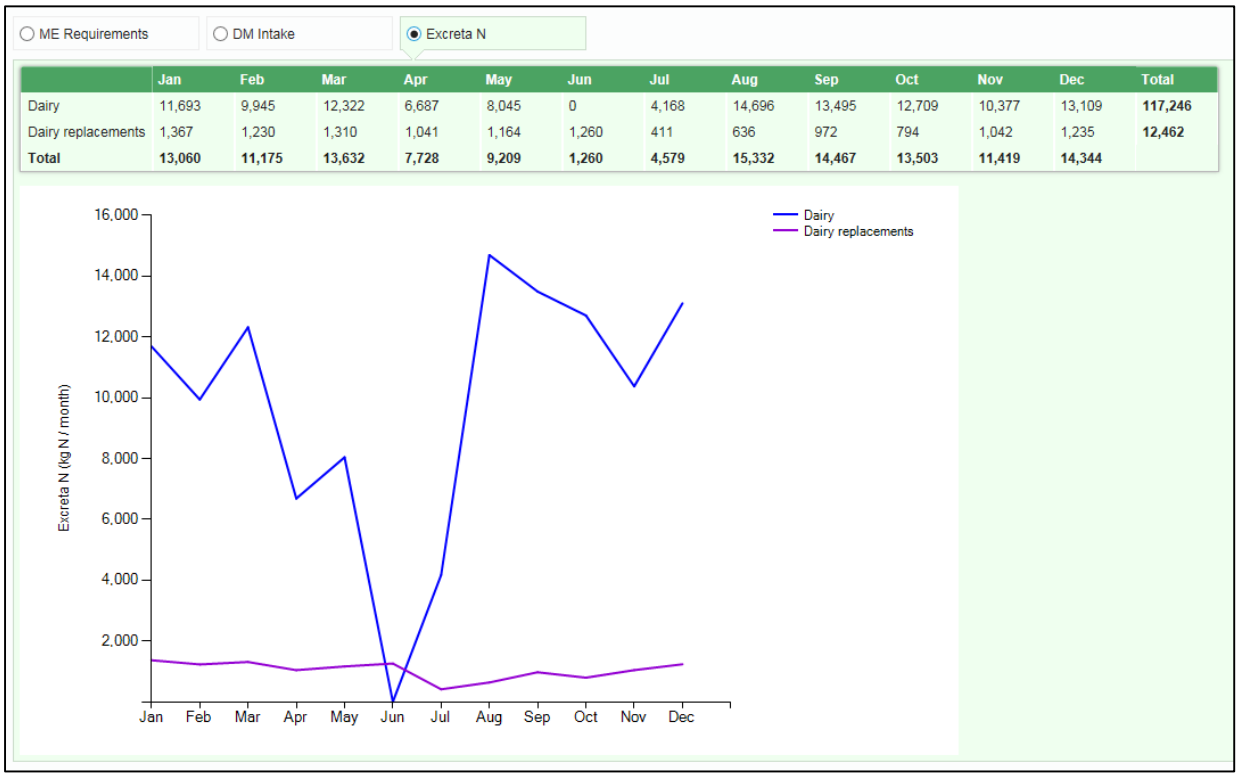
2.7.3. Excreta nitrogen

The purpose of the Excreta nitrogen (N) report is to present estimated monthly excreta N deposited (kg N/month) for each animal enterprise present on the farm. Excreta N is estimated as animal N intake from pasture, supplements, and crops, less N in products (this includes live weight). Excreta N as urine and dung is then distributed around the farm, allowing for excreta deposited on blocks, the farm dairy, pads and lanes. Excreta deposited on the farm dairy and pads is distributed by the effluent management system.

In OVERSEER, the largest source of N leaching from pastoral farms is from the urine patch. The proportion of excreta N that is excreted, as urine is dependent on the diet N concentration, and is typically between 65 and 80% of total N excreted (Ledgard *et al*., 2003). The amount of N leaching from urine patches is based on urine N deposited on blocks, and the monthly risk of that urine leaching.

Interpretation of an Excreta N report:

Figure 9 shows an Excreta N (kg N/month) report for a hypothetical dairy farm. Changes in Excreta N often broadly reflects the pattern observed for ME requirements and DM intake. However, the amount of N excreted may change as the diet changes, depending on the amount and composition (high N or low N) of supplements in the diet.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Dairy	11,693	9,945	12,322	6,687	8,045	0	4,168	14,696	13,495	12,709	10,377	13,109	**117,246**
Dairy replacements	1,367	1,230	1,310	1,041	1,164	1,260	411	636	972	794	1,042	1,235	**12,462**
Total	**13,060**	**11,175**	**13,632**	**7,728**	**9,209**	**1,260**	**4,579**	**15,332**	**14,467**	**13,503**	**11,419**	**14,344**	

Figure 9: Excreta N (kg N/month) report for a hypothetical dairy farm.

3. USING THE ANIMAL REPORTS

Animal reports are provided to help review information describing the farm system, diagnose problems reported by error messages, and provide insight into how the OVERSEER model works.

Diet reports and Additional reports are targeted at experienced users with a good background in nutrient and animal science.

The Location report may be useful more generally, for example, to confirm the placement of animals when diagnosing an error message addressing the placement of animals.

The Stocking rate report may also be useful for assessing and comparing farm carrying capacities.

It is recommended that experienced users refer to published Technical Manual chapters and references that provide information describing the calculations used to estimate ME requirements, DM intake, and excreta N.

OVERSEER Limited does not provide an advisory service. Support when interpreting results must be obtained from a qualified adviser. Please refer to the OVERSEER website for more information (http://overseer.org.nz/find-out-more).

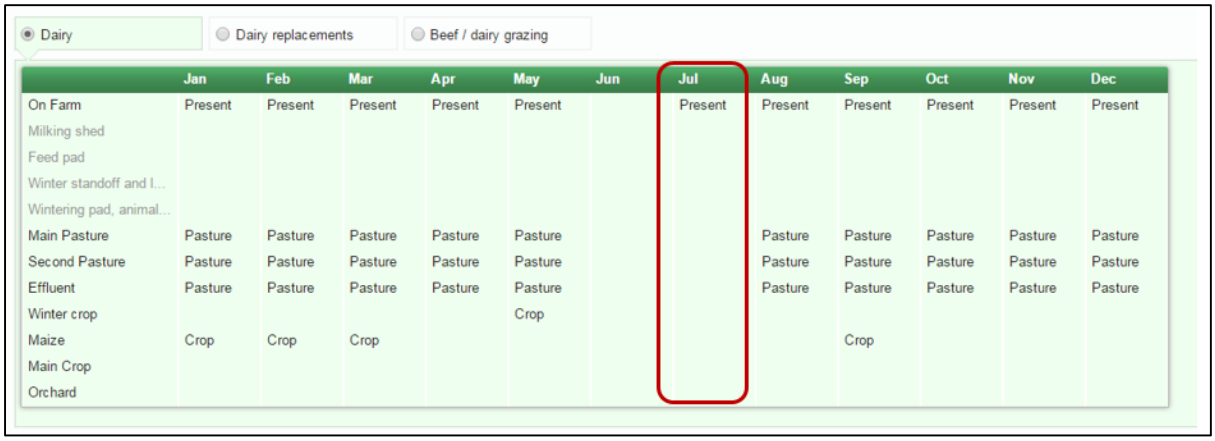
3.1. Practical examples of using the Animal Reports

The following worked examples demonstrate how a user might use the animal reports to help resolve an issue with input data. They are based on feedback received from users.

3.1.1. Animals on farm with nowhere to feed

Below is an example of an error message that may be received while using OVERSEER that relates to the location of the animals on farm and includes the steps that could be undertaken to resolve this error.

> Dairy numbers indicate that animals are on the farm in July but they are not recorded as being grazed off (see Dairy numbers data pane), on a wintering pad/animal shelter (see Dairy Wintering pad management data pane), on pasture (see "Animals on block" data pane, including "Monthly grazing" option if used) or on crops or fodder crops



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
On Farm	Present	Present	Present	Present	Present		Present	Present	Present	Present	Present	Present
Milking shed												
Feed pad												
Winter standoff and l...												
Wintering pad, animal...												
Main Pasture	Pasture	Pasture	Pasture	Pasture	Pasture			Pasture	Pasture	Pasture	Pasture	Pasture
Second Pasture	Pasture	Pasture	Pasture	Pasture	Pasture			Pasture	Pasture	Pasture	Pasture	Pasture
Effluent	Pasture	Pasture	Pasture	Pasture	Pasture			Pasture	Pasture	Pasture	Pasture	Pasture
Winter crop					Crop							
Maize	Crop	Crop	Crop						Crop			
Main Crop												
Orchard												

Using the Location report one can view when animals of an enterprise are on farm and where they are located. This report can be used to compare your expected location of animals with OVERSEER's interpretation of information entered describing the farm operation.

Reviewing the Location report for the Dairy enterprise mentioned in the error message, one can see that animals are on farm in July but are not reported as being on any of the seven blocks. Structures and milking shed feeding are displayed in grey text indicating they are not in use. Using your knowledge of the farm system the error can be resolved, e.g. add a wintering pad, allow dairy animals to graze pastoral and/or crop blocks.

3.1.2. Feed errors that are timing specific

This example is of an error message relating to a feed error which specifies the timing and provides the steps that could be undertaken to resolve the error.

> For Beef / dairy grazing in June, ME of supplements and crops exceeded animal ME requirements by 222%. The feed was predominately fed from crops. Check crop yield, distribution of crops to animals or consider increasing grazing time on fodder crop if this message persists

This error message specifies the enterprise, the month it occurs, the degree of excess and the predominant source. Month only is specified when supplements and crops supplied do not meet the requirements of the enterprise.

> Insufficient feed has been supplied to Dairy when not on pasture for the month of June. Only 48% was supplied.

This feed error is reported when an enterprise has access to insufficient supplements and crops to meet their requirements without access to permanent grazed pasture.

Animal reports show how the OVERSEER model interprets information entered into the model. The Diet (ME place) report supplies information describing the amount of feed obtained from particular sources and fed out in particular places on-farm. Use this report to assess any discrepancies in expected outcomes. This can be used to pinpoint those feeding events requiring adjustment.

Use the Location report to confirm that the location of all enterprises on farm is as expected and determine the scope of the problem, i.e. identify other enterprises or feeding events in other months that may be involved. The last row Animal ME requirements in the Diet ME source report is a useful indicator. Values greater than 120% or less than 80% for any month or any enterprise indicate that feed supplied does not adequately match estimated animal requirements.

Your knowledge of the farm system is required to make judgements as to what corrections can be made to the description of farm conditions and operation. The approach will differ depending whether supplements or crops fed to the enterprise are changed. It may be possible using the Diet (ME source) report to anticipate future errors when navigating towards a final solution.

3.2. Places to look when resolving a feed error

When a feed error occurs in OVERSEER a number of key areas to check your data inputs within the model are shown below:

For crops:

- Crop area
- Crop yield
- Extra defoliations
- Destination of the crop (say between storage, structure, on pasture)
- Months grazed
- The percentage grazed by each enterprise – evenly distributed is a red flag here – It might be better to distribute based on animal requirements (see Additional > ME requirements report).

For supplements:

- Amount made, imported or fed out from storage
- Destination (blocks, enterprises, export and storage)
- Timing of feeding – evenly distributed is a red flag here – consider in the absence of good quality information the distribution based on animal requirements (see Additional > ME requirements report).
- Utilisation

Note: When adjusting the distribution of crops and supplements fed between enterprises first address those not grazing permanent pasture and then distribute the remainder to other enterprises.

For livestock:

- Monthly numbers or peak cow numbers
- Animal weights and/or Age at start

- Check animals have been assigned to the correct mobs
- Milk production
- Leftover feed (dairy goats only)

3.3. What to do when you get a feed error

The intent of these reports is not to provide a guide to manipulating inputs until a nutrient budget is obtained. If feeding errors occur when actual farm inputs are used, then please submit a request on the OVERSEER website so that it can be investigated and further improvements to the allocation routines can be made.

Please note that OVERSEER Limited has commissioned a review of the ME requirements model for the purpose of investigating more fully if there are changes needed to update the ME modelling in OVERSEER. This review is due to be completed in August 2016.

REFERENCES

Ledgard, S., Luo, J., and Monaghan, R. 2003: Partitioning of excreta nitrogen from grazing animals into urine and dung nitrogen. Report for MPI. 14 p.

Wheeler, D.M., Shepherd, M.A., and Selbie, D.R. 2013: From stock numbers to N leaching and nitrous oxide – The progression through OVERSEER. In: *Accurate and efficient use of nutrients on farms*. (Eds L.D. Currie and C L. Christensen). http://flrc.massey.ac.nz/publications.html. Occasional Report No. 26. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand. 10 pages.

Wheeler, D.M. 2015a: Characteristics of pasture. OVERSEER® Technical Manual. ISSN: 2253-461X. 29 p. Retrieved 6 May 2015, from http://overseer.org.nz/technical-information

Wheeler, D.M. 2015b: Animal metabolic energy requirements. OVERSEER® Technical Manual. ISSN: 2253-461X. 22 p. Retrieved 6 May 2015, from http://overseer.org.nz/technical-information

Appendix D: Priority ecosystems for biodiversity management

Acknowledgements and Disclaimers

Disclaimer:
Significant Natural Areas identified in this report have been derived from analysis of GIS data and local ecological knowledge. The data set is an extensive yet provisional inventory and ranking of significant natural areas of stream and river ecosystems of the Waikato Region, and it is subject to revision through consultation with the District Council or other appropriate sources. The Waikato Regional Council strongly advise that the data be used only in conjunction with subsequent field surveys, especially if the data will be used to help with decisions on resource consents, the development of district plan and regional plan schedules, or funding priorities. The data have been captured at scales of 1:10,000 or smaller and should not be used at finer scales (e.g. 1:5,000) without detailed field survey. The absence of an existing natural stream or river ecosystem area from this report does not imply that such an area is not, or cannot be considered, a significant natural area, or significant habitat for indigenous species. Such areas should be assessed when and if required.

Priority ecosystems for biodiversity management (WRC TR 2010 /19)

0 1 2 3 4 5 6 7 8 9 km

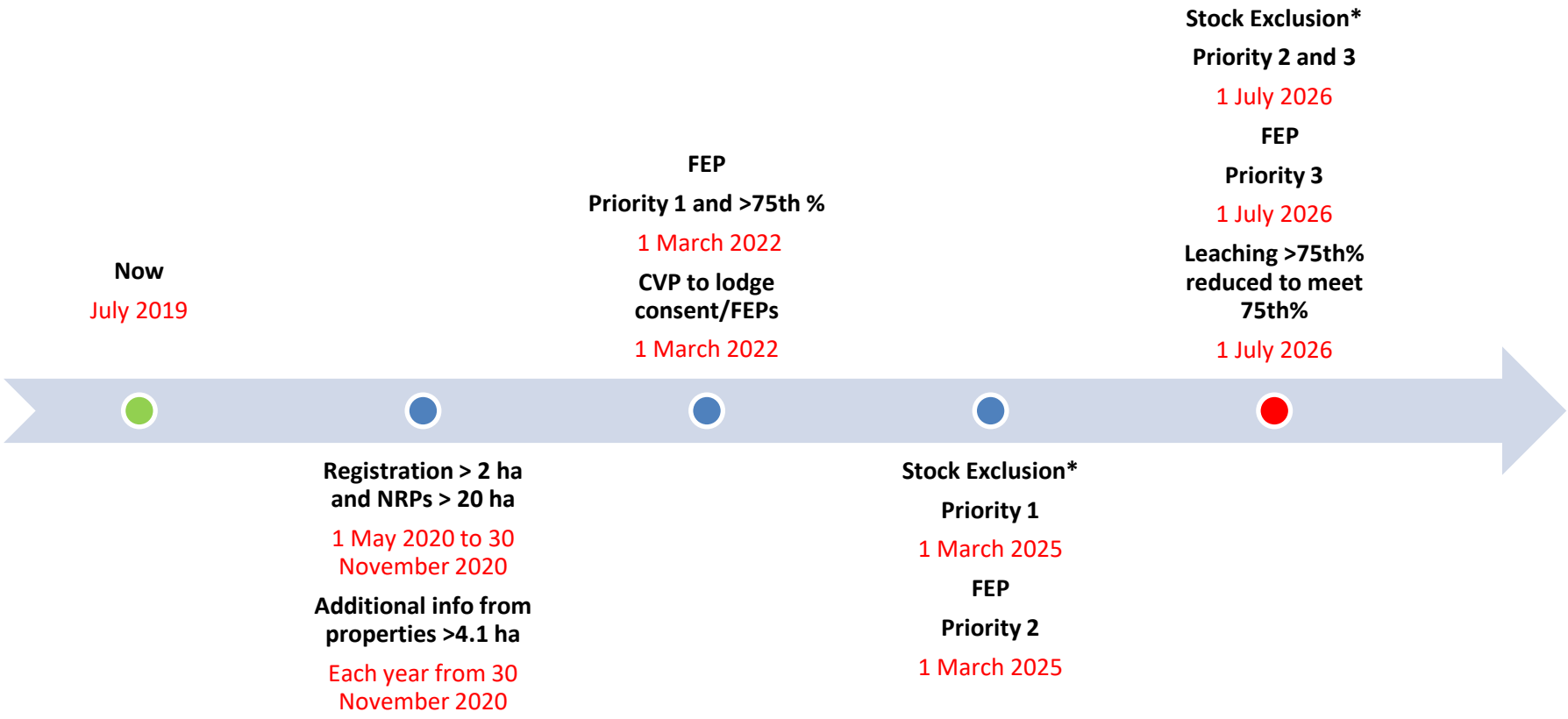
Scale at A3 = 1:90,000

Created by: HCE
Date: 26/06/2019
Version: 1
Job No.: REQ151211
File: REQ151211_Port Waikato Priority Areas.mxd

Waikato REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

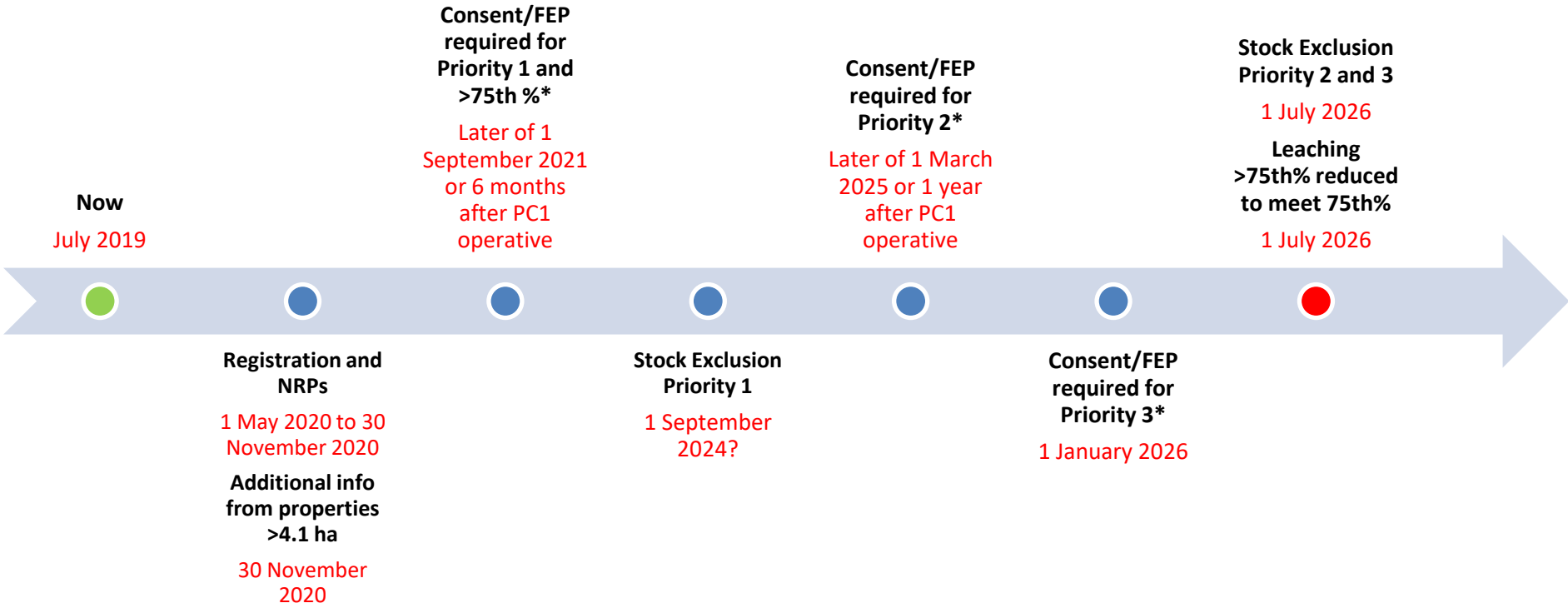
Appendix E: Key dates

Key dates as they appear in notified version of PC1 (as amended by Var1):



* Stock exclusion dates on the timeline refer to land use authorised under Rules 3.11.5.3, 3.11.5.4 or 3.11.5.5. Stock exclusion dates for land use authorised under Rules 3.11.5.1 or 3.11.5.2 are 1 July 2023 and 1 July 2026 for properties within Priority 1 sub-catchments and Priority 2 sub-catchments respectively.

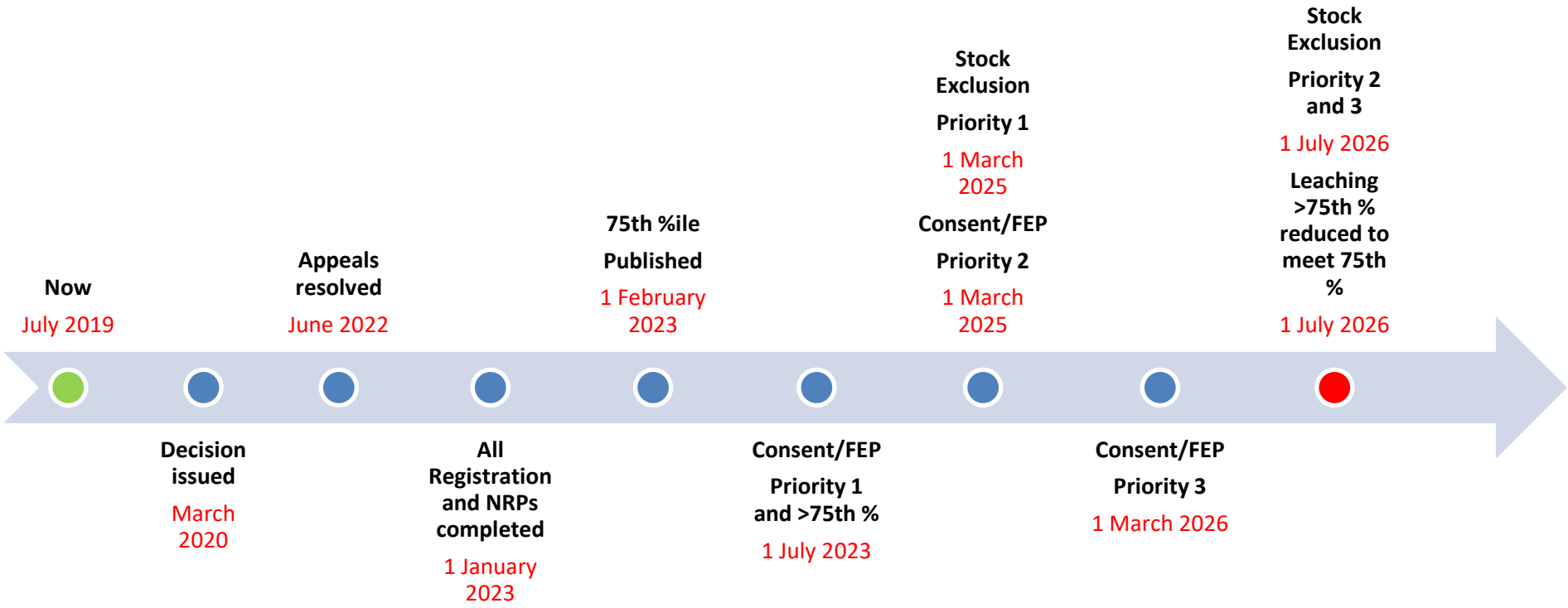
Key dates as they appear in Section 42A Tracked Changes:



* Related to Rule 3.11.5.1A where not a permitted activity under Rule 3.11.5.2. Excludes CVP.

Note: Stock exclusion dates on the timeline refer to land use authorised under Rules 3.11.5.3, 3.11.5.4 or 3.11.5.5. Stock exclusion dates for land use authorised under Rules 3.11.5.1 or 3.11.5.2 are 1 July 2023 and 1 July 2026 for properties within Priority 1 sub-catchments and Priority 2 sub-catchments respectively. [Note the proposed changes to rule structure and numbering].

Key potential dates (subject to finalisation):



Note: This timeline based on maintaining 2026 'implementation date'. Whether this is realistic is still being considered.