

**COMMENTS ON PROPOSED WAIKATO
REGIONAL PLAN CHANGE 1 WAIKATO AND
WAIPA RIVER CATCHMENTS**



TO: Waikato Regional Council

COMMENTS ON: Proposed Waikato Regional Plan Change 1 Waikato and Waipa River Catchments

NAME: Horticulture New Zealand (HortNZ)

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1. **HortNZ's submission, and the decisions sought, are detailed in the attached schedules:**
 - 1.1. HortNZ wishes to be heard in support of this submission.
 - 1.2. This submission is supported by a technical report that is to be read in support of this submission. The report has been lodged with the Waikato Regional Council via FTP file Transfer and is titled "Values and Current Allocation of Responsibility For Discharges" Jacobs Technical Report in Support of the Horticulture NZ Submission on Healthy River Plan Change".
 - 1.3. The Plan and this submission cover a wide range of issues and there are potential consequential amendments that will be required to give effect to the relief sought in this submission.

Decision sought:

- 1.4. Other changes or consequential amendments as are necessary to give effect to the matters raised in this submission.

2. Background to HortNZ and its RMA involvement:

- 2.1. Horticulture New Zealand (HortNZ) was established on 1 December 2005, combining the New Zealand Vegetable and Potato Growers' and New Zealand Fruitgrowers' and New Zealand Berryfruit Growers' Federations.
- 2.2. On behalf of its 5,500 active grower members HortNZ takes a detailed involvement in resource management planning processes as part of its National Environmental Policies. HortNZ works to raise growers' awareness of the RMA to ensure effective grower involvement under the Act, whether in the planning process or through resource consent applications. The principles that HortNZ considers in assessing the implementation of the Resource Management Act 1991 (RMA) include:

- The effects based purpose of the Resource Management Act;

- Non-regulatory methods should be employed by councils;
- Regulation should impact fairly on the whole community, make sense in practice, and be developed in full consultation with those affected by it;
- Early consultation of land users in plan preparation; and
- Ensuring that RMA plans work in the growers' interests both in an environmental and sustainable economic production sense.

2.3. HortNZ works to raise growers' awareness of the RMA to ensure effective grower involvement under the Act, whether in the planning process or through resource consent applications.



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Dated: 8 March 2017

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3. Description of Horticulture in the Waikato Catchment as it relates to PC1

Background

- 3.1. The Commercial Vegetable Production sector has evolved considerably over the last three decades. Before that it was characterised by there being a plethora of relatively small scale businesses producing a wide range of summer and winter leafy greens, root vegetables and other crops which were basically sent into the auction market on the day of harvest and sold for whatever the price was on the day. These businesses were predominantly run and staffed by family members.
- 3.2. As the supermarkets gained dominance in the local market they started to demand year-round supply of high quality produce which they found increasingly difficult to source from the auction market. Sourcing it directly from the producers was restricted by the relatively large number of producers so they progressively set about forming relationships with growers who they knew and trusted to supply them with the quality and quantity of produce which they required.
- 3.3. A number of the entrepreneurial growers very quickly recognised that there was more profit to be made post production so they moved further up the value chain to take control of the processing, packaging, storage and marketing of their produce to both the local and export markets.
- 3.4. The Commercial Vegetable Production sector has now evolved to the point where there are approximately 10 producers who make up approximately 90% of production by volume and planted area. They are managed by family members but by far the greatest majority of staff is employed. There are still smaller family owned businesses that operate as well, but there is significant consolidation that is evident.

The nature of their businesses.

- 3.5. The Commercial Vegetable Production businesses are characterised by being individually very large businesses that incorporate the full range of activity from growing through to marketing of their produce. They are fully integrated. This has involved very significant investment in land, infrastructure, growing and harvesting plant and machinery, processing sites and equipment, storage sites and equipment and such ancillary services as freighting capability etc.
- 3.6. As part of this development they have also developed considerable intellectual property across the full range of production, processing and marketing of their produce.
- 3.7. Because of both the local and international markets requirements for very consistent quality and year-round supply they have had to expand the area that they can grow the crop in across New Zealand and internationally. All of this activity is based around the major processing centres based in either the Auckland or Waikato Regions because that is the closest to the major local market and export centre. It also offers them easy access to a ready available source of labour.

The nature of the land required.

- 3.8. The type of soil which they prefer to grow the crops in are deep, free draining soils. These soils are relatively limited in abundance across the Auckland and Waikato Regions.

- 3.9. There is an extensive range of crops which they grow; some which are very frost sensitive; some which require considerable winter chilling. Some crops can be grown continuously in the same land; some of which requires considerable periods before it can be grown in the same ground again to avoid disease pressure. This means that the land which is used for growing in any one year is less than the total foot print of vegetable production land. The Commercial Vegetable Production sector tends to operate at about half the land owned by the business and half which is leased both long and short term. Access to the right amount of suitable soils on a lease basis is a serious issue for this sector.
- 3.10. To be able to produce sufficient vegetables to meet internal demand during the winter, spring and early summer period requires that access to the suitable soils in the frost-free areas around the Pukekohe and Pukekawa hills are absolutely essential to maintain supply. This access is being threatened by urban creep from Auckland and by the lack of expansion opportunities available in the proposed Waikato PC 1.

The food access issue.

- 3.11. There is no doubt that the New Zealand Commercial Vegetable Production sector provides an essential service to the country by supplying vegetables to our predominantly urban population throughout the year at an affordable cost. Their ability to provide this service is predominantly driven by the availability of the correct soil types in the required climate zones which are situated in the Auckland and lower Waikato regions. The alternative source of these vegetables would involve significant transport costs internationally which would result in the price required to be paid for them to be too high for the majority of consumers.

The footprint of the sector – extracted from the accompanying technical report

- 3.12. In total, horticultural land occupies 0.6% of the total area of the Waikato River catchment, and accounts for 2.5% of the Total Nitrogen (TN) loads and 0.9% of the Total Phosphorous (TP) load in the overall catchment. The contribution of horticulture land to sediment loads predicted from each sub-catchment is also very low. The sediment concentrations in the Lower Waikato are influenced by the inflow of the Waipa River at Ngaruawahia, the Whangape Lake Catchment, the Opuatia catchment, and the Whangamarino River. There is also a marked increase in Chlorophyll a concentration between Huntly-Tainui and Tuakau, which is in response to the inflows from the hypertrophic riverine lakes; Lake Whangape and Lake Waikare.
- 3.13. There is a decreasing water clarity trend throughout the Waikato catchment which generally reflects the increasing concentrations of other constituents that influence it, including nitrogen, phosphorous, sediment and Chlorophyll a. Environmental mitigation programs on horticultural properties are very focused on ways to reduce firstly sediment and phosphorus discharges closely followed by nitrogen discharges. Furthermore, the majority of the horticultural property in the Waikato is in the Lower Waikato catchment, meaning the impact of phosphorus runoff and nitrogen leaching from horticultural enterprises covers a small proportion of the overall Waikato catchment. Horticulture also has a minimal impact on E.coli loads in the overall Waikato River catchment and contributes less E.coli yields compared with dairy, sheep and beef and urban land use.
- 3.14. PC1 outlines that changing landuse to commercial vegetable production is a non-complying activity. However, we think it should be provided for as a restricted

discretionary consent for new commercial vegetable production where it can be demonstrated there is an overall reduction across all four contaminants considered in PC1. The assessment of an application for new commercial vegetable production should allow recognition for any reductions in bacterial contamination as a result of the conversion of land to commercial vegetable production. And in some cases, if it can be demonstrated that the land use change results in a similar or lesser effect on core values protected by the Vision and Strategy; an increase in discharges of nitrogen should be provided for.

- 3.15. Horticulture may have some higher Nitrogen (N) leaching values but a very small N load overall when compared by land area covered by other activities. Policy 3 g states that *'the degree of reduction in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens is proportionate to the amount of current discharge (those discharging more are expected to make greater reductions), and the scale of water quality improvement required in the sub-catchment.'*

Fruit Production

- 3.16. In the Waikato region the total fruit production area is approximately 1,661+ hectares. The largest fruit crops by area are kiwifruit (726ha), berryfruit (342+ha), avocados (176ha), and apples (141ha). Other fruits produced in the region include summerfruit and citrus. There is 459ha of asparagus planted in the Waikato region.
- 3.17. Evidence placed before many regional plan changes has demonstrated that the profile of permanent fruit cropping aligns with a definition of low intensity farming. Low intensity farming options are obviously a mitigation to higher intensity discharges within the catchment and have been enabled by PC1. HortNZ supports this approach and the regime laid out for low intensity farming.
- 3.18. Note: These statistics are representative of the Waikato Region, not the catchment, so the figures for the Waikato are a subset of the total amount

4. **CHAPTER 3.11: WAIKATO AND WAIPA RIVER CATCHMENTS/NGĀ RIU O NGĀ AWA O WAIKATO ME WAIPĀ**

AREA COVERED BY CHAPTER 3.11/NGĀ RIU O NGĀ AWA O WAIKATO ME WAIPĀ

- 4.1. HortNZ opposes the progression of a Plan Change 1 (PC1) without a comprehensive whole of catchment planning response.
- 4.2. Also, the area withdrawn from PC1 effectively divides the key growing regions of Pukekohe and Pukekawa through a north-south boundary. These growing regions need to be assessed as a whole because production is integrated across the growing region. It is already difficult as the growing region is divided by the boundary between Auckland Council and Waikato Regional Council. The horticulture sector in these regions is badly affected by conflicting regional strategies. Dividing the grower region again by withdrawing some of the area covered by PC1 makes it even harder to strategically plan for the future of the growing community.
- 4.3. It is the opinion of HortNZ that the withdrawal of part of the plan to address consultation with Hauraki iwi authorities results in a failure to comply with requirements of the Resource Management Act to ensure integrated management of the natural and physical resources of the region and to give effect to the National Policy Statement for Freshwater Management.

Decision sought:

- 4.4. Withdraw Proposed Plan Change 1 in its entirety to allow for consultation with Hauraki iwi before any further Proposed Plan Change.
- 4.5. Re-notify Proposed Plan Change 1 with the inclusion of the withdrawn area relating to Hauraki iwi so that the catchment can be considered in entirety and so submissions and evidence can be coordinated for the whole of the catchment.
- 4.6. If relief above is unable to be granted; ensure submissions and evidence for each Plan Change can be given as a coordinated package addressing the whole catchment.
- 4.7. Any consequential amendments necessary to address the submission as a result of any changes made to the Plan Change after the withdrawn portion has been re-notified and submissions called for.

BACKGROUND AND EXPLANATION

Lack of an Issue Statement

- 4.8. HortNZ recognises that the function of this plan change is to aid the restoration of the health and well-being of the Waikato River. The background and explanation section outlines one of the key issues; that discharges have degraded the Waikato River to the point that it is over allocated, and there is a statutory requirement to restore key values articulated by Waikato River iwi.
- 4.9. More regular practice is to have an issue statement that points broadly to the objectives and policies in the proposed plan. HortNZ would support the inclusion of an issue statement if it is considered desirable by decision-makers in relation to this plan. However, support would be dependent on an issue statement recognising the most

significant issues and challenges facing the grower community in relation to land and freshwater management. In this section of the submission there is text that could usefully contribute to issue statement.

Decision sought:

- 4.10. If an issue statement is included in this plan, provide recognition of the most significant issues and challenges facing the grower community in relation to land and freshwater management.

Collaborative Approach

- 4.11. HortNZ and Pukekohe Vegetable Growers Association supported a collaborative approach to resolving issues with freshwater for the Waikato River catchment. The collaborative process required significant investment in time and resources. While a collaborative process is unlikely to result in consensus; it is extremely useful for narrowing contentious issues. This is likely to aid decision-makers in a subsequent Schedule One (RMA 1991) process.
- 4.12. While a collaborative process can be very useful it is no substitute for a full First Schedule RMA process. A collaborative group cannot universally speak for a community on anything more than general terms. No collaborative process should fundamentally undermine individual access to justice to the full range of protections outlined in the RMA 1991.
- 4.13. HortNZ could not agree all of the aspects of the "CSG Approach", and this is identified in voting records for the process. But a key benefit of the process for the grower community was the opportunity provided to communicate the plan and the regulatory challenge. The final proposed plan has been delivered to an engaged grower community. The discussion held between the submitters and growers following release of the final proposed PC1 has ensured this submission is more representative of broader grower views.
- 4.14. There were also many aspects of freshwater quality management that were considered to be out of scope for the Collaborative Group. These included:
- management of Pest Aquatic Organisms;
 - the effect on water quality management of past decisions regarding the management of water **quantity** (mainly as a result of Variation six);
 - consideration of the effects of plan changes being undertaken in adjacent regions
 - Consideration of the effects of contaminants other than sediment phosphorus, nitrogen and bacteria.
 - Consideration of the effects of subdivision, use and development on water quality-particularly in relation to the use of rural land for greenfield residential, industrial and commercial development
 - The effect on water quality of the wider suite of rules¹ enabling subdivision of rural land and the provision of drainage, roads, stormwater and sewage infrastructure.

¹ Operative Waikato Regional Plan, particularly modules 3, 4, 5 and 7.

- Consideration of who benefits from better water quality management and who should be involved in funding restoration by phasing out the overallocation of contaminants
- Opportunities to trade an allocation of contaminants to allow a highest value use as market conditions change over time.

Decision sought:

- 4.15. Refine statement regarding the collaborative approach to acknowledge the statements made in the above paragraphs. Acknowledge that the plan does not adequately address all sources of contaminants that impact on values identified in the Vision and Strategy.

Material plan changes prior to PC1 that occurred post adoption of the Vision and Strategy

- 4.16. HortNZ considers that PC1 could be improved by better consideration of prior plan changes that have influenced freshwater management. HortNZ was involved in these prior plan changes.

VARIATION 6 (Water Quantity)

- 4.17. HortNZ considers that has been a mistake not to consider the implications for freshwater quality management of the decisions made during Variation six back in 2009. For growers' the following aspects of those decisions are significant (with respect to water quality management).

4.17.1. Priority of access for new domestic and municipal takes of water within the primary allocable flow regime; effectively allowing a new application to over-allocate the primary allocable flow with the overallocation being subsequently phased out by decreasing other authorised abstractions after 2030. Water for irrigation of horticultural crops is one of the abstractions targeted for reductions. The most significant application has already been lodged and is in a queue waiting for consideration.² This consent application has the potential to reduce surface water allocation to growers by 60%. Given that discharges of nutrients can be estimated to increase without sufficient irrigation to raise yields; this will remove a key mitigation for commercial vegetable growers seeking to reduce discharges unless alternative sources of water can be found.

4.17.2. Development of a controlled activity legitimising more than 2000 unauthorised water takes for dairy shed wash down and milk cooling. This has effectively supported pastoral intensification. The controlled activity grandparents unauthorised water use for some activities, while allowing for other activities to have water allocation clawed back after 2030. Water for irrigation of commercial vegetable crops is one of the uses of water targeted for reduction as a result of grandparenting these unauthorised abstractions.

4.17.3. During variation six a secondary allocable flow that may have provided an alternative for commercial vegetable growers was removed at the request of Waikato Tainui. The secondary allocable flow was removed to provide

² The proposed new take for Watercare Services Ltd to meet the needs of Auckland.

more assimilative capacity to manage the effects of contaminants being discharged in the upper and mid Waikato catchments. Waikato Tainui were concerned about the effect of increased discharges as a result of conversion of land from forestry to pasture. Most of this was occurring in what is now identified as the Upper Waikato FMU. The removal of the secondary allocable flow is effectively a catchment based mitigation for discharges from land use activities higher in the catchment. This mitigation is very likely to place significant costs on the grower community in the lower Waikato.

- 4.17.4. The expansion of Auckland South into the Waikato is enabled by Variation 6 providing Auckland with enough domestic and municipal water supply to expand into rural areas. There will be a concurrent effect on water quality in the lower Waikato waterbodies as rural land is subdivided for a range of residential commercial and industrial purposes. The grower community has a responsibility to manage freshwater, but not to manage the effects of water quality degradation as a result of urbanisation.

Decision sought:

- 4.18. Acknowledge in PC 1 the effect on the grower community of water quantity decisions made in Variation 6 to the Waikato Regional Plan, and
- 4.19. Acknowledge that Variation 6 transferred the cost of unauthorised takes and the discharges these takes allowed; because authorisation of these takes provided for the degradation of water quality in the lower Waikato River.
- 4.20. Acknowledge in PC1 that the resulting clawback of water quantity allocation post 2030 will reduce access to a key mitigation of nutrient discharges.
- 4.21. Provide within the plan the ability for commercial vegetable growers to access water at best practice application rates to manage discharges of nutrients more effectively.
- 4.22. Ensure that the costs incurred by the grower community related to clawback of authorised freshwater abstractions and removal of allocation bands are factored into the section 32 analysis for PC1.
- 4.23. Have regard for the acknowledgements 4.18 to 4.20 by granting consequential relief contained within this submission.

WAIKATO RPS (Regional Policy Statement)

- 4.24. The Waikato RPS also enables the Vision and Strategy for the Waikato River, but goes on to recognise a number of other significant objectives including recognition of the ecosystem services (provisioning aspects) of food production. There is also strong policy recognition of the need to provide for essential industries such as the vegetable production industry. PC1 needs to reconcile the requirement to meet new water quality targets required to achieve The Vision and Strategy for the Waikato River, the need to protect key parts of the commercial vegetable sector as both an ecosystem service and an essential industry.
- 4.25. The submission is provoked by economic modelling of the effects of achieving Scenario One. Published reports utilising Prof Graeme Doole's economic model suggests a complete removal of the commercial vegetable sector within the Waikato catchment. This is an unacceptable outcome for the grower community.

- 4.26. The submission is also provoked by the need to preserve a flexible rotation to maintain sustainable commercial vegetable production system. The location of vegetable production changes over time. The location of discharges will change across land parcels. The plan change must provide for rotation. The past experience of HortNZ suggests the commercial vegetable production systems must be managed as an enterprise requiring consent for a total area that varies over time, but generally remains constant.
- 4.27. Recent developments in Horizons and Canterbury regions have shown that rotational systems are very disadvantaged by land use restriction rules. The chilling effect is most obvious in the determination that benchmarked allowance of nitrogen are fixed to the property through land use consent rules. This means the operation cannot lease new land and transfer the discharge. The formerly leased land benefits from the discharge entitlement of the cropping operation, whereas it should revert to the entitlement of the permitted activity regime. The land to be leased to replace the prior leased parcels has no entitlement. Growers are now asking HortNZ to approach Government and Councils due to the threat to rotation.
- 4.28. Rotation is the crux of sustainable management in arable and vegetable cropping systems. The absence of rotation raises the prevalence of unmanageable disease and does not allow for the rejuvenation or resting of soil. The removal of the options for leasing, sharing and otherwise switching land would basically cause the production system to cease.
- 4.29. The focus of policy controls should not be the management of land use activities; rather it should be the management of discharges to water or to land that may enter water. The rules are designed to manage discharges. The RMA function should be restricted to the management discharges to prevent unintended consequences related to notification and the consenting of multiple land-use parcels by a single grower enterprise.
- 4.30. There is also a greater focus within the Waikato Regional Policy Statement on 2 very significant issues in relation to PC1. These are:
- 4.30.1. Climate Change: The discharges of landuse activities to water should not be considered in isolation from other discharges to air. While this may not affect functional implementation of on farm practice and the management of discharges it should be a factor in considering the benefits and costs of different activities; in terms of the opportunities that are provided for those activities to be enabled.
- 4.30.2. High Class Soils: The preservation of the life supporting capacity derived from High Class soils is a consideration when providing for farming activities within the Waikato region.

Decision sought:

- 4.31. Ensure key elements of the Waikato RPS are given effect to in PC1 including the protection of ecosystem services arising from commercial vegetable production. Provide for continuance of a viable commercial vegetable production industry in the objectives, policies and methods of PC1.

- 4.32. Ensure existing commercial vegetable production rotations can be managed according to best practice growing principles by providing for the movement of commercial vegetable production within the Waikato River catchment.
- 4.33. Ensure that statutory methods within PC1 other than the noncomplying activity land use change rule are discharge controls, not section 9 RMA land use controls.

PROPOSED AUCKLAND UNITARY PLAN (PAUP)

- 4.34. Decisions on the PAUP will impact the availability of rural land for vegetable production in the Pukekohe region. Auckland decisions assume lost productive capacity can be replaced in North Waikato. Decisions on subdivision, use and development have the potential to impact on key groundwater resources in the lower Waikato River basin including the Kaawa aquifer.
- 4.35. A commercially viable vegetable sector will require some increase in Waikato vegetable production sites. The current proposed plan and section 32 analysis has not taken this into account.

Decision sought:

- 4.36. Recognise in the section 32 analysis for PC1 the effect of the Auckland planning regime on the availability of scarce cropping land.
- 4.37. Provide some opportunity for commercial vegetable production on new sites in the Waikato River catchment, to preserve the productive capacity of the vegetable sector; particularly in relation to the production of non-substitutable leafy greens, potatoes and carrots for domestic consumption in key periods of the national domestic foodchain.
- 4.38. These opportunities should be provided for as a restricted discretionary consent for new commercial vegetable production where it can be demonstrated there is an overall reduction across all four contaminants considered in PC1. Assessment of an application for new commercial vegetable production should allow recognition for any reductions in bacterial contamination as a result of the conversion of land to commercial vegetable production.
- 4.39. In some cases, if it can be demonstrated that the land use change results in a similar or lesser effect on core values protected by the Vision and Strategy; an increase in discharges of nitrogen should be provided for.

Co-management of the Waikato and Waipa Rivers

- 4.40. The explanation on the co-management arrangement for the Waikato and Waipa Rivers and catchments is supported.
- 4.41. HortNZ supports the statement that sets out how the Vision and Strategy for the Waikato River established through the three Rivers Acts is to be achieved, by:
- Reducing nitrogen, phosphorus, sediment and microbial pathogen losses from land
 - Ongoing management of diffuse and point source discharges of nitrogen, phosphorus, sediment and microbial pathogens.
 - Giving people and communities time to adapt to the requirements of Chapter 3.11 and supporting actions to achieve short-term objectives while being clear

that further reductions in nitrogen, phosphorus, sediment and microbial pathogen losses from land will be required in subsequent regional plans.

- Ensuring that Waikato Regional Council continues to facilitate ongoing research, monitoring and tracking of changes on the land and in the water to provide for the application of Mātauranga Māori and latest scientific methods, as they become available.
- Preparing for future requirements on what can be undertaken on the land, with limits ensuring that the management of land use and activities is closely aligned with the biophysical capabilities of the land, the spatial location, and the likely effects of discharges on the lakes, rivers and wetlands in the catchment.

- 4.42. The restoration of water quality within the Waikato River so that it is safe for people to swim in and take food from over its entire length will take time and requires an intergenerational response. It is not reasonable or viable to load the full cost of the fix onto current occupants and resource users.
- 4.43. HortNZ supports the outcomes sought through PC1 and reiterates that people and communities need time to adapt to the requirements of Chapter 3.11 and supporting actions to achieve short-term objectives. Further reductions in nitrogen, phosphorus, sediment and microbial pathogen losses from land are anticipated in subsequent regional plans. The methods to support these reductions and timing to achieve the environmental outcomes will continue to require suitable timeframes and buy in from those affected.
- 4.44. HortNZ recognises that there are many ways to achieve the water quality outcomes sought, and the community is to be enabled to achieve water quality targets they must have the flexibility to adopt tailored local solutions. For the greatest efficiency in achieving outcomes the plan must provide for collaborative catchment based solutions involving groups of farmers working under a common entity.
- 4.45. HortNZ also recognises that the effect of farming activities on the values varies greatly. For example, pastoral farm conversion from forestry is a feature of development over the last 20 years. Other activities such as commercial vegetable production have remained static in the land-use footprint over that time. Gains have been made in the commercial vegetable sector by increasing efficiency; not as a result of putting more land into production.
- 4.46. Having said that, the footprint of the commercial vegetable sector has changed in terms of the location and the nature of rotation. This is a result of increasing pressure on the availability of land between Auckland and Hamilton. It is also a result of consolidation within the sector; because scale has been required to maintain profitability.
- 4.47. Pressure on land for commercial vegetable production is extremely worrying. Commercial vegetable producers require rotation for soil sustainability and disease management. A wide range of crops are produced. Each crop has a different market. While some of these markets are export focused, most of the businesses also produce the domestic market. Export crops often support domestic production and make domestic supply viable by increasing the scale and profitability of the business.
- 4.48. In particular Pukekohe and Pukekawa production of carrots, potatoes, and leafy fresh market greens meets domestic demand almost entirely for October, November and the early part of December. This is because of the unique set of environmental conditions

allowing for winter production. Crops from further north are restricted by disease pressure factors, and these same crops growing further south are impacted by frosts.

- 4.49. In this region, the domestic production element (planting for table in late winter and early spring) causes a higher - level discharge in Pukekohe and Pukekawa than in cropping systems modelled elsewhere in New Zealand.
- 4.50. Having said that, vegetable production produces very little bacterial contamination. Environmental mitigation programs are very focused on ways to reduce firstly sediment and phosphorus discharges closely followed by nitrogen discharges. Water efficiency has also been targeted because of the link between efficient irrigation and lower discharges from cropping systems.
- 4.51. There has been a noted improvement in the discharge of soil from systems in Pukekohe and Pukekawa over the last 15 years. That is because cohesive erosion and sediment control plans have been developed and implemented to preserve soil loss. On-farm systems have been integrated into public drainage management because a lack of integration was identified as a key discharge risk.
- 4.52. But the scientific programmes have not identified any "silver bullets" that will allow for a significant reduction in discharges of nitrogen from commercial vegetable production systems without a substantive economic loss. Growers do report that fertiliser application practices have changed significantly and this is demonstrated within literature by reviewing evidence on past application rates compare to common current application rates.
- 4.53. Application technology has been a significant factor in advancing position of fertiliser application. Growers are currently testing new controlled release products that have not been available to date and there is hope that these will be effective in managing nitrogen discharges.
- 4.54. Growers support the production of an industry assurance scheme and a farm planning regime that can be independently monitored to provide evidence of continuous improvement in practice.
- 4.55. OVERSEER is a management tool of significant concern to the horticulture sector. The development of the commercial vegetable cropping modules within OVERSEER has been retarded by the emphasis on pastoral production systems. Recent experience in Canterbury has demonstrated the need for an alternative modelling approach to assess the benchmark contaminant discharge from commercial vegetable cropping rotations.
- 4.56. It is noted that the work that was done in OVERSEER for modelling the contribution of vegetable cropping in the Waikato region³ modelled proxy farms based on three standard rotations. The information collected to support the establishment of proxies was based on 19 surveyed enterprises representing in total as significant proportion of the cropping land in Pukekohe and Pukekawa. Other sites in the catchment were not surveyed.

³ <http://www.hortnz.co.nz/assets/Uploads/nutrient-performance-and-financial-analysis-of-lower-waikato-horticulture.pdf>

- 4.57. A reference group was assembled under the supervision of the Ministry of Primary Industries and The Healthy Rivers Joint Venture Project. The reference group consisted of growers, agronomists, economists, government officials and scientists from Crown Research Institutes. During the process a decision was made to develop a "worst case" leaching profile to be conservative. This was represented by a significant portion of winter vegetable production within the model rotations.
- 4.58. The modelling of the worst case leaching profile needs to be considered when assessing the effect of the sector on discharges.

Decision sought:

- 4.59. Retain the statement on co-management of the Waikato and Waipa Rivers.
- 4.60. Ensure the plan recognises the commitment to date of growers in improving discharges of phosphorus and sediment; through the implementation of erosion and sediment control measures and adoption of more efficient irrigation systems as well as improved nitrogen application. Have regard for this by granting relief contained within this submission.
- 4.61. Ensure the plan provides for the establishment of an alternative method or model to establish a benchmark nitrogen and phosphorus discharge for commercial vegetable production systems from OVERSEER.

Full achievement of the Vision and Strategy will be intergenerational

- 4.62. HortNZ supports recognition of the intergenerational nature of change required; and recognises that the adopted 80-year timeframe to achieve the water quality objectives of the Vision and Strategy is aspirational. As stated in this section, the 80-year timeframe recognises the 'innovation gap' that means full achievement of water quality requires technologies or practices that are not yet available or economically feasible. While recognising that the regional plan is a static instrument, methods (and timeframes) to achieve the water quality objectives may need to change. A;
- staged approach allowing time for the innovation (in technology and practices) is supported
 - will need to be developed to meet the targets and limits in subsequent regional plans to be developed is supported.
- 4.63. The section could be improved by setting out the approach adopted to reducing contaminant losses for commercial vegetable production and how fruit production systems are to be managed. As proposed the section identifies the approach to reducing contaminant losses from pastoral farm land, point source and forestry activities. The proposed land use change constraint is noted but the only reference to commercial vegetable production is to Farm Environment Plans.

Decision sought:

- 4.64. Amend this section to:
- Recognise the essential aspects of the vegetable production industry in the Waikato.
 - Identify that existing vegetable production has a priority over any new production that is likely to have a greater contribution of discharges.

- Authorised farm enterprise through a capped area controlled activity consent, allows for rotation across new and existing land parcels.
- Opportunities for new vegetable production are available if the proposed operation can demonstrate a decrease in discharges (across all four contaminants) compared to the activity it is replacing.
- Recognition of permanent fruit production as a low intensity farming activity

5. 3.11.1 VALUES AND USES FOR THE WAIKATO AND WAIPA RIVERS/NGĀ UARA ME NGĀ WHAKAMAHINGA O NGĀ AWA O WAIKATO ME WAIPĀ

- 5.1. HortNZ supports the identification of Primary Production as a Mana Tangata value of water arising from its use by people for economic, social, and cultural purposes.
- 5.2. Horticulture is a nationally significant primary production activity in the Waikato. This section sets out that the rivers support this production. HortNZ agrees with this statement but this is only part a system that requires access to land, suitable parcel sizes, climate, labour and a supportive regulatory system to enable rural production.

Decision sought:

- 5.3. Retain Primary Production as a Mana Tangata value.
- 5.4. Provide some additional text in the description of the primary production value that recognises the significant role Pukekohe and Pukekawa commercial vegetable production systems have in the national domestic food chain.

6. 3.11.2 OBJECTIVES / NGĀ WHĀINGA

Objective 1: Long-term restoration and protection of water quality for each sub-catchment and Freshwater Management Unit/Te Whāinga 1: Te whakaoranga tauroa me te tiakanga tauroa o te kounga wai ki ia riu kōawaawa me te Wae Whakahaere i te Wai Māori

By 2096, discharges of nitrogen, phosphorus, sediment and microbial pathogens to land and water result in achievement of the restoration and protection of the 80-year water quality attribute targets in Table 3.11-1.

- 6.1. The objective explanation could be improved as the objective is not to restore and protect 80-year water quality attribute targets but to restore and protect the health and wellbeing of the Waikato River.

Decision sought:

- 6.2. Amend as follows:

"By 2096, the adverse effects from discharges of nitrogen, phosphorus, sediment and microbial pathogens to land and water are reduced resulting in achievement of the desired state of intrinsic freshwater values for the Waikato River, represented by the restoration and protection of the 80-year water quality attribute targets in Table 3.11-1."

Objective 2: Social, economic and cultural wellbeing is maintained in the long term/Te Whāinga 2: Ka whakaūngia te oranga ā-pāpori, ā-ōhanga, ā-ahurea hoki i ngā tauroa

Waikato and Waipa communities and their economy benefit from the restoration and protection of water quality in the Waikato River catchment, which enables the people and communities to continue to provide for their social, economic and cultural wellbeing.

- 6.3. Maintaining social, economic and cultural wellbeing must be a cornerstone objective in PC1. The objective could also be improved by splitting the sentence to remove ambiguity.

Decision sought:

- 6.4. Amend Objective 2 as follows:

Waikato and Waipa communities and their economy benefit from the restoration and protection of water quality in the Waikato River catchment. The restoration and protection of water quality, should enables the people and communities to continue to provide for their social, economic and cultural wellbeing.

Objective 3: Short-term improvements in water quality in the first stage of restoration and protection of water quality for each sub-catchment and Freshwater Management Unit/Te Whāinga 3: Ngā whakapainga taupoto o te kounga wai i te wāhanga tuatahi o te whakaoranga me te tiakanga o te kounga wai i ia riu kōawāwa me te Wae Whakahaere Wai Māori

Actions put in place and implemented by 2026 to reduce discharges of nitrogen, phosphorus, sediment and microbial pathogens, are sufficient to achieve ten percent of the required change

between current water quality and the 80-year water quality attribute targets in Table 3.11-1. A ten percent change towards the long term water quality improvements is indicated by the short term water quality attribute targets in Table 3.11-1

6.5. It is agreed that a 10% reduction should be sought overall. HortNZ has commissioned work to ensure that the targeted reductions required for vegetable growing are fair given:

- the impact of the sector on water quality values and the likely cost to the community of achieving the targets.
- The impact of prior regulatory decisions on the ability to mitigate contaminant loss.
- The wider benefits of commercial vegetable production to the New Zealand community.
- Prior work undertaken by growers within the commercial vegetable sector who have reduced the contaminant discharge footprint; particularly in relation to sediment and phosphorus discharges.

6.6. HortNZ also recognises the benefit of providing flexibility to land managers seeking to achieve reductions collaboratively at a catchment or sub-catchment scale. It is acknowledged also that the reductions required in the immediate 10 years may not reflect in the short-term water quality attribute targets (Table 3.11 – 1) being met, due to lags or delays in contaminant delivery to water through or over land. It is recommended that contaminant load targets for sub-catchments are also provided in a new table.

Decision sought:

6.7. Amend the objective in the following way:

"Actions put in place and implemented by 2026 to reduce discharges of nitrogen, phosphorus, sediment and microbial pathogens, are sufficient to achieve ten percent of the required change between current water quality and the 80-year water quality attribute targets in Table 3.11-1. A ten percent change towards the long term water quality improvements is indicated by the short term water quality attribute targets in Table 3.11-1 or achievement of the contaminant load reduction targets specified for each subcatchment in Schedule 1C Table XX⁴."

Objective 4: People and community resilience/Te Whāinga 4: Te manawa piharau o te tangata me te hapori

A staged approach to change enables people and communities to undertake adaptive management to continue to provide for their social, economic and cultural wellbeing in the short term while:

- a. considering the values and uses when taking action to achieve the attribute targets for the Waikato and Waipa Rivers in Table 3.11-1; and*

⁴ For the purpose of this relief HortNZ has produced a 10 year Subcatchment Load Target Table (Schedule 1C Table XX) and attached it to proposed relief as part of new Schedule 1C below. As an alternative where it is mentioned in this submission it could be inserted as a new part of Table 3-11-1

b. **recognising that further contaminant reductions will be required by subsequent regional plans and signalling anticipated future management approaches that will be needed to meet Objective 1.**

6.8. The proposed plan change is not allocating discharge rights. However, the proposed plan is managing the discharges from activities by managing the land use. The land use change consent regime proposed is not a land use consent regime but a discharge consent regime. The ten - year timeframe to develop tools and methods for property level allocation is required. The lack of appropriate accounting frameworks suitable for property level allocation is a significant barrier to accurately measuring success in achieving target contaminant reductions.

6.9. There should be policies and methods supported by an objective to encourage communities who choose to develop more accurate accounting frameworks at the subcatchment scale to manage contaminant reductions collectively.

6.10. The transitional nature of this plan should be identified in this objective. Many elements of the community are reluctant to set an approach for allocating contaminant discharges in stone without far more careful consideration of the options for allocating contaminant discharge responsibilities. HortNZ considers that the current approach of grandparenting discharges is suboptimal but necessary. It is necessary because of the lack of detailed information available at the time of this plan change.

6.11. Following 10 years of information collection the community will be better informed to make long-term decisions about the allocation of discharge rights.

Decision sought:

6.12. Retain the staged approach but add two new aspects to the objective:

*A **staged** approach to change enables people and communities to undertake adaptive management to continue to provide for their social, economic and cultural wellbeing in the short term while:*

- a. *considering the values and uses when taking action to achieve the attribute targets for the Waikato and Waipa Rivers in Table 3.11-1 or achievement of the contaminant load reduction targets specified for each subcatchment in Schedule 1C Table XX; and*
- b. *recognising that further contaminant reductions will be required by subsequent regional plans and signalling anticipated future management approaches that will be needed to meet Objective 1 and*
- c. *recognising that this plan change is transitional, to provide time to develop the tools required to more efficiently allocate responsibility for achieving contaminant reduction targets in the long-term.*
- d. *enabling the production of contaminant accounting frameworks that support robust measurement of progress to achieving the long-term and short-term target states for attributes and subcatchment load limits by more accurately identifying property level responsibilities for contaminant reduction.*

Objective 5: Mana Tangata – protecting and restoring tangata whenua values/Te Whāinga 5: Te Mana Tangata – te tiaki me te whakaora i ngā uara o te tangata whenua
Decision sought:

6.13. Retain this objective as notified.

Objective 6: Whangamarino Wetland/Te Whāinga 6: Ngā Repo o Whangamarino

Decision sought:

6.14. Retain this objective as notified.

Principal Reasons for Adopting Objectives 1-6/Ngā Take Matua me Whai ngā Whāinga 1 ki te 6

Reasons for Adopting Objective 1

Objective 1 sets long term limits for water quality consistent with the Vision and Strategy. Objective 1 sets aspirational 80-year water quality targets, which result in improvements in water quality from the current state monitored in 2010-2014. The water quality attributes listed in Table 3.11-1 that will be achieved by 2096 will be used to characterise the water quality of the different FMUs when the effectiveness of the objective is assessed.

6.15. The "reasons" for Objective 1 should be amended to ensure that a proposed new subcatchment load limit table is incorporated.

6.16. Make consequential methods to the Objectives, policies and rules as required to support this relief.

Decision sought:

6.17. Amend Reasons for Adopting Objective 1 as follows:

Objective 1 sets long term limits for water quality consistent with the Vision and Strategy. Objective 1 sets aspirational 80-year water quality targets, which result in improvements in water quality from the current state monitored in 2010-2014. The water quality attributes listed in Table 3.11-1 (and / or the contaminant load reduction targets specified for each subcatchment in Schedule 1C Table XX) that will be achieved by 2096 will be used to characterise the water quality of the different FMUs when the effectiveness of the objective is assessed. There is benefit in providing flexibility to land managers seeking to achieve reductions collaboratively at a catchment or subcatchment scale. Contaminant load targets are therefore set for subcatchments to support achieving the Vision and Strategy.

Reasons for Adopting Objective 2

6.18. Objective 2 sets the long-term outcome for people and communities, recognising that restoration and protection of water quality will continue to support communities and the economy. The full achievement of the Table 11-1 2096 water quality attribute target may require a potentially significant departure from how businesses and communities currently function, and it is important to minimise social disruption during this transition.

- 6.19. The "reason" supporting Objective 2 is important and would be improved by noting that it is important to minimise the 'economic' and social disruption to the community during the transition to achieving water quality targets.

Decision sought:

- 6.20. Amend Reasons for Adopting Objective 2 as follows:

Objective 2 sets the long-term outcome for people and communities, recognising that restoration and protection of water quality will continue to support communities and the economy. The full achievement of the Table 11-1 2096 water quality attribute target may require a potentially significant departure from how businesses and communities currently function, and it is important to minimise economic and social disruption during this transition.

Reasons for adopting Objective 3

- 6.21. Objective 3 sets short term goals for a 10-year period, to show the first step toward full achievement of water quality consistent with the Vision and Strategy.
- 6.22. The effort required to make the first step may not be fully reflected in water quality improvements that are measureable in the water in 10 years. For this reason, the achievement of the objective will rely on measurement and monitoring of actions taken on the land to reduce pressures on water quality.
- 6.23. Point source discharges are currently managed through existing resource consents, and further action required to improve the quality of these discharges will occur on a case-by-case basis at the time of consent renewal, guided by the targets and limits set in Objective 1.
- 6.24. A consequential amendment to the reasons for Objective 3 is required to insertion a new subcatchment load limit table. The reasons would also be improved by the insertion of new text encouraging collaborative approaches to managing discharges at the subcatchment enterprise scale.

Decision sought:

- 6.25. Amend Reasons for Adopting Objective 3 as follows:

Objective 3 sets short term goals for a 10-year period, to show the first step toward full achievement of water quality consistent with the Vision and Strategy.

The effort required to make the first step may not be fully reflected in water quality improvements that are measureable in the water in 10 years. For this reason, the achievement of the objective will rely on measurement and monitoring of actions taken on the land to reduce pressures on water quality. A range of actions will be promoted including collaborative approaches to managing discharges at a subcatchment scale to achieve subcatchment load limits.

Point source discharges are currently managed through existing resource consents, and further action required to improve the quality of these discharges will occur on a case-by-case basis at the time of consent renewal, guided by giving effect to the targets and limits set in Objective 1.

Reasons for adopting Objective 4

- 6.26. Objective 4 provides for a staged approach to long-term achievement of the Vision and Strategy. It acknowledges that in order to maintain the social, cultural and economic wellbeing of communities during the 80-year journey, the first stage must ensure that overall costs to people can be sustained.
- 6.27. In the future, a property-level allocation of contaminant discharges may be required. Chapter 3.11 sets out the framework for collecting the required information so that the most appropriate approach can be identified. Land use type or intensity at July 2016 will not be the basis for any future allocation of property-level contaminant discharges. Therefore, consideration is needed of how to manage impacts in the transition.
- 6.28. Objective 4 seeks to minimise social disruption in the short term, while encouraging preparation for possible future requirements.
- 6.29. The reasons supporting Objective 4 is important and would be improved by noting that it is important to minimise the 'economic' and social disruption to the community during the transition to achieving water quality targets.

Decision sought:

- 6.30. Amend Reasons for Adopting Objective 4 as follows:

Objective 4 provides for a staged approach to long-term achievement of the Vision and Strategy. It acknowledges that in order to maintain the social, cultural and economic wellbeing of communities during the 80-year journey, the first stage must ensure that overall costs to people can be sustained.

In the future, a property-level allocation of contaminant discharges may be required. Chapter 3.11 sets out the framework for collecting the required information so that the most appropriate approach can be identified. Land use type or intensity at July 2016 will not be the basis for any future allocation of property-level contaminant discharges. Therefore, consideration is needed of how to manage impacts in the transition.

Objective 4 seeks to minimise economic and social disruption in the short term, while encouraging preparation for possible future requirements.

- 6.31. Add a statement to the reasons as follows:

The consenting regime will manage the discharges from activities by managing the use. The regime is, therefore, a discharge consent regime under section 15 RMA not a land use consent regime under section 9 RMA.

7. 3.11.3 POLICIES/NGĀ KAUPAPA HERE

Policy 1: Manage diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens/Te Kaupapa Here 1: Te whakahaere i ngā rukenga roha o te hauota, o te pūtūtae-whetū, o te waiparapara me te tukumate ora poto

Manage and require reductions in sub-catchment-wide discharges of nitrogen, phosphorus, sediment and microbial pathogens, by:

- a. Enabling activities with a low level of contaminant discharge to water bodies provided those discharges do not increase; and*
- b. Requiring farming activities with moderate to high levels of contaminant discharge to water bodies to reduce their discharges; and*
- c. Progressively excluding cattle, horses, deer and pigs from rivers, streams, drains, wetlands and lakes.*

- 7.1. HortNZ supports recognition and enablement of low intensity farming systems. This is particularly important for the fruit production sector. Typical fruit production systems in the Waikato grow kiwifruit, berry fruit and apples. Scientific data on contaminant discharges in fruit production systems demonstrates a low environmental risk. If contaminant discharge levels are to be reduced across the catchment there should be no impediment to the establishment of new low discharge primary production.
- 7.2. The regional plan must continue to recognise permanent fruit production as a low intensity farming activity that is entitled to expand without excessive limitations through the ten-year transitional period. HortNZ supports the minimum requirements for registration and reporting on low intensity farming systems and that they remain a permitted activity.
- 7.3. Given that this policy speaks to the management of subcatchment wide discharges, it is an appropriate place to enable the collaborative management of discharges at a scale greater than a single farm. Farmer / catchment collectives managing discharges as a single enterprise within a subcatchment or a water management unit are very likely to achieve environmental outcomes in a more coordinated and effective way.
- 7.4. It is accepted that farming activities with moderate to high levels of contaminant discharge to waterbodies should reduce the effect of those discharges. However, there is no provision in the plan to offset the effects of diffuse discharges by providing mitigations beyond the farm boundary. Proposed Policy 3.11.3-1 should be modified to provide for offsetting where it can be demonstrated there will be a commensurate effect on the restoration of the health and well-being of the Waikato River.
- 7.5. The policy should enable a consenting pathway for groups that form to take responsibility for contaminant reductions by implementing a combination of catchment and paddock scale mitigations that are able to be measured and reported.
- 7.6. In order to assess the ability of the farmer/catchment collective to achieve reduction targets at the time of resource consent application; will be necessary to provide the Council with a credible natural resource accounting framework. The framework must be able to model the likely effectiveness of a suite of discharge mitigations.
- 7.7. For a decision to be made by the council any lodged proposal would need to be assessed against catchment load targets and/or instream concentration targets

specified within the plan. This is a key reason for HortNZ to seek the insertion into this plan of a schedule listing 10-year load targets for each contaminant by subcatchment. Changes sought to this policy proposed to be supported by some consequential changes to methods. These are also outlined in the submission.

Decision sought:

7.8. Modify policy 3.11.3.1 to achieve the intent of revised policy below;

Manage and require reductions in sub-catchment-wide discharges of nitrogen, phosphorus, sediment and microbial pathogens, by:

- a. Enabling activities with a low level of contaminant discharge to water bodies provided those discharges do not increase; and*
- b. Requiring farming activities with moderate to high levels of contaminant discharge to water bodies to reduce the effect of their discharges through on-farm and / or off-farm actions;*
 - ba. Enabling collective action at a catchment scale by groups seeking to manage discharges as a single entity; and*
 - bb. Providing criteria for the approval of natural resource accounting systems used to enable catchment or sub catchment based approaches;*
 - bc. Providing a table of ten-year sub catchment load targets for the four contaminants (Schedule 1C Table XX).*
- c. Progressively excluding cattle, horses, deer and pigs from rivers, streams, drains, wetlands and lakes.*

Policy 2: Tailored approach to reducing diffuse discharges from farming activities/Te Kaupapa Here 2: He huarahi ka āta whakahāngaihia hei whakaiti i ngā rukenga roha i ngā mahinga pāmu

Manage and require reductions in sub-catchment-wide diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens from farming activities on properties and enterprises by:

- a. Taking a tailored, risk based approach to define mitigation actions on the land that will reduce diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens, with the mitigation actions to be specified in a Farm Environment Plan either associated with a resource consent, or in specific requirements established by participation in a Certified Industry Scheme; and*
- b. Requiring the same level of rigour in developing, monitoring and auditing of mitigation actions on the land that is set out in a Farm Environment Plan, whether it is established with a resource consent or through Certified Industry Schemes; and*
- c. Establishing a Nitrogen Reference Point for the property or enterprise; and*
- d. Requiring the degree of reduction in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens to be proportionate to the amount of current discharge (those discharging more are expected to make greater reductions), and proportionate to the scale of water quality improvement required in the sub-catchment; and*
- e. Requiring stock exclusion to be completed within 3 years following the dates by which a Farm Environment Plan must be provided to the Council, or in any case no later than 1 July 2026.*

- 7.9. HortNZ supports a policy platform that provides for a Farm Environment Plan approach established by resource consent or certified industry schemes. The focus on providing a nitrogen reference point appears unbalanced, however.
- 7.10. Nitrogen is one of the four contaminants that are a focus of this plan. All four contaminants affect the values. The effect of each contaminant discharge on the values differs depending on the location and character of the discharge.
- 7.11. The introduction of a nitrogen reference point places an unhealthy emphasis on one contaminant. HortNZ has concerns that this emphasis may have the following adverse consequences:
- It may adversely affect the community's ability to establish a new allocation framework in ten years' time.
 - It does not provide for a tailored / spatial approach to managing discharges across the contaminants depending on the location of the activity and the effect of the activity on the values.
- 7.12. There are significant problems relating to the measurement or modelling of a nitrogen reference point. Dealing with these problems within the planning framework has de-emphasised the importance of managing other contaminants within the planning framework.
- 7.13. HortNZ recognises there has to be a way of measuring change from the status quo to make sure there is not a continuance of the increases in discharges seen over time. But estimation of the discharges of one contaminant should not be a proxy for measuring an increase or a decrease in the other discharges.
- 7.14. The last 20 years of good management practice within the commercial vegetable sector has focused on reduction of phosphorus and sediment from cultivated land. Significant advances have been made in the development of systems to manage and reduce the discharge of contaminants and preserve the scarce soil resource in the Pukekohe and Pukekawa districts.
- 7.15. Subsurface drainage and percolation of water through soil as opposed to across land is a key mitigation. Increased focus on nitrogen may be to the detriment of these mitigations. It is the view of HortNZ that a balanced approach needs to be taken to contaminant reductions across all the 4 contaminants.
- 7.16. The nitrogen reference point may be useful, but it should not be required at the property level when there is a collective group seeking to manage discharges at a greater scale. There should be alternatives to the nitrogen reference point during the transitional period, where it can be demonstrated that the absence of the nitrogen reference point will not increase the overall level of discharges.

Decision sought:

- 7.17. Reword as proposed below:

Manage and require reductions in sub-catchment-wide diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens from farming activities on properties and enterprises by:

- a. *Taking a tailored, risk based approach to define mitigation actions on the land that will reduce diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens, with the mitigation actions to be specified in a Farm or Enterprise Environment Plan either associated with a resource consent, or in specific requirements established by participation in a Certified Industry Scheme; and*
- b. *Requiring the same level of rigour in developing, monitoring and auditing of mitigation actions on the land that is set out in a Farm or Enterprise Environment Plan, whether it is established with a resource consent or through Certified Industry Schemes; and*
- c. *Establishing a Nitrogen Reference Point or proxy for the property or enterprise that is not part of a consented catchment collective managing a range of properties as a single group; and*
- d. *Requiring the degree of reduction in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens to be proportionate to the amount of current discharge (those discharging more are expected to make greater reductions) when assessed across all 4 contaminants, and proportionate to the scale tailored to ensure reductions are targeted at actions within the subcatchments that will improve the values of freshwater specified within this plan. Of improving values water quality improvements required in the sub-catchment; and*
- e. *Requiring stock exclusion to be completed within 3 years following the dates by which a Farm Environment Plan must be provided to the Council, or in any case no later than 1 July 2026.*

Policy 3: Tailored approach to reducing diffuse discharges from commercial vegetable production systems/Te Kaupapa Here 3: He huarahi ka āta whakahāngaihia hei whakaiti i ngā rukenga roha i ngā pūnaha arumoni hei whakatupu hua whenua

Manage and require reductions in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens from commercial vegetable production through a tailored, property or enterprise-specific approach where:

- a. *Flexibility is provided to undertake crop rotations on changing parcels of land for commercial vegetable production, while reducing average contaminant discharges over time; and*
- b. *The maximum area in production for a property or enterprise is established and capped utilising commercial vegetable production data from the 10 years up to 2016; and*
- c. *Establishing a Nitrogen Reference Point for each property or enterprise; and*
- d. *A 10% decrease in the diffuse discharge of nitrogen and a tailored reduction in the diffuse discharge of phosphorus, sediment and microbial pathogens is achieved across the sector through the implementation of Best or Good Management Practices; and*
- e. *Identified mitigation actions are set out and implemented within timeframes specified in either a Farm Environment Plan and associated resource consent, or in specific requirements established by participation in a Certified Industry Scheme.*
- f. *Commercial vegetable production enterprises that reduce nitrogen, phosphorus, sediment and microbial pathogens are enabled; and*
- g. *The degree of reduction in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens is proportionate to the amount of current discharge (those discharging more are expected to make greater reductions), and the scale of water quality improvement required in the sub-catchment.*

7.18. HortNZ supports a policy platform that provides for:

- The essential aspects of the vegetable production industry in the Waikato.
- Targeted reductions required for vegetable growing that are fair given the impact of the sector on water quality and the likely cost to the community of achieving the targets.
- Protects existing production as a priority over any new production that is likely to have a greater contribution of discharges.
- Protects the concept of an authorised farm enterprise through a capped area controlled activity consent, that allows for rotation across new and existing land parcels.
- Enables opportunities for new vegetable production through a new restricted discretionary rule if the proposed operation can demonstrate a decrease in discharges compared to the activity it is replacing. Those discharges should be assessed across all four contaminants as covered by the plan change.
- Ensures the proposed farm planning framework is practical and achievable for growers.

7.19. It is not necessary to refer to the nitrogen reference point in this policy as it is already required by policy 2.

7.20. The outcomes sought by PC1 would be further advanced by providing an offsetting mechanism for non-point source discharges.

Decision sought:

7.21. Amend Policy 3 as follows:

Manage and require reductions in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens from commercial vegetable production through a tailored, property or enterprise-specific approach to consenting discharges where:

- Flexibility is provided to undertake crop rotations on changing parcels of land for commercial vegetable production, while reducing average contaminant discharges over time; and*
- The maximum area in production for a property or enterprise is established and capped utilising commercial vegetable production data sourced from the 10 years up to 2016; and*
- Establishing a Nitrogen Reference Point for each property or enterprise⁵; and*
- A ~~40% decrease in the diffuse discharge of nitrogen and a~~ tailored reduction of no more than 5% through the implementation of Best or Good Management Practices in the diffuse discharge of nitrogen, phosphorus, and sediment is achieved across the sector through the while recognising:*
 - the absent or low risk of discharges of microbial pathogens from commercial vegetable production;*
 - the need to preserve aspects of commercial vegetable production required to maintain domestic supply of vegetables;*
 - the pressure on and scarcity of land suitable for commercial vegetable production. This pressure has recently increased as a*

⁵ if it is considered that policy 3C should be retained HortNZ seeks changes to the wording: "Utilise proxy farm systems to approximate a nitrogen reference point in recognition that OVERSEER is unlikely to identify a nitrogen reference point for commercial vegetable production systems that is accurate enough for the purpose".

result of greenfields expansion onto versatile land in the Auckland region.

- e. prior implementation of Best or Good Management Practices; and Identified mitigation actions that are set out and implemented within timeframes specified in either a Farm Environment Plan and associated resource consent, or in specific requirements established by participation in a Certified Industry Scheme or a collective enterprise managing discharges as a group.
- f. Commercial vegetable production enterprises that reduce can demonstrate an overall reduction in the combined discharges of nitrogen, phosphorus, sediment and microbial pathogens (compared to the existing activity) are enabled; and
- g. The degree of reduction in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens is proportionate to the amount of current discharge (those discharging more are expected to make greater reductions), and the scale of water quality improvement required in the sub-catchment.
- h. Consent will generally be granted for a term greater than 15 years
- i. An offset measure may be proposed in an alternative location or locations to the non-point source discharge, for the purpose of ensuring positive effects on the environment to lessen any residual adverse effects of the discharge(s) that will or may result from allowing the activity provided that the:
 - i. Primary discharge does not result in any significant toxic adverse effect at the non-point source discharge location; and
 - ii. Offset measure provides an equivalent benefit for the values of freshwater specified in this plan; and
 - iii. Offset measure occurs preferably within the same sub-catchment in which the primary discharge occurs and if this is not practicable, then within the same Freshwater Management Unit or a Freshwater Management Unit located upstream, and
 - vi. Offset measure remains in place for the duration of the consent and is secured by consent condition.

Policy 4: Enabling activities with lower discharges to continue or to be established while signalling further change may be required in future/Te Kaupapa Here 4: Te tuku kia haere tonu, kia whakatūria rānei ngā tūmahi he iti iho ngā rukenga, me te tohu ake ākuanei pea me panoni anō hei ngā tau e heke mai ana

Manage sub-catchment-wide diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens, and enable existing and new low discharging activities to continue provided that cumulatively the achievement of Objective 3 is not compromised. Activities and uses currently defined as low dischargers may in the future need to take mitigation actions that will reduce diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens in order for Objective 1 to be met.

- 7.22. HortNZ supports a policy platform that enables existing and new low discharging activities to continue while recognising that low dischargers may in the future need to take mitigation actions to reduce contaminants.
- 7.23. Asparagus production differs in nature from other commercial vegetable cropping activities but is currently captured by the definition of commercial vegetable cropping.

HortNZ and the Asparagus Industry Council are of the view that the perennial nature of asparagus and the subsequently different discharges and cultivation regimes justify treatment of asparagus as an existing or new low discharging activity.

Decision sought:

- 7.24. Retain as proposed.
- 7.25. Alter the definition of commercial vegetable cropping by deleting reference to asparagus.

Policy 5: Staged approach/Te Kaupapa Here 5: He huarahi wāwāhi

Recognise that achieving the water quality attribute targets set out in Table 11-1 will need to be staged over 80 years, to minimise social disruption and allow for innovation and new practices to develop, while making a start on reducing discharges of nitrogen, phosphorus, sediment and microbial pathogens, and preparing for further reductions that will be required in subsequent regional plans.

- 7.26. The proposed plan change is not allocating discharge rights. The ten - year timeframe to develop tools and methods for property level allocation is required. For this reason, HortNZ seeks clarity within the plan that the discharge controls and methods are not considered to be section 9 land use controls; because it is possible that grandparenting of current discharges will prevent a more optimum allocation approach to be established following the 1st 10 years that are covered by this plan change.
- 7.27. Following the first 10 years of transition it may be desirable to introduce a system of land use controls that allocate discharges to parcels of land depending on the natural features of land and climate. However, making these section 9 controls in the transitional plan will severely hamper the ability to maintain rotations across shared and leased land managed by commercial vegetable growers alongside their own land. A significant feature of many commercial vegetable production enterprises is the high proportion of leased blocks within an enterprise.
- 7.28. During implementation of rules requiring consent for commercial vegetable production operations in high risk catchments in the Horizons region, significant impediments were identified as a result of the discharge controls being adjudged land use controls as well. Some of these impediments related to the status of affected parties to the consent application. The same issues may end up being evident here.

Decision sought:

- 7.29. Retain staged approach as proposed, but clarify that discharge controls are not section 9 land use rules.
- 7.30. Make consequential amendments to other policies and methods to give effect to the relief sought.

Policy 6: Restricting land use change/Te Kaupapa Here 6: Te here i te panonitanga ā-whakamahinga whenua

Except as provided for in Policy 16, land use change consent applications that demonstrate an increase in the diffuse discharge of nitrogen, phosphorus, sediment or microbial pathogens will generally not be granted.

Land use change consent applications that demonstrate clear and enduring decreases in existing diffuse discharges of nitrogen, phosphorus, sediment or microbial pathogens will generally be granted.

- 7.31. While HortNZ supports this policy, some improvements could be made to it. While the policy relates to the noncomplying activity land use rule generally, the management purpose of the policy relates to managing discharges so there is no overall increase in the effects of those discharges.
- 7.32. The policy would benefit from an ability to assess the overall effect of an activity based on spatial location and discharge footprint across all 4 contaminants without restricting any individual contaminant from increasing, should an assessment demonstrate that on balance the activity has a lesser adverse effect.
- 7.33. HortNZ supports a clear consenting path for the approval of land use applications that can demonstrate clear and enduring decreases in overall discharges when compared to existing activities on the site.
- 7.34. HortNZ does not agree however that operations capable of demonstrating clear and enduring decreases in existing diffuse discharges should be required to undertake an application for a non-complying activity resource consent. They should be provided for as a restricted discretionary activity.

Decision sought:

- 7.35. Amend the policy in the following way:

"Except as provided for in Policy 16, ~~land-use-change~~ consent applications under Rule 3.11.5.7 that demonstrate on the balance an increase in the diffuse discharge of nitrogen, phosphorus, sediment or microbial pathogens will generally not be granted.

Land-use-change Consent applications that demonstrate on the balance clear and enduring decreases in existing diffuse discharges of nitrogen, phosphorus, sediment or microbial pathogens will generally be granted."

Policy 7: Preparing for allocation in the future/Te Kaupapa Here 7: Kia takatū ki ngā tohanga hei ngā tau e heke mai ana

Prepare for further diffuse discharge reductions and any future property or enterprise-level allocation of diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens that will be required by subsequent regional plans, by implementing the policies and methods in this chapter. To ensure this occurs, collect information and undertake research to support this, including collecting information about current discharges, developing appropriate modelling tools to estimate contaminant discharges, and researching the spatial variability of land use and contaminant losses and the effect of contaminant discharges in different parts of the catchment that will assist in defining 'land suitability'.

Any future allocation should consider the following principles:

- a. *Land suitability which reflects the biophysical and climate properties, the risk of contaminant discharges from that land, and the sensitivity of the receiving water body, as a starting point (i.e. where the effect on the land and receiving waters will be the same, like land is treated the same for the purposes of allocation); and*

- b. Allowance for flexibility of development of tangata whenua ancestral land; and
- c. Minimise social disruption and costs in the transition to the 'land suitability' approach; and
- d. Future allocation decisions should take advantage of new data and knowledge.

7.36. The proposed plan change is not allocating discharge rights. The ten - year timeframe to develop tools and methods for property level allocation is required and must be supported by information gathering and research to inform future allocation.

7.37. HortNZ has developed a full set of discharge allocation principles⁶ and would reserve the right to promote the full set of principles in any future plan change. It is our view that principle c) is not equitable if it does not fully embrace the "polluter pays" concept. We suggest deletion of principle c) or modification of the principle to recognise the polluter pays principle.

Decision sought:

7.38. Modify the policy as follows:

"Prepare for further diffuse discharge reductions and any future property or enterprise-level allocation of diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens that will be required by subsequent regional plans, by implementing the policies and methods in this chapter. To ensure this occurs, collect information and undertake research to support this, including collecting information about current discharges, developing appropriate modelling tools to estimate contaminant discharges, and researching the spatial variability of land use and contaminant losses and the effect of contaminant discharges in different parts of the catchment that will assist in defining 'land suitability'.

Any future allocation should consider the following principles:

- a. Land suitability which reflects the biophysical and climate properties, the risk of contaminant discharges from that land, and the sensitivity of the receiving water body, as a starting point (i.e. where the effect on the land and receiving waters will be the same, like land is treated the same for the purposes of allocation); and
- b. Allowance for flexibility of development of tangata whenua ancestral land; and
- c. ~~Minimise social disruption and costs in the transition to the 'land suitability' approach; and~~
- d. Future allocation decisions should take advantage of new data and knowledge. And;
- e. Having regard for the finite nature of High Class Soils
- f. Incorporating the principle of "polluter pays"; meaning that when assessed across the balance of contaminant discharges to water those having the greatest effect bear a proportionally greater cost of the transition."

Policy 8: Prioritised implementation/Te Kaupapa Here 8: Te raupapa o te whakatinanatanga

⁶ <http://hortnz.co.nz/assets/Natural-Resources-Documents/HortNZ-Nutrient-Allocation-Principles-July-16.pdf>

Prioritise the management of land and water resources by implementing Policies 2, 3 and 9, and in accordance with the prioritisation of areas set out in Table 3.11-2. Priority areas include:

- a. *Sub-catchments where there is a greater gap between the water quality targets in Objective 1 (Table 3.11-1) and current water quality; and*
- b. *Lakes Freshwater Management Units; and*
- c. *Whangamarino Wetland.*

In addition to the priority sub-catchments listed in Table 3.11-2, the 75th percentile nitrogen leaching value dischargers will also be prioritised for Farm Environment Plans.

- 7.39. Hort NZ partially supports a sub-catchment approach that prioritises the management of land and water resources, however notes that this policy is more related to the timing of stock exclusion given that all commercial vegetable production requires consent by the same date.
- 7.40. While HortNZ can see some benefits in a sub-catchment approach, grower operations do not neatly fit into subcatchments. Rotations are likely to vary across subcatchments on a yearly basis. This variance is unlikely to be large but in our view the management of enterprises across a number of subcatchments should be enabled given the scarcity of the land resource available for commercial vegetable cropping and the difficulty of managing multiple consents for the discharges across each subcatchment and balancing within the current capped area for each subcatchment referred to in the consents.

Decision sought:

- 7.41. Retain as proposed, but add to this policy or another if more appropriate an enabling policy that allows for the management of horticultural enterprises between subcatchments to recognise there will be a minimal overall variance in proportion of vegetable cropping across all enterprises in each subcatchment at any one time.

Policy 9: Sub-catchment (including edge of field) mitigation planning, co-ordination and funding/Te Kaupapa Here 9: Te whakarite mahi whakangāwari, mahi ngātahi me te pūtea mō te riu kōawāwa (tae atu ki ngā taitapa)

Take a prioritised and integrated approach to sub-catchment water quality management by undertaking sub-catchment planning, and use this planning to support actions including edge of field mitigation measures. Support measures that efficiently and effectively contribute to water quality improvements. This approach includes:

- a. *Engaging early with tangata whenua and with landowners, communities and potential funding partners in sub-catchments in line with the priority areas listed in Table 3.11-2; and*
- b. *Assessing the reasons for current water quality and sources of contaminant discharge, at various scales in a sub-catchment; and*
- c. *Encouraging cost-effective mitigations where they have the biggest effect on improving water quality; and*
- d. *Allowing, where multiple farming enterprises contribute to a mitigation, for the resultant reduction in diffuse discharges to be apportioned to each enterprise in accordance with their respective contribution to the mitigation and their respective responsibility for the ongoing management of the mitigation.*

- 7.42. Given that this policy speaks to the management of subcatchment wide discharges, it is an appropriate place to enable the collaborative management of discharges at a

scale greater than a single farm. Farmer / catchment collectives managing discharges as a single enterprise within a subcatchment or a water management unit are very likely to achieve environmental outcomes in a more coordinated and effective way.

- 7.43. It is accepted that farming activities with moderate to high levels of contaminant discharge to waterbodies should reduce the effect of those discharges. However, there is no provision in the plan to offset the effects of diffuse discharges by providing mitigations beyond the farm boundary. The inclusion within this policy of the words "edge of field" makes it difficult to see how this policy can currently provide for a collaborative approach if not all mitigations are proposed to be considered. We suggest that these words are deleted from the policy.
- 7.44. Proposed Policy 3.11.3.9 should be modified to provide for offsetting where it can be demonstrated there will be a commensurate effect on the restoration of the health and well-being of the Waikato River.
- 7.45. The policy should enable a consenting pathway for groups that form to take responsibility for contaminant reductions by implementing a combination of catchment and paddock scale mitigations that are able to be measured and reported.
- 7.46. In order to assess the ability of the farmer/catchment collective to achieve reduction targets at the time of resource consent application; will be necessary to provide the Council with a credible natural resource accounting framework. The framework must be able to model the likely effectiveness of a suite of discharge mitigations.
- 7.47. For a decision to be made by the council any lodged proposal would need to be assessed against catchment load targets and/or instream concentration targets specified within the plan. This is a key reason for HortNZ to seek the insertion into this plan of a schedule listing 10-year load targets for each contaminant by subcatchment. Changes sought to this policy proposed to be supported by some consequential changes to methods. These are also outlined in the submission.

Decision sought:

- 7.48. Amend Policy 9 as follows:

Policy 9: Sub-catchment (~~including edge of field~~) mitigation planning, co-ordination and funding/Te Kaupapa Here 9: Te whakarite mahi whakangāwari, mahi ngātahi me te pūtea mō te riu kōawāwa (tae atu ki ngā taitapa)

Take a prioritised and integrated approach to sub-catchment water quality management by undertaking sub-catchment planning, and use this planning to support actions including edge of field mitigation measures and catchment collective responses. Support measures that efficiently and effectively contribute to water quality improvements. This approach includes:

- a. *Engaging early with tangata whenua and with landowners, communities and potential funding partners in sub-catchments in line with the priority areas listed in Table 3.11-2; and*
- b. *Assessing the reasons for current water quality and sources of contaminant discharge, at various scales in a sub-catchment; and*
- c. *Encouraging cost-effective mitigations where they have the biggest effect on improving water quality; and*

- da. Enable the collaborative management of discharges at a scale greater than a single farm and provide a consenting pathway for groups that form to take responsibility for contaminant reductions by implementing a combination of catchment and paddock scale mitigations that are able to be measured and reported.
- d. Allowing, where multiple farming enterprises contribute to a mitigation, for the resultant reduction in diffuse discharges to be apportioned to each enterprise in accordance with their respective contribution to the mitigation and their respective responsibility for the ongoing management of the mitigation.
- e. Provide for offsetting where it can be demonstrated there will be a commensurate effect on the restoration of the health and well-being of the Waikato River.

Policy 10: Provide for point source discharges of regional significance/Te Kaupapa Here 10: Te whakataui i ngā rukenga i ngā pū tuwha e noho tāpua ana ki te rohe

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 the:

- a. Continued operation of regionally significant infrastructure; and
- b. Continued operation of regionally significant industry.

Decision sought:

- 7.49. Ensure that the recognition in the RPS for agriculture as a regionally significant industry is given equal weight when ensuring that point source discharges are to give effect to the targets of the Vision and Strategy as outlined in Table 3-11-1.
- 7.50. Make consequential amendments to the proposed changes to existing objectives, policies and rules relating to point source discharges that are contained within Part D of this notified proposed Plan Change to give effect to the relief described in 7.49 of this submission above.

Policy 11: Application of Best Practicable Option and mitigation or offset of effects to point source discharges/Te Kaupapa Here 11: Te whakahāngai i te Kōwhiringa ka Tino Taea me ngā mahi whakangāwari pānga; te karo rānei i ngā pānga ki ngā rukenga i ngā pū tuwha

Require any person undertaking a point source discharge of nitrogen, phosphorus, sediment or microbial pathogens to water or onto or into land in the Waikato and Waipa River catchments to adopt the Best Practicable Option to avoid or mitigate the adverse effects of the discharge, at the time a resource consent application is decided. Where it is not practicable to avoid or mitigate all adverse effects, an offset measure may be proposed in an alternative location or locations to the point source discharge, for the purpose of ensuring positive effects on the environment to lessen any residual adverse effects of the discharge(s) that will or may result from allowing the activity provided that the:*

- a. Primary discharge does not result in any significant toxic adverse effect at the point source discharge location; and
- b. Offset measure is for the same contaminant; and
- c. Offset measure occurs preferably within the same sub-catchment in which the primary discharge occurs and if this is not practicable, then within the same Freshwater Management Unit or a Freshwater Management Unit located upstream, and

d. Offset measure remains in place for the duration of the consent and is secured by consent condition.

7.51. HortNZ supports offsetting policy and methods as a practical tool for mitigating the effects of discharges within a catchment.

7.52. The policy and method should be extended to non-point source discharges where the same environmental outcomes can be achieved.

Decision sought:

7.53. Retain as proposed.

8. 3.11.4 IMPLEMENTATION METHODS/NGĀ TIKANGA WHAKATINANA

3.11.4.1 Working with others/Te mahi tahi me ētehi atu

8.1. HortNZ supports a collaborative approach to the implementation of PC1.

Decision sought:

8.2. Retain as proposed.

3.11.4.2 Certified Industry Scheme/Te kaupapa ā-ahumahi kua whai tohu

8.3. HortNZ supports the development of an industry certification process for industry bodied as per the standards outlined in Schedule 2.

Decision sought:

8.4. Retain as proposed.

3.11.4.3 Farm Environment Plans/Ngā Mahere Taiao ā-Pāmu

8.5. HortNZ supports the use of Farm Environment Plans to assist with achieving the outcomes sought through PC1.

8.6. HortNZ also supports the development of a certification process for professionals to develop, certify and monitor Farm Environment Plans and the use of third party audits. HortNZ has considerable evidence working with other local authorities (e.g. ECAN) to enable the quality assurance scheme NZGAP to be recognised in delivering, managing and auditing grower's environmental requirements and good management practices.

Decision sought:

8.7. Retain as proposed.

3.11.4.5 Sub-catchment scale planning/Te whakamāherehere mō te whānuitanga o ngā riu kōawaawa

Waikato Regional Council will work with others to develop sub-catchment scale plans (where a catchment plan does not already exist) where it has been shown to be required. Sub-catchment scale planning will:

a. Identify the causes of current water quality decline, identify cost-effective measures to bring about reductions in contaminant discharges, and coordinate the reductions required at a property, enterprise and sub-catchment scale (including recommendations for funding where there is a public benefit identified),

b. Align works and services to reduce nitrogen, phosphorus, sediment and microbial pathogen discharges including riparian management, targeted reforestation, constructed wetlands, sediment traps and sediment detention bunds.

c. Assess and determine effective and efficient placement of constructed wetlands at a sub-catchment scale to improve water quality.

d. Support research that addresses the management of wetlands, including development of techniques to monitor ecological change and forecasting evolution of wetland characteristics resulting from existing land use in the wetland catchments.

- e. Integrate the regulatory requirements to fence waterways with the requirements for effective drainage scheme management.*
- f. Coordinate funding of mitigation work by those contributing to water quality degradation, in proportion to that contribution.*
- g. Utilise public funds to support edge of field mitigations where those mitigations provide significant public benefit.*

8.8. Hort NZ supports a sub-catchment approach that priorities the management of land and water resources. In our view the method could be helpfully modified to include support for management of discharges by a group/catchment collective that has verified their approach through the use of approved decision support tools. The creation of accounting frameworks at the subcatchment level is a direct benefit to Waikato Regional Council because it increases the opportunity for collective management at a large-scale. It also provides data or modelling information at a far more discreet scale.

Decision sought:

8.9. Modify as proposed.

Waikato Regional Council will work with others to develop sub-catchment scale plans and decision support tools (where a catchment plan or tool does not already exist) where it has been shown to be required. Sub-catchment scale planning will:

- a. Identify the causes of current water quality decline, identify cost-effective measures to bring about reductions in contaminant discharges, and coordinate the reductions required at a property, enterprise and sub-catchment scale (including recommendations for funding where there is a public benefit identified).*
- b. Align works and services to reduce nitrogen, phosphorus, sediment and microbial pathogen discharges including riparian management, targeted reforestation, constructed wetlands, sediment traps and sediment detention bunds.*
- c. Assess and determine effective and efficient placement of constructed wetlands at a sub-catchment scale to improve water quality.*
- d. Support research that addresses the management of wetlands, including development of techniques to monitor ecological change and forecasting evolution of wetland characteristics resulting from existing land use in the wetland catchments.*
- e. Integrate the regulatory requirements to fence waterways with the requirements for effective drainage scheme management.*
- f. Coordinate funding of mitigation work by those contributing to water quality degradation, in proportion to that contribution.*
- g. Utilise public funds to support edge of field or catchment scale mitigations where those mitigations provide significant public benefit.*
- h. In support of method 3.11.4.7, utilise (and coordinate the management of) public funds to share the cost of constructing decision support tools meeting the criteria specified in Schedule 1C Table XX.*

3.11.4.6 Funding and implementation/Te pūtea me te whakatinanatanga

8.10. Hort NZ supports the identification in the plan of Council's commitment to securing funding to implement PC1 through the annual plan and long term plan process. There

may be opportunities for collaborative actions (e.g. offsetting) where funding from a variety of sources could support effective discharge management and environmental enhancement.

Decision sought:

8.11. Retain as proposed.

3.11.4.7 Information needs to support any future allocation/Ngā pārongo e hiahiatia ana hei taunaki i ngā tohanga o anamata

a. Implementing processes that will support the setting of property or enterprise-level diffuse discharge limits in the future.

b. Researching:

i. The quantum of contaminants that can be discharged at a sub-catchment and Freshwater Management Unit[^] scale while meeting the Table 3.11-1 water quality attribute[^] targets[^]

ii. Methods to categorise and define 'land suitability'.

iii. Tools for measuring or modelling discharges from individual properties, enterprises and sub-catchments, and how this can be related to the Table 3.11-1 water quality attribute[^] targets[^].

8.12. The proposed plan change is not allocating discharge rights. The ten - year timeframe to develop tools and methods for property level allocation is required and must be supported by information gathering and research to inform future allocation.

8.13. This makes the methods on information gathering are integral to the success of the plan. The creation of accounting frameworks at the subcatchment level is a direct benefit to Waikato Regional Council because it increases the opportunity for collective management at a large-scale. It also provides data or modelling information at a far more discreet scale. But in the interests of transparency it will be important that this information is available to the public.

Decision sought:

8.14. Amend as proposed:

a. Implementing processes that will support the setting of property or enterprise-level diffuse discharge limits in the future.

b. Researching and making publicly available:

i. The quantum of contaminants that can be discharged at a sub-catchment and Freshwater Management Unit[^] scale while meeting the Table 3.11-1 water quality attribute[^] targets[^] and / or subcatchment load targets identified Schedule 1C Table XX.

ii. Methods to categorise and define 'land suitability'.

iii. Tools for measuring or modelling discharges from individual properties, enterprises and sub-catchments, and how this can be related to the Table 3.11-1 water quality attribute[^] targets[^] and / or subcatchment load targets identified Schedule 1C Table XX.

c. Prior to Jan 2019, by working with the Foundation of Arable Research, Horticulture New Zealand and The Pukekohe Vegetable Growers Association to develop a proxy nitrogen reference point for enterprises managing multiple properties and crops using a model or method approved by the Chief Executive of Waikato Regional Council.

3.11.4.8 Reviewing Chapter 3.11 and developing an allocation framework for the next Regional Plan/Te arotake i te Upoko 3.11, te whakarite hoki i tētehi anga toha mō te Mahere ā-Rohe e whai ake ana

- 8.15. The proposed plan change is not allocating discharge rights. The ten - year timeframe to develop tools and methods for property level allocation is required and must be supported by information gathering and research to inform future allocation.

Decision sought:

- 8.16. Retain as proposed.

3.11.4.9 Managing the effects of urban development/Te whakahaere i ngā pānga o te whanaketanga ā-tāone

Waikato Regional Council will:

- a. Continue to work with territorial authorities to implement the Waikato Regional Policy Statement set of principles that guide future development of the built environment which anticipates and addresses cumulative effects over the long term.*
- b. When undertaking sub-catchment scale planning under Method 3.11.4.5 in urban sub-catchments engage with urban communities to raise awareness of water quality issues, and to identify and implement effective solutions for the urban context.*

- 8.17. Urbanisation of rural land typically results in a degradation of water quality and can adversely affect those water resource rural production systems rely on. Wetlands, lakes, rivers and groundwater resources should be protected from the adverse effects of urban related subdivision and land disturbance.
- 8.18. To achieve this, better locational decisions must be made about where and how urban growth is provided. It is the opinion of HortNZ that this has not been the case in a recent change to the Waikato District Plan (Plan Change 16 - Tuakau Structure Plan (Stage 1) - Residential and Industrial Rezoning (Waikato Section And Franklin Section). The Future Urban Zone of Auckland and the future urban areas proposed through the Tuakau Structure Plan will be less than 2.5km apart and fall across rural production systems that are a critical part of the food supply system. It is the opinion of HortNZ that through this plan change and structure plan the Waikato District Council has chosen housing over food production when alternatives to meeting housing demand have not been fully considered and where food production opportunities will be lost forever.
- 8.19. In addition, a proportion of the urbanisation planned feeds into the Whakapipi and Tutuenui Stream headwaters. If the trend in water degradation continues despite grower practices and commitments being implemented, growers should not be held responsible for the degradation. The only way to prevent this is to measure, model or monitor the effects of urban discharges on water quality in places where urbanisation is occurring.
- 8.20. Hort NZ suggests the method should reflect the new 'avoidance' approach promoted in the development principles for new development specified in 6A(m) of the Waikato Regional Policy Statement:

"m) avoid as far as practicable adverse effects on natural hydrological characteristics and processes (including aquifer recharge and flooding

patterns), soil stability, water quality and aquatic ecosystems including through methods such as low impact urban design and development (LIUDD);”

Decision sought:

8.21. Amend 3.11.4.9 as follows:

“Waikato Regional Council will:

- a. Continue to work with territorial authorities to implement the Waikato Regional Policy Statement set of principles that guide future development of the built environment which anticipates and addresses cumulative effects over the long term including avoiding the degradation of freshwater resources and discharge of contaminants from urban activities into the urban environment.*
- b. When undertaking sub-catchment scale planning under Method 3.11.4.5 in urban sub-catchments engage with urban communities to raise awareness of water quality issues, and to identify and implement effective solutions for the urban context.*
- c. Assess the contribution of contaminants to waterbodies from urban areas over time to ensure that urban discharges are accounted for, to allow responsibility for managing urban discharges to be allocated.*
- d. In evaluating c. above, publicly report the assessment of contributions and their assessed effect on values for freshwater identified in this plan change.”*

3.11.4.10 Accounting system and monitoring/Te pūnaha kaute me te aroturuki

Waikato Regional Council will establish and operate a publicly available accounting system and monitoring in each Freshwater Management Unit[^], including:

- a. Collecting information on nitrogen, phosphorus, sediment and microbial pathogen levels in the respective fresh water bodies in each Freshwater Management Unit[^] from:
 - i. Council’s existing river monitoring network; and*
 - ii. Sub-catchments that are currently unrepresented in the existing monitoring network;*and*
 - iii. Lake Freshwater Management Units[^].*
- b. Using the information collected to establish the baseline data for compiling a monitoring plan and to assess progress towards achieving the Table 11-1 water quality attribute[^] targets[^]; and*
- c. Using state of the environment monitoring data including biological monitoring tools such as the Macroinvertebrate Community Index to provide the basis for identifying and reporting on long-term trends; and*
- d. An information and accounting system for the diffuse discharges from properties and enterprises that supports the management of nitrogen, phosphorus, sediment and microbial pathogens diffuse discharges at an enterprise or property scale.*

8.22. Development of a freshwater management unit based accounting system will give effect to the NPSFM. Hort NZ has made submissions on other methods in this plan to support the development of accounting frameworks.

8.23. Given the requirement to move to property based allocation within the next 10 years, regional Council should be seeking to coordinate public and private investment in accounting frameworks. There are likely to be applications for sub-catchment accounting frameworks to be adopted as decision support tools for managing catchment discharges collectively. The regional Council should be focused on setting

up the framework that connects the subcatchments decision support tools to provide a holistic view of resource allocation within the Waikato River catchment.

Decision sought:

8.24. Amend as proposed.

Waikato Regional Council will establish and operate a publicly available accounting system and monitoring in each Freshwater Management Unit[^], including:

- a. *Collecting information on nitrogen, phosphorus, sediment and microbial pathogen levels in the respective fresh water bodies in each Freshwater Management Unit[^] from:
 - i. Council's existing river monitoring network; and
 - ii. Sub-catchments that are currently unrepresented in the existing monitoring network; and
 - iii. Lake Freshwater Management Units[^].*
- b. *Using the information collected to establish the baseline data for compiling a monitoring plan and to assess progress towards achieving the Table 11-1 water quality attribute[^] targets[^]; and*
- c. *Using state of the environment monitoring data including biological monitoring tools such as the Macroinvertebrate Community Index to provide the basis for identifying and reporting on long-term trends; and*
- ca. *Produce a framework model for the greater Waikato River and surrounding land using the best available data, that can be adapted to include new decision support tools at the subcatchment level.*
- d. *An information and accounting system for the diffuse discharges from properties and enterprises that supports the management of nitrogen, phosphorus, sediment and microbial pathogens diffuse discharges at a subcatchment, enterprise or property scale.*

3.11.4.11 Monitoring and evaluation of the implementation of Chapter 3.11/Te aroturuki me te arotake i te whakatinanatanga o te Upoko 3.11

8.25. HortNZ supports a practical monitoring and evaluation program and in particular working with industry to collate information on the functioning and success of any Certified Industry Scheme.

Decision sought:

8.26. Retain as proposed.

3.11.4.12 Support research and dissemination of best practice guidelines to reduce diffuse discharges/Te taunaki i te rangahautanga me te tuaritanga o ngā aratohu mō ngā mahi tino whai take hei whakaiti i ngā rukenga roha

8.27. HortNZ has considerable evidence working with other local authorities (e.g. ECAN) to enable the quality assurance scheme NZGAP to be recognised in delivering, managing and auditing grower's environmental requirements and good management practices.

Decision sought:

8.28. Retain as proposed.

9. 3.11.5 Rules/Ngā Ture

3.11.5.1 Permitted Activity Rule – Small and Low Intensity farming activities/Te Ture mō ngā Mahi e Whakaaetia ana – Ngā mahi iti, ngā mahi pāiti hoki i runga pāmu

- 9.1. Hortnz supports recognition and enablement of low intensity farming systems. This is particularly important for the fruit production sector. The regional plan must continue to recognise permanent fruit production as a low intensity farming activity that is entitled to expand without excessive limitations through the ten-year transitional period. HortNZ supports the minimum requirements for registration and reporting on low intensity farming systems and that they remain a permitted activity.

Decision sought:

- 9.2. Retain as proposed.

3.11.5.5 Controlled Activity Rule – Existing commercial vegetable production/Te Ture mō ngā Mahi ka āta Whakahaerehia – Te whakatupu hua whenua ā-arumoni o te wā nei

Rule 3.11.5.5 - Controlled Activity Rule – Existing commercial vegetable production

The use of land for commercial vegetable production and the associated diffuse discharge of nitrogen, phosphorus, sediment and microbial pathogens onto or into land in circumstances which may result in those contaminants entering water, is a permitted activity until 1 January 2020, from which date it shall be a controlled activity (requiring resource consent) subject to the following standards and terms:

- a. The property is registered with the Waikato Regional Council in conformance with Schedule A; and*
- b. A Nitrogen Reference Point is produced for the property or enterprise in conformance with Schedule B and provided to the Waikato Regional Council at the time the resource consent application is lodged; and*
- c. Cattle, horses, deer and pigs are excluded from water bodies in conformance with Schedule C; and*
- d. The land use is registered to a Certified Industry Scheme; and*
- e. The areas of land, and their locations broken down by sub-catchments [refer to Table 3.11-2], that were used for commercial vegetable production within the property or enterprise each year in the period 1 July 2006 to 30 June 2016, together with the maximum area of land used for commercial vegetable production within that period, shall be provided to the Council; and*
- f. The total area of land for which consent is sought for commercial vegetable production must not exceed the maximum land area of the property or enterprise that was used for commercial vegetable production during the period 1 July 2006 to 30 June 2016; and*
- g. Where new land is proposed to be used for commercial vegetable production, an equivalent area of land must be removed from commercial vegetable production in order to comply with standard and term f.; and*
- h. A Farm Environment Plan for the property or enterprise prepared in conformance with Schedule 1 and approved by a Certified Farm Environment Planner is provided to the Waikato Regional Council at the time the resource consent application is lodged.*

Matters of Control

Waikato Regional Council reserves control over the following matters:

- i. *The content of the Farm Environment Plan.*
- ii. *The maximum area of land to be used for commercial vegetable production.*
- iii. *The actions and timeframes for undertaking mitigation actions that maintain or reduce the diffuse discharge of nitrogen, phosphorus or sediment to water or to land where those contaminants may enter water, including provisions to manage the effects of land being retired from commercial vegetable production and provisions to achieve Policy 3(d).*
- iv. *The actions and timeframes to ensure that the diffuse discharge of nitrogen does not increase beyond the Nitrogen Reference Point for the property or enterprise.*
- v. *The term of the resource consent.*
- vi. *The monitoring, record keeping, reporting and information provision requirements for the holder of the resource consent to demonstrate and/or monitor compliance with the Farm Environment Plan.*
- vii. *The time frame and circumstances under which the consent conditions may be reviewed.*
- viii. *Procedures for reviewing, amending and re-certifying the Farm Environment Plan.*

Notification:

Consent applications will be considered without notification, and without the need to obtain written approval of affected persons

Advisory note: Under section 20A(2) of the RMA a consent must be applied for within 6 months of 1 January 2020, namely by 1 July 2020.

9.3. HortNZ supports Rule 3.11.5.5 that provides a Controlled Activity non-notified consent pathway that recognises and provides for:

- The essential aspects of the vegetable production industry in the Waikato.
- Targeted reductions required for vegetable growing that are fair given the impact of the sector on water quality and the likely cost to the community of achieving the targets.
- Protection of existing production as a priority over any new production that is likely to have a greater contribution of discharges.
- Protection of the concept of an authorised farm enterprise through a capped area controlled activity consent, that allows for rotation across new and existing land parcels.
- Ensures the proposed farm planning framework is practical and achievable for growers.

Decision sought:

9.4. Amend as proposed below:

3.11.5.5 Controlled Activity Rule – Discharge of contaminants from existing commercial vegetable production/Te Ture mō ngā Mahi ka āta Whakahaerehia – Te whakatupu hua whenua ā-arumoni o te wā nei

~~The use of land for commercial vegetable production and the associated diffuse discharge of nitrogen, phosphorus, sediment and microbial pathogens onto or into land from commercial vegetable production in circumstances which may result in those contaminants entering water, is a permitted activity until 1 January 2020, from~~

which date it shall be a controlled activity (requiring resource consent) subject to the following standards and terms:

- a. The property is registered with the Waikato Regional Council in conformance with Schedule A; and
- b. A Nitrogen Reference Point ~~is produced for the property or enterprise in conformance with Schedule B and provided to the Waikato Regional Council at the time the resource consent application is lodged:~~
 - i in conformance with Schedule B; or
 - ii Through use of a proxy farm system;
to approximate the nitrogen reference, is produced for the property, enterprise or catchment collective and provided to the Waikato Regional Council at the time the resource consent application is lodged; and
- c. Cattle, horses, deer and pigs are excluded from water bodies in conformance with Schedule C; and
- d. The land use is registered to a Certified Industry Scheme; and
- e. The areas of land, and their locations broken down by sub-catchments [refer to Table 3.11-2], that ~~were~~ are used for commercial vegetable production within the property or enterprise ~~each year in the period 1 July 2006 to 30 June 2016~~, together with the maximum area of land used for commercial vegetable production within the period 1 July 2006 to 30 June 2016 ~~that~~ period, shall be provided to the Council; and
- f. The total area of land across all subcatchments grown in for which consent is sought for commercial vegetable production must not exceed the maximum land area of the property or enterprise that was used for commercial vegetable production during the period 1 July 2006 to 30 June 2016; and
- g. Where new land is proposed to be used for commercial vegetable production, an equivalent area of land must be removed from commercial vegetable production in order to comply with standard and term f.; and
- h. A Farm Environment Plan for the property or enterprise prepared in conformance with Schedule 1B and approved by a Certified Farm Environment Planner (commercial vegetable crops) is provided to the Waikato Regional Council at the time the resource consent application is lodged.

Matters of Control

Waikato Regional Council reserves control over the following matters:

- i. The content of the Farm Environment Plan.
- ii. The maximum area of land to be used for commercial vegetable production.
- iii. The actions and timeframes for undertaking mitigation actions that maintain or reduce the diffuse discharge of nitrogen, phosphorus or sediment to water or to land where those contaminants may enter water, including provisions to manage the effects of land being retired from commercial vegetable production and provisions to achieve Policy 3(d).
- iv. The actions and timeframes to ensure that the diffuse discharge of nitrogen from activities existing prior to 2016 do not increase beyond the Nitrogen Reference Point for the property or enterprise.
- v. The term of the resource consent.

- vi. *The monitoring, record keeping, reporting and information provision requirements for the holder of the resource consent to demonstrate and/or monitor compliance with the Farm Environment Plan.*
- vii. *The time frame and circumstances under which the consent conditions may be reviewed.*
- viii. *Procedures for reviewing, amending and re-certifying the Farm Environment Plan.*

Notification:

Consent applications will be considered without notification, and without the need to obtain written approval of affected persons

Advisory notes: Under section 20A(2) of the RMA a consent must be applied for within 6 months of 1 January 2020, namely by 1 July 2020.

Consents will generally be granted for a term not less than 15 years.

3.11.5.6 Restricted Discretionary Activity Rule – The use of land for farming activities/Te Ture mō ngā kōwhiringa mahi e herea ana – te whakamahinga o te whenua mō ngā mahinga pāmu

Rule 3.11.5.6 - Restricted Discretionary Activity Rule – The use of land for farming activities

The use of land for farming activities that does not comply with the conditions, standard or terms of Rules 3.11.5.1 to 3.11.5.5 and the associated diffuse discharge of nitrogen, phosphorus, sediment and microbial pathogens onto or into land in circumstances which may result in those contaminants entering water is a restricted discretionary activity (requiring resource consent).

Waikato Regional Council restricts its discretion over the following matters:

- i. Cumulative effects on water quality of the catchment of the Waikato and Waipa Rivers.*
- ii. The diffuse discharge of nitrogen, phosphorus, sediment and microbial pathogens.*
- iii. The need for and the content of a Farm Environment Plan.*
- iv. The term of the resource consent.*
- v. The monitoring, record keeping, reporting and information provision requirements for the holder of the resource consent.*
- vi. The time frame and circumstances under which the consent conditions may be reviewed.*
- vii. The matters addressed by Schedules A, B and C.*

Notification:

Consent applications will be considered without notification, and without the need to obtain written approval of affected persons

- 9.5. HortNZ supports Rule 3.11.5.6 that provides a Restricted Discretionary Activity status and non-notification path for the use of land for farming activities that does not comply with the conditions, standard or terms of Rules 3.11.5.1 to 3.11.5.5 and the associated diffuse discharges onto or into land in circumstances which may result in those contaminants entering water.

- 9.6. HortNZ also supports extending the rule to provide for new commercial vegetable cropping activities that can demonstrate reductions in contaminant discharge when assessed across all of the contaminants. It is unlikely that all applications would be able to demonstrate this; because many farming activities that currently exist would most probably be assessed to have a lower level of discharges than would be possible to achieve with a commercial vegetable production operation.
- 9.7. However, some other activities are likely to have a greater level of adverse effect than a new commercial vegetable production system would have. For example sheep and beef finishing platforms with high stocking rates, some dairy systems and potentially other mixed systems.
- 9.8. The effect of contaminants on the values protected by this plan change will vary depending on the subcatchment and location of the enterprise. In catchments/subcatchments where microbiological contamination is causing significant adverse effects on values, commercial vegetable production may be a mitigation that reduces the microbiological load and its concurrent effect on values.
- 9.9. This is why it is important for the plan to provide for spatially different assessments. It is noted that a non-complying activity application could be lodged under the notified version of PC 1, however HortNZ does not feel this provide significant enough incentive for operations that are likely to have a lower impact. Given the acknowledged significant costs involved in implementing PC 1 will be important to encourage economically viable alternatives that have a lesser footprint than existing activities. The noncomplying activity status that would be applied to any commercial vegetable production land conversion is considered too onerous. The appropriate assessment to be conducted within a restricted discretionary activity application.

Decision sought:

- 9.10. Amend as proposed.

Rule 3.11.5.6 - Restricted Discretionary Activity Rule – ~~The use of land for Discharges from farming activities~~

Discharges related to the use of land for farming activities that either:

- a) cannot comply with the conditions, standard or terms of Rules 3.11.5.1 to 3.11.5.5 and the associated diffuse discharge of nitrogen, phosphorus, sediment and microbial pathogens onto or into land in circumstances which may result in those contaminants entering water) ~~is a restricted discretionary activity (requiring resource consent); or~~
- b) is for new commercial vegetable cropping that can demonstrate a lesser effect from the contaminant discharge compared with the existing activity (when the diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens are considered together);

Is a restricted discretionary activity (requiring resource consent).

Waikato Regional Council restricts its discretion over the following matters:

- i. Cumulative effects on water quality of the catchment of the Waikato and Waipa Rivers.*

- ii. *The diffuse discharge of nitrogen, phosphorus, sediment and microbial pathogens.*
- iii. *The need for and the content of a Farm Environment Plan.*
- iv. *The term of the resource consent.*
- v. *The monitoring, record keeping, reporting and information provision requirements for the holder of the resource consent.*
- vi. *The time frame and circumstances under which the consent conditions may be reviewed.*
- vii. *The matters addressed by Schedules A, B and C.*
- viii. *With respect to applications made under 3.11.5.6 b), the relevant clauses of policy 3⁷*

Notification:

Consent applications will be considered without notification, and without the need to obtain written approval of affected persons

- 9.11. Seek new restricted discretionary rule for a collective catchment consent to manage within a group the outcomes specified in schedules to this plan.

Decision sought:

- 9.12. Insert new rule as drafted below:

Rule 3.11.5.X - Restricted Discretionary Activity Rule – The management of contaminants from farming activities by a catchment collective

The management of diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens onto or into land by a catchment collective in circumstances which may result in those contaminants entering water is a restricted discretionary activity (requiring resource consent).

Waikato Regional Council restricts its discretion over the following matters:

- i. Cumulative effects on water quality of the catchment of the Waikato and Waipa Rivers.*
- ii. The diffuse discharge of nitrogen, phosphorus, sediment and microbial pathogens.*
- iii. Achieving the contaminant load reduction targets specified for each for subcatchment in Schedule 1C Table XX*
- iv. The matter set out in Schedule 1C Catchment Collectives.*
- v. The term of the resource consent. Minimum 15 years.*
- vi. The monitoring, record keeping, reporting and information provision requirements for the holder of the resource consent.*
- vii. The time frame and circumstances under which the consent conditions may be reviewed.*
- viii. The matters addressed by Schedules A and C and the Nitrogen Reference Point being:*
 - 1. In conformance with Schedule B; or
 - 2. Determined through use of proxy farm systems to approximate the nitrogen reference for the catchment collective; or

⁷ All except clause b of policy 3

3. Through modelling a series of collective mitigations that are estimated sufficient to meet the load limit targets, in accordance with the criteria in schedule 1C.

Notification:

Consent applications will be considered without notification, and without the need to obtain written approval of affected persons

3.11.5.7 Non-Complying Activity Rule – Land Use Change/Te Ture mō ngā mahi kāore e whai i ngā ture – Te Panonitanga ā-Whakamahinga Whenua

Rule 3.11.5.7 - Non-Complying Activity Rule – Land Use Change

Notwithstanding any other rule in this Plan, any of the following changes in the use of land from that which was occurring at 22 October 2016 within a property or enterprise located in the Waikato and Waipa catchments, where prior to 1 July 2026 the change exceeds a total of 4.1 hectares:

1. *Woody vegetation to farming activities; or*
2. *Any livestock grazing other than dairy farming to dairy farming; or*
3. *Arable cropping to dairy farming; or*
4. *Any land use to commercial vegetable production except as provided for under standard and term g. of Rule 3.11.5.5*

is a non-complying activity (requiring resource consent) until 1 July 2026.

Notification:

Consent applications will be considered without notification, and without the need to obtain written approval of affected persons, subject to the Council being satisfied that the loss of contaminants from the proposed land use will be lower than that from the existing land use.

- 9.13. HortNZ opposes the non-complying activity status for land use change to commercial vegetable production. The plan should enable opportunities for new vegetable production through a new restricted discretionary rule if the proposed operation can demonstrate a decrease in discharges compared to the activity it is replacing. Those discharges should be assessed across all four contaminants as covered by the plan change.
- 9.14. A non-notified consent pathway exists, supported by Policy 6. As a sector HortNZ has demonstrated that conversion to commercial vegetable production can achieve the environmental outcomes sought by PC1 and a more enabling consent framework can be established.

Decision sought:

- 9.15. Amend Rule 3.11.5.7 as follows:

3.11.5.7 Non-Complying Activity Rule – Land Use Change/Te Ture mō ngā mahi kāore e whai i ngā ture – Te Panonitanga ā-Whakamahinga Whenua

Rule 3.11.5.7 - Non-Complying Activity Rule – Land Use Change

Notwithstanding any other rule in this Plan, any of the following changes in the use of land from that which was occurring at 22 October 2016 within a property or enterprise located in the Waikato and Waipa catchments, where prior to 1 July 2026 the change exceeds a total of 4.1 hectares:

- 1. Woody vegetation to farming activities; or*
- 2. Any livestock grazing other than dairy farming to dairy farming; or*
- 3. Arable cropping to dairy farming; or*
- 4. Any land use to commercial vegetable production that cannot be provided for through Rule 3.11.5.5, 3.11.5.6 b, or 3.11.5.X ~~except as provided for under standard and term g. of Rule 3.11.5.5~~*

is a non-complying activity (requiring resource consent) until 1 July 2026.

Notification:

Consent applications will be considered without notification, and without the need to obtain written approval of affected persons, subject to the Council being satisfied that the loss of contaminants from the proposed land use will be lower than that from the existing land use.

Alternative relief:

Rule 3.11.5.7 - Non-Complying Activity Rule – Land Use Change

Notwithstanding any other rule in this Plan, any of the following changes in the use of land from that which was occurring at 22 October 2016 within a property or enterprise located in the Waikato and Waipa catchments, where prior to 1 July 2026 the change exceeds a total of 4.1 hectares:

- 1. Woody vegetation to farming activities; or*
- 2. Any livestock grazing other than dairy farming to dairy farming; or*
- 3. Arable cropping to dairy farming; or*
- 4. Any land use to commercial vegetable production except as provided for under standard and term q. of Rule 3.11.5.5, 3.11.5.6 b, or 3.11.5.X*

is a non-complying activity (requiring resource consent) until 1 July 2026.

Notification:

Consent applications will be considered without notification, and without the need to obtain written approval of affected persons, subject to the Council being satisfied that the loss of contaminants from the proposed land use will be lower than that from the existing land use.

10. 3.11.5 Schedules

Schedule B Nitrogen Reference Point

- 10.1. There are significant problems with the use of a nitrogen reference point to place a moratorium on increases of discharges and more importantly increases of adverse impacts on the values for freshwater that have been identified. The method relies on discharges of phosphorus, sediment and microbiological contaminants remaining fixed due to nitrogen remaining fixed.
- 10.2. HortNZ does not believe appropriate weighting has been given across the four contaminant discharges; particularly with respect to sediment loss from cultivation practices more broadly across the catchment.
- 10.3. Sediment and phosphorus loss from cultivated land in Pukekohe and Pukekawa have been a key focus for the sector because these contaminants create the greatest level of risk regarding discharges to waterbodies. The mitigations used to manage this risk rely on large-scale drainage networks with nested mitigations such as raised headlands, interception bunds, check dams, decanting silt traps, deep ripping, subsoil drainage and use of cover crops. It is very likely some of these mitigations increase the level of risk for nitrate leaching. But it is very hard to determine which is the better balance of mitigations across the four contaminants in relation to the site, location and resulting effect on freshwater values.
- 10.4. Additionally the method to calculate the nitrogen reference point is too restrictive and too focused on use of the OVERSEER tool. Practical application of OVERSEER in the commercial vegetable sector has shown its unsuitability for modelling discharges of nitrogen in complex cropping systems. As a result the sector has undertaken a large research program based on actual measurement at key reference sites within the region for discharges of soil, phosphorous and nitrogen. HortNZ is doing this collaboratively with Waikato and Auckland Regional Councils among other partners.
- 10.5. We have also conducted joint research with OVERSEER owners comparing a daily time step research model (APSIM⁸) with OVERSEER. APSIM is considered more likely by the science community to accurately reflect a complex rotation of vegetables, pasture, arable and cover crops. The comparison of OVERSEER and APSIM have shown significant variance between the outputs of the 2 models for vegetable cropping systems.⁹
- 10.6. Much is made of the desire to have consistency within the methods that compare different farming systems. This is often used as a reason for insisting on OVERSEER as a base model for the entire rural sector. The issue with this approach is that the development of OVERSEER has not been consistent across sectors due to the significant pastoral demand for research time. Some of the key problems with the use of OVERSEER have been outlined in a report that was included as part of the Section 32 for this Plan.¹⁰
- 10.7. Another option is the use of a broader based decision support tool that factors in tailored mitigations both at the property scale and the enterprise scale. This could be

⁸ Agricultural Production Systems sIMulator

⁹ <http://hortnz.us14.list-manage1.com/track/click?u=aeecda7aaa04d433b3c1267c8e&id=e2d3a6fb555e=1472779fa4>

¹⁰ <http://www.hortnz.co.nz/assets/Natural-Resources-Documents/Nitrogen-estimation-and-the-proposed-Waikato-75th-percentile-rule-for-vegetable-cropping-April-2016-002.pdf>

extended to the subcatchment scale. This should be provided for as an alternative to a nitrogen reference point. It is recognised that the Council should have a default system they can apply.

- 10.8. The Waikato River catchment scale modelling of commercial vegetable cropping operations and the potential for mitigations has been severely retarded by the lack of ability to model the mitigations using overseer. In our view the property level nitrogen reference point established using overseer is inaccurate because:
- cropping rotations occur at a greater frequency than OVERSEER is currently capable of managing
 - the lack of cropping options or cultivation methods to enter; and the gross time step utilised by OVERSEER
 - the difficulties of modelling overlapping cropping sequences across different blocks and properties over time.
- 10.9. Recently Canterbury Regional Council adopted a property level nitrogen reference point system and has attempted to implement this on vegetable cropping systems present in Canterbury. The Regional Council has recently accepted the presence of issues that need to be resolved before OVERSEER can be utilised at the property scale for commercial vegetable cropping systems.
- 10.10. As a result, HortNZ has been able to develop a series of proxy measurements for vegetable cropping based on highly researched rotation data processed through the Matrix of Good Management Project in Canterbury. The resulting tool is called N-Check. There are some key features to N-Check:
- It provides a range of standardised Canterbury cropping rotations to select from. It assumes a mitigation package that has been modelled closely by Crown Research Institutes.
 - It models discharges at the enterprise level across a range of properties and rotated crops to take account of variance and uncertainty.
 - It requires evidence that a list of specific mitigations are undertaken on the farm.
 - It is a transitional tool provided by the Regional Council as an option until 2022 when the suitability of OVERSEER will be reviewed.
- 10.11. HortNZ supports inclusion of alternative options for establishing a nitrogen reference point. In our view the current schedule needs to be extensively modified. In a very minimum it should provide for:
- the development of a range of property or enterprise level proxies for a nitrogen reference point utilising a range of decision support tools more suited than OVERSEER for measuring complex arable and vegetable cropping systems.
 - The ability to use decision support tools approved by the Council at a larger than property scale.
 - Incorporation of new information about discharges from direct measurement research over the next 10 years.

Decision Sought:

- 10.12. Rewrite the schedule to provide options as alternatives to the use of OVERSEER for the arable and commercial vegetable sector, based on the content of the paragraphs above.

- 10.13. HortNZ also has a wider concern in relation to the calculation of a nitrogen reference point. Our expert advisers suggest OVERSEER should not be manipulated in the way the schedule provides for, because this may provide nitrogen reference points that are not reflective of a 30-year climate. In particular, use of a benchmarking period is problematic, and there are various other general provisions that are not required or that may hinder an accurate measurement.

Decision sought:

- 10.14. Revise and simplify the protocol for use of OVERSEER in the following manner

Schedule B - Nitrogen Reference Point/Te Āpitiwhanga B – Te tohu ā-hauota

A property or enterprise with a cumulative area greater than 20 hectares (or any property or enterprise used for commercial vegetable production) must have a Nitrogen Reference Point calculated as follows:

- A. The Nitrogen Reference Point must be calculated by a person who is certified as being competent to do so, with a certification being approved by the Chief Executive of the Waikato Regional Council ~~Certified Farm Nutrient Adviser~~ to determine the amount of nitrogen being leached from the property or enterprise during the relevant reference period specified in clause f), except for any land use change approved under Rule 3.11.5.7 where the Nitrogen Reference Point shall be determined through the Rule 3.11.5.7 consent process.
- B. The Nitrogen Reference Point shall be the highest annual nitrogen leaching loss that occurred during a single year (being 12 consecutive months) within the reference period specified in clause f), except for commercial vegetable production in which case the Nitrogen Reference Point shall be the average annual nitrogen leaching loss in kilograms per hectare per year during the reference period.
- C. The Nitrogen Reference Point must be calculated using the current version of the OVERSEER® Model, APSIM or SPASMO (or any other model approved by the Chief Executive of the Waikato Regional Council).
- D. The Nitrogen Reference Point data shall comprise the electronic output file from the OVERSEER®, APSIM or SPASMO (or other approved model, and where the OVERSEER Model is used, it must be calculated using the OVERSEER Best Practice Data Input Standards 2016, with the exceptions and inclusions set out in Schedule B Table 1.
- E. The Nitrogen Reference Point and the Nitrogen Reference Point data must be provided to Waikato Regional Council within the period 1 September 2018 to 31 March 2019.
- F. The reference period is the two financial years covering 2014/2015 and 2015/2016, except for commercial vegetable production in which case the reference period is 1 July 2006 to 30 June 2016.
- G. The following records (where relevant to the land use undertaken on the property or enterprise) must be retained and provided available for inspection by ~~to~~ Waikato Regional Council at its request:

- i. Stock numbers as recorded in annual accounts together with stock sale and purchase invoices;
- ii. Dairy production data;
- iii. Invoices for fertiliser applied to the land;
- iv. Invoices for feed supplements sold or purchased;
- v. Water use records for irrigation (to be averaged over 3 years or longer) in order to determine irrigation application rates;
- vi. The representative range of Crops grown on the land; and
- vii. Horticulture crop diaries and NZGAP records.

Schedule 1 Requirements for Farm Environment Plans

- 10.15. Part of the issue with the current plan is the lack of focus on managing losses from cultivation practices across broader rural land than that occupied by the vegetable sector. HortNZ considers that a range of practices could be mandated across cultivated land

Decision Sought:

- 10.16. Split commercial vegetable cropping farm plans out into a new Schedule 1B. Add new Schedule 1C to provide for subcatchment scale solutions. Revise Schedule 1 in the following way:

Schedule 1 - Requirements for Farm Environment Plans/Te Āpitihanga 1: Ngā Herenga i ngā Mahere Taiao ā-Pāmu

A Farm Environment Plan shall be prepared in accordance with the requirements of A below. The Farm Environment Plan shall be certified as meeting the requirements of A by a Certified Farm Environment Planner.

The Farm Environment Plan must clearly identify how specified minimum standards will be complied with.

The requirements set out in A apply to all Farm Environment Plans, including those prepared within a Certified Industry Scheme. A separate schedule has been prepared for commercial vegetable cropping systems and plans prepared by catchment collectives.

This Schedule 1 applies to all farming activities other than commercial vegetable cropping systems, but it is acknowledged that some provisions will not be relevant to every farming activity.

A. Farm Environment Plans shall contain as a minimum:

1. *The property or enterprise details:*

- (a) *Full name, address and contact details (including email addresses and telephone numbers) of the person responsible for the property or enterprise.*
 - (b) *Trading name (if applicable, where the owner is a company or other entity).*
 - (c) *A list of land parcels which constitute the property or enterprise:*
 - i. *the physical address and ownership of each parcel of land (if different from the person responsible for the property or enterprise) and any relevant farm identifiers such as the dairy supply number, Agribase identification number, valuation reference; and*
 - ii. *the legal description of each parcel of land.*
2. *An assessment of the risk of diffuse discharge of sediment, nitrogen, phosphorus and microbial pathogens associated with the farming activities on the property, and the priority of those identified risks, having regard to sub-catchment targets in Table 3.11-1 and the priority of lakes within the sub-catchment. As a minimum, the risk assessment shall include (where relevant to the particular land use):*
- (a) *A description of where and how stock shall be excluded from water bodies for stock exclusion including:*
 - i. *the provision of fencing and livestock crossing structures to achieve compliance with Schedule C; and*
 - ii. *for areas with a slope exceeding 25 degrees and where stream fencing is impracticable, the provision of alternative mitigation measures.*
 - (b) *A description of setbacks and riparian management, including:*
 - i. *The management of water body margins including how damage to the bed and margins of water bodies, and the direct input of contaminants will be avoided, and how riparian margin settling and filtering will be provided for; and*
 - ii. *Where practicable the provision of minimum grazing setbacks from water bodies for stock exclusion of 1 metre for land with a slope of less than 15degrees and 3 metres for land with a slope between 15 and 25 degrees;*
 - iii. *The provision of minimum cultivation setbacks of 5 metres and/or any other practicable measures considered necessary in an erosion and sediment control plan.*
 - (c) *A description of the critical source areas from which sediment, nitrogen, phosphorus and microbial pathogens are lost, including:*
 - i. *the identification of intermittent waterways, overland flow paths, cultivated land and areas prone to flooding and ponding, and an assessment of opportunities to minimise losses from these areas through appropriate stocking policy, stock exclusion and/or measures to detain floodwaters and settle out or otherwise remove sediment, nitrogen, phosphorus and microbial pathogens (e.g. detention bunds, sediment traps, natural and constructed wetlands); and*

- II. *the identification of actively eroding areas, erosion prone areas, and areas of bare soil and appropriate measures for erosion and sediment control and re-vegetation; and*
 - III. *an assessment of the risk of diffuse discharge of sediment, nitrogen, phosphorus and microbial pathogens from cultivated land, tracks and races and livestock crossing structures to waterways, and the identification of appropriate measures to minimise these discharges (e.g. cut-off drains, and shaping); and*
 - IV. *the identification of areas where effluent accumulates including yards, races, livestock crossing structures, underpasses, stock camps, and feed-out areas, and appropriate measures to minimise the risk of diffuse discharges of contaminants from these areas to groundwater or surface water; and*
 - V. *the identification of other 'hotspots' such as fertiliser, silage, compost, or effluent storage facilities, wash-water facilities, offal or refuse disposal pits, and feeding or stock holding areas, and the appropriate measures to minimise the risk of diffuse discharges of contaminants from these areas to groundwater or surface water.*
- (d) *An assessment of appropriate land use and grazing management for specific areas on the farm in order to maintain and improve the physical and biological condition of soils and minimise the diffuse discharge of sediment, nitrogen, phosphorus and microbial pathogens to water bodies, including:*
- I. *matching land use to land capability; and*
 - II. *identifying areas not suitable for grazing; and*
 - III. *stocking policy to maintain soil condition and pasture cover; and*
 - IV. *the appropriate location and management of winter forage crops; and*
 - V. *suitable management practices for strip grazing.*
- (e) *A description of nutrient management practices including a nutrient budget for the farm enterprise calculated using the model OVERSEER in accordance with the OVERSEER use protocols, or using any other model or method approved by the Chief Executive Officer of Waikato Regional Council.*
- (f) *A description of cultivation management, including:*
- I. *The identification of slopes over 15 degrees and how cultivation on them will be avoided; unless contaminant discharges to water bodies from that cultivation can be avoided; and*
 - II. *How the adverse effects of cultivation on slopes of less than 15 degrees will be mitigated through appropriate erosion and sediment controls for each paddock that will be cultivated including by:*
 - a. *assessing where overland flows enters and exits the paddock in rainfall events; and*
 - b. *identifying appropriate measures to divert overland flows from entering the cultivated paddock; and*
 - c. *identifying measures to trap control and minimise sediment leaving the cultivated paddock in overland flows; and*
 - d. *maintaining appropriate buffers between cultivated areas and water bodies (minimum 5m setback).*

- e. A description of collected animal effluent management including how the risks associated with the operation of effluent systems will be managed to minimise contaminant discharges to groundwater or surface water.
 - f. A description of freshwater irrigation management including how contaminant loss arising from the irrigation system to groundwater or surface water will be minimised.
3. A spatial risk map(s) at a scale that clearly shows:
- (a) The boundaries of the property; and
 - (b) The locations of the main relevant land uses¹¹ activities that occur on the property;
 - (c) The locations of existing and future mitigation actions to manage contaminant diffuse discharges; and
 - (d) Any relevant internal property boundaries that relate to risks and mitigation actions described in this plan; and
 - (e) The location of continually flowing rivers, streams, and drains and permanent lakes, ponds and wetlands; and
 - (f) The location of riparian vegetation and fences adjacent to water bodies; and
 - (g) The location of critical source areas for contaminants, as identified in 2 (c) above.
4. A description of the actions that will be undertaken in response to the risks identified in the risk assessment in 2 above (having regard to their relative priority) as well as where the mandatory time-bound actions will be undertaken, and when and to what standard they will be completed.
5. A description of the following:
- (a) Actions, timeframes and other measures to ensure that the diffuse discharge of nitrogen from the property or enterprise, as measured by the five-year rolling average annual nitrogen loss as determined by the use of the current version of OVERSEER, does not increase beyond the property or enterprise's Nitrogen Reference Point, unless other suitable mitigations are specified; or:
 - (b) Where the Nitrogen Reference Point exceeds the 75th percentile nitrogen leaching value, actions, timeframes and other measures to ensure the diffuse discharge of nitrogen is reduced so that it does not exceed the 75th percentile nitrogen leaching value by 1 July 2026, ~~except in the case of Rule 3.11.5.5.~~

Vegetable growing minimum standards

¹¹ For dairy farms this might be the OVERSEER locks, for drystock farms this might be Land Use Capability blocks.

Farm environment plans required under Rule 3.11.5.5 shall, in addition to the matters set out above, ensure the following matters are addressed.

No	Contaminant	Vegetable growing minimum standards
1	Nitrogen, Phosphorus	Annual soil testing regime, fertiliser recommendations by block and by crop
2	Nitrogen, Phosphorus	Tailored fertiliser plans by block and by crop
3	Nitrogen, Phosphorus	Both (1) and (2) prepared by an appropriately qualified person
4	Nitrogen, Phosphorus	Annual calibration of fertiliser delivering systems through an approved programme such as Spreadmark/Fertsread
5	Soil/Phosphorus	As a minimum by block: an approved erosion and sediment control plan constructed in accordance with the Erosion and Sediment Control Guidelines for Vegetable Production June 2014
6	Nitrogen, Phosphorus	Documentation available for proof of fertiliser placement according to recommended instruction
7	Nitrogen, Phosphorus	Adoption and use of improved fertiliser products proved effective and available such as formulated prills, coatings and slow release mechanisms
8	Nitrogen, Phosphorus	Evidence available to demonstrate split applications by block/crop following expert approved practice relating to: <ul style="list-style-type: none"> form of fertiliser applied rate of application placement of fertiliser timing of application

Schedule 1B - Requirements for Farm Environment Plans for commercial vegetable production enterprises

1. A Farm Environment Plan shall be prepared in accordance with the requirements of A below. The Farm Environment Plan shall be certified as

- meeting the requirements of A by a Certified Farm Environment Planner (commercial vegetable production).
2. The construction of a farm plan does not require duplication of material within existing farm environment plans that are considered sufficient for purpose by a Certified Farm Environment Planner (commercial vegetable production).
 3. Farm plans are not required to duplicate material provided to Waikato Regional Council for the purpose of complying with other rules in the plan.
 4. Farm Plans will not be incorporated into consent conditions as a whole; but matters of control or discretion will include relevant actions committed to by the consent holder.
 5. The Farm Environment Plan shall identify key risk areas for the discharge of sediment, nitrogen, phosphorus and microbial pathogens, and identify actions, and timeframes for those actions to be completed, in order to reduce the diffuse discharges of these contaminants where practicable.

The Farm Environment Plan must clearly identify how any specified consent condition will be complied with.

A Farm Environment Plans shall contain as a minimum:

1. The name of the legal entity registered with the Waikato Regional Council.
2. Information provided by the Council from registration between 1 Sep 2018 and 31 March 2019.
3. A description of the enterprise, detailing the general rotational cropping system, properties owned, leased and otherwise farmed on over time. This will include the legal description for each parcel of land.
4. An assessment of the risk of diffuse discharge of sediment, nitrogen, phosphorus and microbial pathogens associated with the farming activities on the property, and the priority of those identified risks, having regard to sub-catchment targets in Table 3.11-1 and the priority of lakes within the sub-catchment. As a minimum, the risk assessment shall include:
 - a. A risk assessment for nutrient discharges that is approved by a Certified Farm Environment Planner (commercial vegetable crops). The risk assessment should be equivalent to the process outlined in Section 4 of the Horticulture New Zealand Code of Practice for Nutrient Management Version 1.0 August 2014.
 - b. A risk assessment for soil conservation purposes, that is approved by a Certified Farm Environment Planner (commercial vegetable crops). The risk assessment should be equivalent to the process outlined in Section 1 of the Horticulture New Zealand Erosion &

Sediment Control Guidelines for Vegetable Production Version 1.1
June 2014.

- c. If manures are used, undertake a microbiological discharge risk assessment.
5. If stock are present on land managed within the enterprise, provisions of Schedule 1 relating to the farming of animals apply. If stock are present a risk assessment for stock related discharges must be undertaken.
6. A schedule of mitigation actions and target completion dates derived from the risk assessments undertaken in 4 and 5 above.
7. **Vegetable Growing Minimum Standards**

Farm environment plans required under Rule 3.11.5.5, 3.11.5.6 b, or 3.11.5.X shall, in addition to the matters set out above, ensure the following matters are addressed.

<u>No</u>	<u>Contaminant</u>	<u>Vegetable growing minimum standards</u>
<u>1</u>	<u>Nitrogen, Phosphorus</u>	<u>Annual soil testing regime, fertiliser recommendations by block and by crop</u>
<u>2</u>	<u>Nitrogen, Phosphorus</u>	<u>Tailored fertiliser plans by block and by crop</u>
<u>3</u>	<u>Nitrogen, Phosphorus</u>	<u>Both (1) and (2) prepared by an appropriately qualified person</u>
<u>4</u>	<u>Nitrogen, Phosphorus</u>	<u>Annual calibration of fertiliser delivering systems through an approved programme such as Spreadmark/Fertspread</u>
<u>5</u>	<u>Soil / Phosphorus</u>	<u>As a minimum by block: an approved erosion and sediment control plan constructed in accordance with the Erosion and Sediment Control Guidelines for Vegetable Production June 2014</u>
<u>6</u>	<u>Nitrogen, Phosphorus</u>	<u>Documentation available for proof of fertiliser placement according to recommended instruction</u>
<u>7</u>	<u>Nitrogen, Phosphorus</u>	<u>Adoption and use of improved fertiliser products proved effective and available such as formulated prills, coatings and slow release mechanisms</u>

8	<u>Nitrogen, Phosphorus</u>	<u>Evidence available to demonstrate split applications by block/crop following expert approved practice relating to:</u> <ul style="list-style-type: none"> • <u>form of fertiliser applied</u> • <u>rate of application</u> • <u>placement of fertiliser</u> • <u>timing of application</u>
9	<u>Nitrogen</u>	<u>Maintain efficient irrigation to ensure yields and the export of nitrogen in crop are maximised.</u>

Schedule 1C - Requirements for a subcatchment scale management plan applying to Rule 3.11.5.X iv - Restricted Discretionary Activity Rule – The management of contaminants from farming activities by a catchment collective

A subcatchment scale management plan (SSMP) shall be prepared in accordance with the requirements below.

- 1) The (SSMP) must be approved by the Regional Council Chief Executive before an application under Rule 3.11.5.X can be granted by the Council.
- 2) The SSMP must meet or exceed the expected reduction in discharges to freshwater that would be achieved through completing and implementing a farm or enterprise scale farm environment plan in accordance with Schedule 1 and Schedule 1b. The achievement in reduction of discharges must be comparable when considered over all of the properties and enterprises managed by the SSMP.
- 3) The SSMP must be the responsibility of a legal entity that is accountable for achieving compliance with the conditions of a resource consent issued under Rule 3.11.5.X.
- 4) The SSMP must be supported by a decision support tool that is able to be utilised as the accounting framework for the relevant subcatchment. The decision support tool must:
 - a) Calibrate discharges and hydrological flows to observed monitoring sites within the catchment. The calibration must achieve at least

achieve a "Satisfactory" criteria for a daily model with NSE – 0.6, % bias – +/- 25%¹²

and the decision support tool must be capable of continuous upgrade and improvement.

- b) Be capable of integrating with other subcatchment, freshwater management unit and catchment scale accounting systems.
 - c) Be able to measure mitigations for microbial, sediment, nitrogen and phosphorus discharges at all scales within the domain of the decision support tool to a standard approved by peer review agent approved by the Chief Executive of the Regional Council.
 - d) Be made available to the Council for use in assessing compliance with the load limit targets for the relevant subcatchment listed in Schedule 1C Table XX.
- 5) The SSMP must clearly identify how any specified consent condition will be complied with.
- 6) The SSMP shall contain as a minimum:
- a) The name of the legal entity registered with the Waikato Regional Council. Information provided by the Council from registration between 1 Sep 2018 and 31 March 2019.
 - b) A legal description of all properties and enterprises the legal entity described in Schedule 1C 3) above have legal authority to act on behalf of.
 - c) A description of the nature of enterprises, farms and properties and the domain of the SSMP.
 - d) An assessment of the risk of diffuse discharge of sediment, nitrogen, phosphorus and microbial pathogens associated with the activities within the SSMP domain, and the priority of those identified risks, having regard to sub-catchment load targets in Schedule 1C Table XX below.
 - e) A schedule of approved mitigation actions and target completion dates.

¹² Based on that recommended by Moriasi et al 2007:
<http://hortnz.co.nz/assets/Uploads/moriasi-et-al-2007-modeleval.pdf>

Schedule 1C Table XX Estimated Subcatchment unattenuated loads for the short-term water quality targets (excluding point sources)

Site	FMU	Annual Median Chlorophyll a (mg/m3)		Annual Maximum Chlorophyll a (mg/m3)		Annual Median Total Nitrogen (mg/m3)		Annual Total Nitrogen Load t/yr		Annual Median Total Phosphorus (mg/m3)		Annual Total Phosphorus Load t/yr		Annual Median Nitrate (mg NO3-N/L)		Annual 95th percentile Nitrate (mg NO3-N/L)		Annual Nitrate Load t/yr		Annual Median Ammonia (mg NH4-N/L)		Annual Maximum Ammonia (mg NH4-N/L)		Annual Ammonia Load t/yr		95th percentile E. coli (E.coli/100mL)		Annual E. coli Load 10*15 organisms/yr		Clarity (m)	
		Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year
		Upper Waikato Freshwater Management Unit																													
Waikato River at Ohaaki Br	Upper Waikato	1.5	1.5	13	13	134	134	255	10	10	18	0.039	0.039	0.062	0.062	255	0.002	0.002	0.013	0.013			70	70	1.00	3.8	3.8				
Waikato River at Ohakuri Tailrace Br	Upper Waikato	3.2	3.2	11	11	206	160	554	17	17	50	0.084	0.084	0.172	0.172	555	0.003	0.003	0.017	0.017			15	15	2.16	3.4	3.4				
Waikato River at Whakamaru Tailrace	Upper Waikato		5		25	260	160	364	20	20	31	0.101	0.101	0.23	0.23	364	0.003	0.003	0.01	0.01			60	60	1.39	2	3				
Waikato River at Waipapa tailrace	Upper Waikato	4.1	4.1	25	25	318	160	552	25	20	48	0.164	0.164	0.32	0.32	552	0.007	0.007	0.017	0.017			162	162	2.23	2	3				
Pueto Stm at Broadlands Rd Br	Upper Waikato											0.45	0.45	0.53	0.53	129	0.003	0.003	0.009	0.009			92	92	0.49	1.8	3				
Torepatutahi Stm Valle Rd Br	Upper Waikato											0.5	0.5	0.8	0.8	79	0.002	0.002	0.011	0.011			216	216	0.69						
Waiotapu Stm Homestead Rd Br	Upper Waikato											1.257	1	1.563	1.5	229	0.112	0.03	0.176	0.05			281	281	0.66						
Mangakara Stm (Ireporoa) SH5	Upper Waikato											1.27	1	1.59	1.5	24	0.008	0.008	0.062	0.05			1584	540	0.07	0.9	1				
Kawaunui Stm SH5 Br	Upper Waikato											2.58	2.4	2.85	1.5	32	0.006	0.006	0.079	0.05			2335	540	0.08	1.4	1.6				
Waiotapu Stm Campbell Rd Br	Upper Waikato											0.915	0.915	1.1	1.1	48	0.291	0.24	0.315	0.05			18	18	0.18	1.2	1.6				
Otamakokore Stm Hossack Rd	Upper Waikato											0.74	0.74	1.19	1.19	60	0.006	0.006	0.024	0.024			680	540	0.23	1.2	1.6				
Whirinaki Stm Corbett Rd	Upper Waikato											0.77	0.77	0.87	0.87	10	0.002	0.002	0.012	0.012			98	98	0.06	2.7	3				
Tahunaaatara Stm Ohakuri Rd	Upper Waikato											0.555	0.555	0.83	0.83	204	0.003	0.003	0.015	0.015			783	540	0.69	1.3	1.6				
Mangaharakeke Stm SH30 (Off jct SH1)	Upper Waikato											0.525	0.525	0.75	0.75	35	0.003	0.003	0.015	0.015			684	540	0.11	1.1	1.6				
Waipapa Stm (Mokai) Tirohanga Rd Br	Upper Waikato											1.189	1	1.5	1.5	102	0.003	0.003	0.005	0.005			1147	540	0.52	1.2	1.6				
Mangakino Stm Sandel Rd	Upper Waikato											0.65	0.65	0.86	0.86	222	0.003	0.003	0.012	0.012			251	251	0.77	1.8	3				
Whakauru Stm SH1 Br	Upper Waikato											0.26	0.26	0.45	0.45	86	0.003	0.003	0.033	0.033			2106	540	0.23	0.8	1				
Mangamingi Stm Paraonui Rd Br	Upper Waikato											2.76	2.4	3.12	1.5	113	0.091	0.03	0.296	0.05			2151	540	0.29	0.8	1				
Pokaiwhenua Stm Arapuni - Putaruru Rd	Upper Waikato											1.68	1	2.04	1.5	484	0.002	0.002	0.02	0.02			1363	540	1.23	1.3	1.6				
Little Waipa Stm Arapuni - Putaruru Rd	Upper Waikato											1.522	1	2.04	1.5	210	0.002	0.002	0.085	0.05			1377	540	0.69	1.5	1.6				
Central Waikato Freshwater Management Unit																															
Waikato River Narrows Boat Ramp	Central Waikato	5.5	5	23	23	404	350	204	28	20	10	0.235	0.235	0.5	0.5	204	0.009	0.009	0.018	0.018			340	260	0.76	1.7	1.7				
Waikato River Horotiu Br	Central Waikato	6.1	5	23	23	432	350	78	34	20	3	0.26	0.26	0.53	0.53	78	0.007	0.007	0.029	0.029			774	540	0.50	1.4	1.6				
Karapiro Stm Hickey Rd Bridge	Central Waikato											0.52	0.52	1.689	1.5	94	0.008	0.008	0.031	0.031			4518	540	0.75	0.9	1				
Mangawhero Stm Cambridge-Ohaupo Rd	Central Waikato											1.99	1	2.49	1.5	94	0.041	0.03	0.072	0.05			2920	540	0.30	0.3	1				
Mangaonua Stm Hoeke Rd	Central Waikato											1.455	1	1.878	1.5	126	0.036	0.03	0.051	0.05			6372	540	0.44	1	1				
Mangaone Stm Annebrooke Rd Br	Central Waikato											2.58	2.4	2.94	1.5	105	0.009	0.009	0.02	0.02			2052	540	0.35	0.9	1				
Mangakotukutuku Stm Peacocks Rd	Central Waikato											0.8	0.8	1.788	1.5	55	0.077	0.03	0.132	0.05			11394	540	0.15	0.5	1				
Waitawhirihiri Stm Edgecumbie Street	Central Waikato											0.88	0.88	1.24	1.24	36	0.256	0.24	0.318	0.05			5922	540	0.14	0.4	1				
Kirikiroa Stm Tauhara Dr	Central Waikato											0.815	0.815	1.572	1.5	14	0.096	0.03	0.183	0.05			2124	540	0.11	0.5	1				
Lower Waikato Freshwater Management Unit																															
Waikato River Huntly-Tainui Br	Lower Waikato	5.9	5	19	19	562	350	314	43	20	9	0.365	0.365	0.9	0.9	314	0.005	0.005	0.015	0.015			1944	540	0.99	0.9	1				
Waikato River Mercer Br	Lower Waikato	10	5	30	25	631	350	484	49	20	31	0.365	0.365	0.87	0.87	484	0.003	0.003	0.01	0.01			1494	540	2.82						

Waikato River Tuakau Br	Lower Waikato	11.3	5	37	25	571	350	156	50	20	9	0.325	0.325	0.88	0.88	156	0.003	0.003	0.008	0.008		1584	540	0.46	0.7	1
Komakorau Stm Henry Rd	Lower Waikato											1.279	1	4.4	3.5	414	0.25	0.24	0.419	0.4		3474	540	0.97	0.3	1
Mangawara Stm Rutherford Rd Br	Lower Waikato											0.765	0.765	2.76	1.5	695	0.103	0.03	0.172	0.05		4955	540	1.78	0.3	1
Awaroa Stm (Rotowaro) Samsons Br @ Rotowaro-Huntly Rd	Lower Waikato											0.7	0.7	1.19	1.19	35	0.021	0.021	0.089	0.05		1800	540	0.33	0.8	1
Matahuru Stm Waiterimu Road Below Confluence	Lower Waikato											0.715	0.715	1.689	1.5	113	0.016	0.016	0.059	0.05		6147	540	0.73	0.4	1
Whangape Stm Rangiriri-Glen Murray Rd	Lower Waikato											0.004	0.004	0.69	0.69	386	0.006	0.006	0.134	0.05		584	540	3.17	0.3	1
Waerenga Stm SH2 Maramarua	Lower Waikato											0.82	0.82	1.41	1.41	17	0.005	0.005	0.022	0.022		5098	540	0.18	0.9	1
Whangamarino River Jefferies Rd Br	Lower Waikato											0.625	0.625	1.842	1.5	117	0.012	0.012	0.147	0.05		4712	540	0.54	0.6	1
Mangatangi River SH2 Maramarua	Lower Waikato											0.11	0.11	1.12	1.12	174	0.005	0.005	0.038	0.038		5567	540	0.66	0.5	1
Mangatawhiri River Lyons Rd Buckingham Br	Lower Waikato											0.013	0.013	0.37	0.37	20	0.003	0.003	0.011	0.011		5108	540	0.08	1.6	1.6
Whangamarino River Island Block Rd	Lower Waikato											0.075	0.075	0.7	0.7	135	0.011	0.011	0.054	0.05		655	540	0.47	0.3	1
Whakapipi Stm SH22 Br	Lower Waikato											3.39	2.4	5.12	3.5	99	0.006	0.006	0.081	0.05		1773	540	0.25	1.1	1.1
Ohaeroa Stm SH22 Br	Lower Waikato											1.473	1	1.806	1.5	29	0.003	0.003	0.015	0.015		4667	540	0.10	0.8	1
Opuatia Stm Pongau Rd	Lower Waikato											0.74	0.74	1.06	1.06	71	0.005	0.005	0.016	0.016		2898	540	0.73	0.6	1
Awaroa River (Waluku) Otua Rd Br Moseley Rd	Lower Waikato											1.369	1	2.31	1.5	32	0.021	0.021	0.135	0.05		1017	540	0.12	0.4	1

Waipa Waikato Freshwater Management Unit																											
Waipa River Mangaokewa Rd	Waipa												0.38	0.38	0.6	0.6	17	0.003	0.003	0.017	0.017		2417	540	0.18	1.5	1.6
Waipa River Otewa	Waipa												0.228	0.228	0.502	0.502	224	0.003	0.003	0.008	0.008		2036	540	1.76	2.1	2.1
Waipa River SH3 Otorohanga	Waipa												0.37	0.37	1.05	1.05	301	0.004	0.004	0.02	0.02		3289	540	0.94	1.2	1.6
Waipa River Pirongia-Ngutu Rd Br	Waipa												0.565	0.565	1.27	1.27	977	0.008	0.008	0.023	0.023		4441	540	2.56	0.7	1
Waipa River Whatawhata Bridge	Waipa												0.673	0.673	1.319	1.319	612	0.009	0.009	0.026	0.026		3657	540	1.94	0.6	1
Ohote Stm Whatawhata/Horotiu Rd	Waipa												0.495	0.495	1.37	1.37	57	0.023	0.023	0.052	0.05		2142	540	0.19	0.6	1
Kaniwhaniwha Stm Wright Rd	Waipa												0.35	0.35	0.89	0.89	116	0.007	0.007	0.022	0.022		1917	540	0.53	0.9	1
Mangapiko Bowman Rd Stm	Waipa												1.369	1	2.49	1.5	592	0.022	0.022	0.076	0.03		7074	540	1.92	0.6	1
Mangaohoi Stm South Branch Maru Rd	Waipa												0.23	0.23	0.39	0.39	2	0.003	0.003	0.008	0.008		943	540	0.05	1.5	1.6
Mangauike Stm Te Awamutu Borough W/S intake	Waipa												0.21	0.21	0.28	0.28	4	0.002	0.002	0.003	0.003		1008	540	0.01	3.3	3.3
Puniu River Bartons Corner Rd Br	Waipa												0.65	0.65	1.28	1.28	511	0.007	0.007	0.029	0.029		2790	540	1.50	0.9	1
Mangatutu Stm Walker Rd Br	Waipa												0.38	0.38	0.88	0.88	152	0.003	0.003	0.012	0.012		738	540	0.61	1.5	1.6
Waitomo Stm SH31 Otorohanga	Waipa												0.52	0.52	0.83	0.83	45	0.008	0.008	0.025	0.025		1453	540	0.28	0.6	1
Mangapu River Otorohanga	Waipa												0.86	0.86	1.36	1.36	236	0.015	0.015	0.057	0.05		4284	540	1.34	0.7	1
Waitomo Stm Tumutumu Rd	Waipa												0.63	0.63	0.8	0.8	33	0.004	0.004	0.013	0.013		2241	540	0.23	1.1	1.6
Mangaokewa Stm Lawrence Street Br	Waipa												0.53	0.53	0.98	0.98	165	0.004	0.004	0.013	0.013		6224	540	1.87	1.4	1.6

Schedule 2 - Certification of Industry Schemes/Te Āpitiwhanga 2 – Te whakamana i ngā tohu o ngā Kaupapa Ahumahi

- 10.17. It is not up to the scheme itself to demonstrate the achievement of water quality targets it is the operator the scheme is the assurance system that audits that this is being done and gives assurance to Council. The scheme should include topics that align with water quality targets. But the actual targets themselves are the responsibility of the Council.
- 10.18. The Farm Environment Plans laid out in Schedules above provide for the farm risk assessment and the outline of actions to complete them. The Scheme should provide independent assurance that these actions and risk assessments have been completed.

Decision Sought

- 10.19. Amend the Schedule as follows:

The purpose of this schedule is to set out the criteria against which applications to approve an industry scheme will be assessed.

The application shall be lodged with the Waikato Regional Council, and shall include information that demonstrates how the following requirements are met. The Waikato Regional Council may request further information or clarification on the application as it sees fit.

Approval will be at the discretion of the Chief Executive Officer of the Waikato Regional Council subject to the Chief Executive Officer being satisfied that the scheme will effectively deliver on the assessment criteria.

Assessment Criteria

A. Certified Industry Scheme System

The application must demonstrate that the Certified Industry Scheme:

~~1. Is consistent with:~~

~~a) the achievement of the water quality targets referred to in Objective 3; and~~

~~b) the purposes of Policy 2 or 3; and~~

~~c) the requirements of Rules 3.11.5.3 and 3.11.5.5.~~

1. Has an appropriate ownership structure, governance arrangements and management.
2. Has documented systems, processes, and procedures to ensure:
 - a) Competency assessment and checks for people who generate and subsequently monitor Farm Environment Plans in line with the relevant industry qualifications as agreed with Waikato Regional Council
 - b) Competent and consistent performance in Farm Environment Plan preparation and audit.
 - c) Effective internal monitoring of performance.

- d) Robust data management.
- e) Timely provision of suitable quality data to Waikato Regional Council.
- f) Timely and appropriate reporting.
- g) Corrective actions will be implemented and escalated where required, including escalation to Waikato Regional Council if internal escalation is not successful.
- h) Internal quality control.
- i) The responsibilities of all parties to the Certified Industry Scheme are clearly stated.
- j) An accurate and up to date register of scheme membership is maintained.
- k) Transparency and public accountability of Certified Industry Schemes
- l) The articles of the scheme are available for public viewing.

~~B. People~~

~~The application must demonstrate that:~~

- ~~1. Those generating and auditing Farm Environment Plans are suitably qualified and experienced.~~
- ~~2. Auditing of Farm Environment plan requirements is independent of the Farm Environment Plan preparation and approval.~~

~~C. Farm Environment Plans~~

~~The application must demonstrate that Farm Environment Plans are prepared in conformance with Schedule 1 or 1B.~~

11. Additions to Glossary of Terms/Ngā Āpiti hanga ki te Rārangi Kupu

- 11.1. To achieve the intent of this submission HortNZ has suggested the following amendments to proposed terms and some new definitions.

Definition - Best Management Practice/s

- 11.2. HortNZ supports separate definitions for best and good management practice which for the horticultural sector are two different methods. Good management practices are described as an entry level practice that all growers could expect to undertake to manage nutrients. Best management practices are advanced mitigation options that often require significant investment which may present a barrier for uptake, especially for smaller growers.

Decision sought:

- 11.3. Retain the definition of Best Management Practice.

Catchment Collective

- 11.4. Enable the collaborative management of discharges at a scale greater than a single farm. Farmer / catchment collectives managing discharges as a single enterprise within a subcatchment or a water management unit are very likely to achieve environmental outcomes in a more coordinated and effective way.

Decision sought:

- 11.5. Add a new definition for a Catchment Collective as follows:

Definition - Catchment collective

Catchment collective: means a group of enterprises or properties in multiple ownership, where the owners of those enterprises or properties undertake farming activities and operate as a collective for the purposes of contaminant management.

Certified Farm Environment Planner (Commercial Vegetable Production)

- 11.6. HortNZ supports the development of an industry certification process for industry bodies and proposes an industry specific regulatory framework for commercial vegetable production.

Decision sought:

- 11.7. Add a new definition for a Certified Farm Environment Planner (Commercial Vegetable Production) as follows:

Certified Farm Environment Planner (Commercial Vegetable Production)

Certified Farm Environment Planner (Commercial Vegetable Production): is a person or entity certified by the Chief Executive Officer of Waikato Regional Council and listed on the Waikato Regional Council website as a Certified Farm Environment

Planner (Commercial Vegetable Production) and has as a minimum the following qualifications and experience:

a. Tertiary qualifications in agronomy or agricultural engineering

b. More than 15 years' experience working with commercial vegetable cropping systems

c. A certificate of competence approved by the Waikato Regional Council relating to the relevant aspects of environmental farm plan assessment

Commercial vegetable production

- 11.8. HortNZ supports the definition of Commercial vegetable production. An amendment is required to remove the crop 'Asparagus' being a perennial plant which has effects more like small or low intensity fruit growing in the Waikato.

Decision sought:

- 11.9. Amend the definition of Commercial vegetable production as follows:

Definition - Commercial vegetable production

Commercial vegetable production: means the following vegetables grown in New Zealand for commercial purposes:

i. artichokes, Asian vegetables, beans, beetroot, boxthorn, broccoflower, broccoli, broccolini, Brussels sprouts, burdock, cabbage, capsicums, carrots, cauliflower, celeriac, celery, chilli peppers, chokos, courgettes, cucumbers, eggplant, Florence fennel, garland chrysanthemum, garlic, gherkins, herbs, Indian vegetables, kohlrabi, kumara, leeks, lettuces, marrows, melons, okra, parsnips, peas, puha, pumpkin, purslane, radishes, rakkyo, rhubarb, salad leaves, salsify, scallopini, scorzonera, shallots, silverbeet, spinach, spring onions, sprouted beans and seeds, squash, swedes, sweetcorn, taro, turnips, ulluco, watercress, witloof, yakon, yams, zucchinis, potatoes, tomatoes, asparagus, onions; and

ii. the hybrids of the vegetables listed in subparagraph i.

Enterprise/s

- 11.10. The definition of enterprise should be amended to recognise the activity may involve parts of parcels of land to reflect leasing arrangements which may only involve areas of land in rural production.
- 11.11. The definition should also be amended to recognise that land use activities will vary within the nature of an enterprise and that all relevant primary production activities should be accounted for.
- 11.12. Commercial vegetable production activities typically occur across more than one subcatchment and the ability to operate one enterprise across multiple subcatchments must be provided.

Decision sought:

- 11.13. Amend the definition of Enterprise/s as follows:

Definition - Enterprise/s

Enterprise/s: means one or more parcels of land (or parts of parcels of land) held in single or multiple ownership to support the primary production activities undertaken principle land use or land which the principle land use is reliant upon, and constitutes a single operating unit for the purposes of management. An enterprise is considered to be within a sub-catchment if more than 50% of that enterprise is within the sub-catchment.

Definition - Good Management Practice/s

- 11.14. HortNZ supports separate definitions for best and good management practice which for the horticultural sector are two different methods. Good management practices are described as an entry level practice that all growers could expect to undertake to manage nutrients. Best management practices are advanced mitigation options that often require significant investment which may present a barrier for uptake, especially for smaller growers.

Decision sought:

- 11.15. Retain the definition of Good Management Practice.

Nitrogen Reference Point

- 11.16. OVERSEER is a management tool of significant concern to the horticulture sector. The development of the commercial vegetable cropping modules within OVERSEER has been retarded by the emphasis on pastoral production systems. Recent experience in Canterbury has demonstrated the need for an alternative modelling approach to assess the benchmark contaminant discharge from commercial vegetable cropping rotations.
- 11.17. The proposed definition of Nitrogen Reference Point is supported by HortNZ to the extent that the plan provides for the establishment of an alternative method or model to establish a benchmark nitrogen and phosphorus discharge for commercial vegetable production systems from OVERSEER.

Decision sought:

- 11.18. Retain definition of Nitrogen Reference Point that provides for the establishment of an alternative method or model to establish a benchmark nitrogen and phosphorus discharge for commercial vegetable production systems.

Definition - Certified Farm Nutrient Advisor

- 11.19. The definition of Certified Farm Nutrient Advisor is too focussed on OVERSEER qualifications to provide for a vegetable production nutrient budget. It should be amended in the following manner:

Decision sought:

11.20. Amend the definition in the following way:

Certified Farm Nutrient Advisor:

is a person certified by the Chief Executive Officer of Waikato Regional Council and listed on the Waikato Regional Council website as a certified farm nutrient advisor and has the following competencies qualifications and experience:

a. Has completed nutrient management training to at least intermediate level, sufficient agronomic knowledge to conduct the assessment of a budget for the farm or enterprise, and

b. Has experience in nutrient management planning the appropriate level of experience in the modelling tool utilised to develop the nutrient budget.

Subcatchment Scale Management Plan (SSMP)
--

11.21. Enable the collaborative management of discharges at a scale greater than a single farm. Farmer / catchment collectives managing discharges as a single enterprise within a subcatchment or a water management unit are very likely to achieve environmental outcomes in a more coordinated and effective way.

Decision sought:

11.22. Add new definition of Subcatchment Scale Management Plan (SSMP) as follows:

Subcatchment Scale Management Plan (SSMP)

Subcatchment Scale Management Plan (SSMP): means a subcatchment scale plan for that sets out actions and responsibilities for a Catchment Collective (representing all or part of a subcatchment) for the purposes of contaminant management that meets or exceeds the expected reduction in discharge to freshwater that would otherwise be achieved through a Farm Environment Plan.



Healthy Rivers Plan Change Technical Support for Horticulture New Zealand's Submission

Horticulture New Zealand

Values and Current Allocation of Responsibility for Contaminant Discharges

IZ081700-RP-0001 | 0

08 March 2017

Healthy Rivers Plan Change Technical Support for Horticulture New Zealand's Submission

Project No: IZ081700
 Document Title: Values and Current Allocation of Responsibility for Contaminant Discharges
 Document No.: IZ081700-RP-0001
 Revision: 0
 Date: 31 January 2017
 Client Name: Horticulture New Zealand
 Project Manager: Tim Baker
 Author: Michelle Sands, Tom Nation, Tim Baker, Catherine Sturgeon
 File Name: J:\IE\Projects\02_New Zealand\IZ081700\21 Deliverables\sent to hort\IZ081700-RP-0001_Healthy Rivers Plan Change Technical Support_Task 1 Values and current allocation of responsibility001.docx

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Document history and status

Revision	Date	Description	By	Review	Approved
A	27/02/2017	Professional and Technical Review (internal)	C. Sturgeon, A. Robertson, T Nation, M Sands	M.Sands	M.Sands
B	07/03/2017	Professional and Technical Review (internal)	C. Sturgeon, A. Robertson, T Nation, M Sands	M.Sands	M.Sands
C	07/03/2017	Professional and Technical Review (internal)	C. Sturgeon, A. Robertson, T Nation, M Sands	M.Sands	M.Sands
001	08/03/2017	FINAL Report for Submission	C. Sturgeon, A. Robertson, T Nation, M Sands	M.Sands/ Tim Baker	M.Sands

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Appendix A. Healthy Rivers Catchments

Appendix B. Proportions of land use and water quality constituent loads in selected
subcatchments of the Waikato River Catchment

Appendix C. Graphed proportions of land use and water quality constituent cumulative loads along
the Waikato River

Executive Summary

The Proposed Healthy Rivers Plan Change has been developed to give effect to the Vision and Strategy for the Waikato River and the National Policy Statement for Freshwater Management 2014 (NPS FM). It requires regional councils to formulate freshwater objectives that give effect to the objectives of the NPS FM and describe the condition that Waikato regional communities want for fresh water in the future. The NPS FM process included identifying freshwater management units (FMU) and the values for each, and then choosing relevant water quality attributes and attribute states that can be monitored over time.

The values and water quality attributes were prepared by the Collaborative Stakeholder Group (CSG) and consist of Mana Atua (intrinsic values) and Mana Tangata (use values) of the water. The attributes that the plan focuses on are the following water quality indicators: nitrogen, phosphorus, chlorophyll, sediment and *E. coli*.

The objective of this report is to provide technical support for amendments to the Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments (Dated 3 December 2016) (WRC, 2016) ('PC1') that would achieve the Mana Atua and the Mana Tangata values of the Plan in pragmatic and equitable manner.

Modelling limitations

The water quality models developed for the Healthy Rivers process include numerous limitations including limitations in the underlying contaminant yield and landuse datasets. Our report does not seek to review the validity of the modelling undertaken for the Healthy Rivers process.

We have used some of the model inputs and outputs to discuss the assumed relative contribution of diffuse discharges from the primary sector and discussed some of the limitations of the modelling.

In our view it is vital that decision makers are aware of the limitations of the water quality modelling used to inform policy development.

Horticulture land use and values

Section 3 of this report summarises the impact of horticultural landuse in the catchment on the attributes identified by the CSG, and the corresponding effect that this has on values identified in PC1.

In total, horticultural land occupies 0.6% of the total area of the Waikato River catchment, and accounts for 2.5% of the Total Nitrogen (TN) loads and 0.9% of the Total Phosphorous (TP) load in the overall catchment. The contribution of horticulture land to sediment loads predicted from each sub-catchment is also very low. The sediment concentrations in the Lower Waikato are influenced by the inflow of the Waipa River at Ngaruawahia, the Whangape Lake Catchment, the Opuatia catchment, and the Whangamarino River. There is also a marked increase in chlorophyll a concentration between Huntly-Tainui and Tuakau, which is in response to the inflows from the hypertrophic riverine lakes; Lake Whangape and Lake Waikare.

There is a decreasing water clarity trend throughout the Waikato catchment which generally reflects the increasing concentrations of other constituents that influence it, including nitrogen, phosphorous, sediment and chlorophyll a. Environmental mitigation programs on horticultural properties are very focused on ways to reduce firstly sediment and phosphorus discharges closely followed by nitrogen discharges. Furthermore the majority of the horticultural property in the Waikato is in the Lower Waikato catchment, meaning the impact of phosphorus runoff and nitrogen leaching from horticultural enterprises covers a small proportion of the overall Waikato catchment. Horticulture also has a minimal impact on *E. coli* loads in the overall Waikato River catchment and contributes less *E. coli* yields compared with dairy, sheep and beef and urban land use.

Horticulture may have higher nitrogen (N) leaching values but a very small N load overall when compared by land area to dairy. Policy 3 g states that *'the degree of reduction in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens is proportionate to the amount of current discharge (those discharging more are expected to make greater reductions), and the scale of water quality improvement required in the sub-catchment*

PC1 outlines that changing landuse to commercial vegetable production is a non-complying activity. However Horticulture New Zealand thinks it should be provided for as a restricted discretionary consent for new commercial vegetable production where it can be demonstrated there is an overall reduction across all four contaminants considered in PC1. The assessment of an application for new commercial vegetable production should allow recognition for any reductions in bacterial contamination as a result of the conversion of land. And in some cases, if it can be demonstrated that the land use change results in a similar or lesser effect on core values protected by the Vision and Strategy, an increase in discharges of nitrogen should be provided for.

Leaching rate assumptions in water quality modelling

Nitrogen is one of the four contaminants that are a focus of this plan. All four contaminants affect the values. The introduction of a nitrogen reference point places an inequitable emphasis on one contaminant. It is the view of Horticulture New Zealand that a balanced approach needs to be taken to contaminant reductions across all the 4 contaminants.

Nitrogen mitigation and the influence of Variation 6

Discharges of nutrients can be estimated to increase without sufficient irrigation to raise crop yields; however surface water takes for crop irrigation are likely to be reduced to phase-out overallocation in the catchment. This is due to past decisions regarding the management of water quantity (e.g. Variation 6 and the Watercare application). This will remove a key mitigation for commercial vegetable growers seeking to reduce discharges using efficient irrigation unless alternative sources of water can be found.

Offset mitigation

The Whangape Lake Catchment, the Opuatia catchment, and Lake Waikare are hypertrophic riverine lakes and discharge sediment and phytoplankton into the Lower Waikato catchment. These sub-catchments have the potential to impact on the ability of the downstream community to achieve targets for contaminant reduction or restoration of values to achieve The Vision and Strategy for the Waikato River.

PC1 provides for offset to be used for point source discharges. The discharge from Lake Waikare into the Whangamarino wetland is a consented point source and therefore this policy could apply to mitigating the impact of the flood protection scheme on the water quality discharged from Lake Waikare.

Horticulture New Zealand seeks an offset measure for horticulture in an alternative location or locations to the non-point source discharge, for the purpose of ensuring positive effects on the environment to lessen any residual adverse effects of the discharge(s) that will or may result from allowing the activity

Farm Management Plans

Horticulture New Zealand seeks amendments to the Farm Management Plan Schedule1; part of Horticulture New Zealand's issue with the current plan is the lack of focus on managing losses from cultivation practices across broader rural land than that occupied by the vegetable sector. Horticulture New Zealand considers that a range of practices could be mandated across cultivated land.

In the Mangaone catchment Horticulture makes up 2% of the landuse, bare earth makes up 5% of the land within the catchment. Our estimate is the horticultural landuse makes up approximately 30% of the bare earth within the catchment, which means that 70% of the bare earth is within other landuses

Managing the effect of soil erosion from cultivated land, will require measures are implemented on all landuses, including horticultural land.

Sub-catchment allocation

The Horticulture New Zealand submission proposes a change to Objective 3 to add the *achievement of the contaminant load reduction targets specified for each subcatchment in Table 3.11.*

We requested catchment loads that were associated with the 10 year water quality targets from Waikato University, at the time of submission these loads have not been made available, however we know these loads were developed as part of the Healthy Rivers modelling, and could be supplied along-side the water quality concentration targets.

We have attempted to calculate loads for TN, Nitrate, TP and E.coli, for those sites where it was possible, the calculations we have undertaken include a number of assumptions. These loads should be updated with the modelled loads. It was not possible to calculate a catchment load for Chl a from the data available.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to review available technical reports undertaken by third parties for the Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments and assess the information in support of a submission on behalf of Horticulture New Zealand on the plan change in accordance with the scope of services set out in the contract between Jacobs and Horticulture New Zealand ('the Client'). That scope of services, as described in the Jacobs proposal dated 16 December 2016, was developed with the Client.

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1. Introduction

The objective of this assessment is to provide technical support for amendments to the Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments (Dated 3 December 2016) (WRC, 2016) ('PC1') that would achieve the Mana Atua and the Mana Tangata values of the Plan in pragmatic and equitable manner.

The analysis draws on existing published science for testing the proposed case studies and these results are discussed in the context of the Healthy Rivers water quality modelling results. Wherever possible we have utilised the Healthy Rivers data sets to test scenarios using the Healthy Rivers water quality modelling methodology.

Section 2 of this report summarises the values identified in the Healthy Rivers Plan and Section 3 discusses the impact of horticultural landuse in the catchment on these values. The discussion covers all the values, and considers the link between water use and water quality and focuses on the following water quality indicators: nitrogen, phosphorus, chlorophyll, sediment and *E.coli*.

Section 4 discusses the PC1 allocation of responsibility for contaminant discharges, and provides four cases studies to provide focus for the relief sought by the Horticultural New Zealand submission. The case studies include:

- Leaching assumptions focused on horticulture and dairy leaching
- Nitrogen mitigation and focused on the influence of Variation 6 and the Watercare abstraction
- Offset mitigation and the potential for offset to be used for the flood protection scheme point source discharges and Horticultural diffuse discharges
- Farm Management Plans and in particular managing sediment from cultivated land.

Section 4.5 includes a sub-catchment load table. Horticulture New Zealand's submission includes seeking the ability for people to manage diffuse discharges on a sub-catchment scale.

2. Summary of values and targets

The Vision and Strategy for the Waikato River is the primary direction setting document for the Waikato and Waipa Rivers, and regional and district plans must give effect to the Vision and Strategy. PC1 gives effect to the Vision and Strategy, whereas the current Regional Plan objectives do not currently fulfil the Vision and Strategy. Furthermore, the National Policy Statement for Freshwater Management 2014 (NPS FM) requires regional councils to formulate freshwater objectives that give effect to the objectives of the NPS FM and describe the condition that Waikato regional communities want for fresh water in the future. The NPS FM process included identifying freshwater management units (FMU) and the values for each, and then choosing relevant water quality attributes and attribute states that can be monitored over time.

The values to be enforced by PC1 were prepared and supported by the Collaborative Stakeholder Group (CSG). The final list of values and uses were finalised on 9-10 August 2015 and consist of the following:

- Mana Atua is the **intrinsic** values of water including mauri (the principle of life force), wairua (the principle of spiritual dimension), and mana (the principle of prestige, authority of the water and its ecosystems in their natural state).
- Mana Tangata refers to the **use** values of water from its use for economic, social, spiritual and cultural purposes.
- Together these represent Te Mana o te Wai. Te Mana o te Wai represents the relationship between the health and mauri of the water and the health and mauri of the environment which is integral to the social, cultural, economic and environmental well-being of communities (MfE, 2014).

Mana Atua in PC1 is made up of 3 key values and Mana Tangata is made up of 10 key values, which can be further grouped under cultural and social use values, and economic use values (see Table 2-1 below).

Table 2-1 : Key values listed in the Proposed Plan.

Values	Description
Mana Atua Values	
History	Each River Iwi has their own unique and intergenerational relationship with the rivers.
Ecosystem Health	The Waikato and Waipa catchments support resilient freshwater ecosystems and healthy freshwater populations of indigenous plants and animals.
Natural Form and Character	Retain the integrity of the rivers within the landscape and its aesthetic features and natural qualities for people to enjoy.
Mana Tangata Values	
Wai tapu (sacred waters)	Area of water body set aside for spiritual activities that support spiritual, cultural and physical wellbeing.
Geothermal	A valued resource that is naturally gifted to sustain certain activities (meeting spiritual and physical needs).
Mahinga kai and fishing	The ability to access the Waikato and Waipa and their tributaries to gather sufficient quantities of kai (food) that is safe to eat and meets the social and spiritual needs of their stakeholders.
Human health for recreation	The rivers are a place to swim and undertake recreation activities in an environment that poses minimal risk to health.
Transport and tauranga waka	All communities can use the rivers to pilot their vehicles and waka and navigate to their destinations.
Primary production	The rivers support regionally and nationally significant primary production in the catchment (agricultural, horticultural, forestry). 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 also support other industries and communities within rural and urban

Values	Description
	settings.
Water supply	The rivers provide for community water supply, municipal supply, drinkable water supply and health.
Commercial, municipal and industrial use	The rivers provide economic opportunities to people, businesses and industries e.g. tourism; assimilative capacity for discharges, wastewater disposal, flood and stormwater.
Electricity generation	The river provides for reliable, renewable hydro and geothermal energy sources and thermal generation, securing national self-reliance and resilience.
Mitigating flood hazards	Flood management systems protect land used and inhabited by people.

From the above values that were developed, three core values were identified: **human health for recreation, ecosystem health, and mahinga kai**. For each value, the expert panel of the Technical Leaders Group (TLG) reviewed attributes contained in the NPS-FM National Objectives Framework (NOF) and assessed how they might be applied to the Waikato-Waipā catchment. The panel also provided advice on other attributes deemed relevant to the measurement of the three values in FMUs in the catchment (i.e. if they were within scope and related to the four contaminants) (WRC, 2016a). This process is outlined in more detail in Scarsbrook (2016). The agreed attributes are based on the NOF for nitrate, ammonia and *E. coli*; on the NOF for phytoplankton (chlorophyll *a*), total nitrogen and total phosphorus for lakes except that they are also to be applied to the main stem of the Waikato River (in recognition of the hydro-lakes); and on a proposed clarity attribute developed by the TLG to address sediment with input from the CSG to define appropriate bands (WRC, 2016).

The impact that relevant water quality attributes have on the three core values are outlined in the table below (Table 2-2). This is based upon the information outlined in the NPS FM (Appendix 2 – Attribute tables). A summary is outlined in the points below:

- Human Health for Recreation is measured against concentrations of *E. coli* (in lakes, rivers, and lake-fed rivers), chlorophyll *a* (lakes and lake fed rivers) and planktonic cyanobacteria (lakes only), and levels of clarity (lakes, rivers, and lake-fed rivers). Visual clarity is measured as the horizontal sighting range of a black disc under base flow conditions. The key contributors to visual clarity are considered to be yellow substance, phytoplankton (floating algae) and fine sediment.
- Ecosystem Health is measured against trophic state indicators such as concentrations of chlorophyll *a* (lakes and lake-fed rivers) and planktonic cyanobacteria (lakes only), TP and TN concentrations (lakes and lake-fed rivers), and nitrate-N and ammoniacal N (as toxicants in rivers and lake-fed rivers).
- Mahinga kai is measured against concentrations of *E. coli* (in lakes, rivers, and lake-fed rivers) and chlorophyll *a* (lakes and lake-fed rivers) and planktonic cyanobacteria (lakes only).

Values and Current Allocation of Responsibility for Contaminant Discharges



Table 2-2 : The chosen water quality attributes and the corresponding effect that each have on the three core values identified in PC1.

Values	Description	Total Nitrogen ¹ , Nitrate ² , Ammonia ²	Total Phosphorus ¹	Clarity ¹	<i>E. coli</i> ²	Chlorophyll <i>a</i> ¹ Planktonic cyanobacteria ¹
Human health for recreation ('Swimmability')	The rivers are a place to swim and undertake recreation activities in an environment that poses minimal risk to health.	Not directly used to measure the state of this value. However, elevated nutrients and increased residence time can lead to excessive algal and/or plant growth may limit visibility.	Not directly used to measure the state of this value. However, elevated nutrients and increased residence time can lead to excessive algal and/or plant growth may limit visibility.	Reductions in water clarity which may limit visibility resulting in injury. Water clarity influences people's choice of where to swim, but does not directly affect human health (Scarsbrook, 2016).	Pathogens such as <i>E. coli</i> are harmful to human health. People can be exposed to a risk of infection from contact with water during activities and with occasional immersion and some ingestion of water (such as wading and boating). (MfE, 2014).	Planktonic cyanobacteria - Potential health risks (eg, respiratory, irritation and allergy symptoms) exist from exposure to cyanobacteria (from any contact with fresh water) (MfE, 2014).
Ecosystem Health	The Waikato and Waipa catchments support resilient freshwater ecosystems and healthy freshwater populations of indigenous plants and animals.	Trophic state - Ecological communities may become degraded due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as the loss of oxygen in bottom waters of deep lakes (MfE, 2014). Toxicity – Nitrate and ammonia may impact on growth of multiple species and approach acute impact level (i.e. risk of death) for sensitive species at higher concentrations (MfE, 2014).	Trophic state - Ecological communities may become degraded due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as the loss of oxygen in bottom waters of deep lakes (MfE, 2014).	Not directly used to measure the state of this value. Affects ecosystem health either through deposition and smothering of biota or through the clarity reductions altering the success of visual feeders such as birds and fish (Hughes, 2015; Yalden & Elliot, 2015).	Not directly used to measure the state of this value.	Trophic state - Regular and/or extended-duration nuisance blooms reflecting high nutrient enrichment and/or significant alteration of the natural flow regime or habitat (MfE, 2014).
Mahinga kai	The ability to access the Waikato and Waipa and their tributaries to gather sufficient quantities of kai (food) that is safe to eat and meets the social and spiritual needs of their stakeholders.	Not directly used to measure the state of this value. Ecological communities may become degraded due to elevated nutrients and increased residence time leading to excessive algal and/or plant growth, as well as the loss of oxygen in bottom waters of deep lakes (MfE, 2014).	Not directly used to measure the state of this value. Ecological communities may become degraded due to elevated nutrients and increased residence time leading to excessive algal and/or plant growth, as well as the loss of oxygen in bottom	Not directly used to measure the state of this value. Affects ecosystem health either through deposition and smothering of biota or through the clarity reductions altering the success of visual feeders such as birds and	Pathogens such as <i>E. coli</i> are harmful to human health.	Planktonic cyanobacteria - Potential health risks (eg, respiratory, irritation and allergy symptoms) exist from exposure to cyanobacteria (from any contact with fresh water) (MfE, 2014).

Values and Current Allocation of Responsibility for Contaminant Discharges



Values	Description	Total Nitrogen ¹ , Nitrate ¹ , Ammonia ²	Total Phosphorus ¹	Clarity ¹	<i>E. coli</i> ³	Chlorophyll <i>a</i> ⁴ Planktonic cyanobacteria ⁴
			waters of deep lakes (MFE, 2014).	fish (Hughes, 2015; Yalden & Elliot, 2015).		

Notes:

1. TN, TP and chlorophyll *a* (phytoplankton) attributes apply to lakes but also over the entire length of the main stem of the Waikato River from Taupo Gates to Port Waikato. This recognises that the Waikato River is lake-fed, the eight hydro-dam affected reaches function as lakes and phytoplankton growth occurs along the entire river.
2. Nitrate and ammonia attributes apply to rivers, and lake-fed rivers.
3. Water clarity and *E. coli* attributes apply to lakes, rivers, and lake-fed rivers.
4. Planktonic cyanobacteria attribute applies to lakes only.

3. Horticulture land use and value attributes

The three core values, **human health for recreation**, **ecosystem health**, and **mahinga kai**, have associated water quality attributes that directly or indirectly measure their corresponding effects. This section will discuss these water quality attributes including their current measured status in the Waikato River, the short and long term water quality targets set in PC1, and the modelled yield contributions of horticultural land use to these attributes at a subcatchment scale throughout the Waikato River catchment.

In the following subsections each water quality attribute is discussed in greater detail at the subcatchment scale (linked to monitoring sites) and in relation to horticultural land use. Figure 3.1 on the following page shows the location of the monitoring sites associated with each subcatchment along the Waikato River, from the source at Lake Taupo to the mouth at Port Waikato.

Sites appear in order from upstream to downstream as follows: Ohaaki, Ohakuri, Whakamaru, Waipapa, Narrows, Horotiu Br, Huntly-Tainui Br, Mercer Br, Tuakau Br, and Port Waikato. Port Waikato does not have measured water quality data or water quality targets listed in PC1.

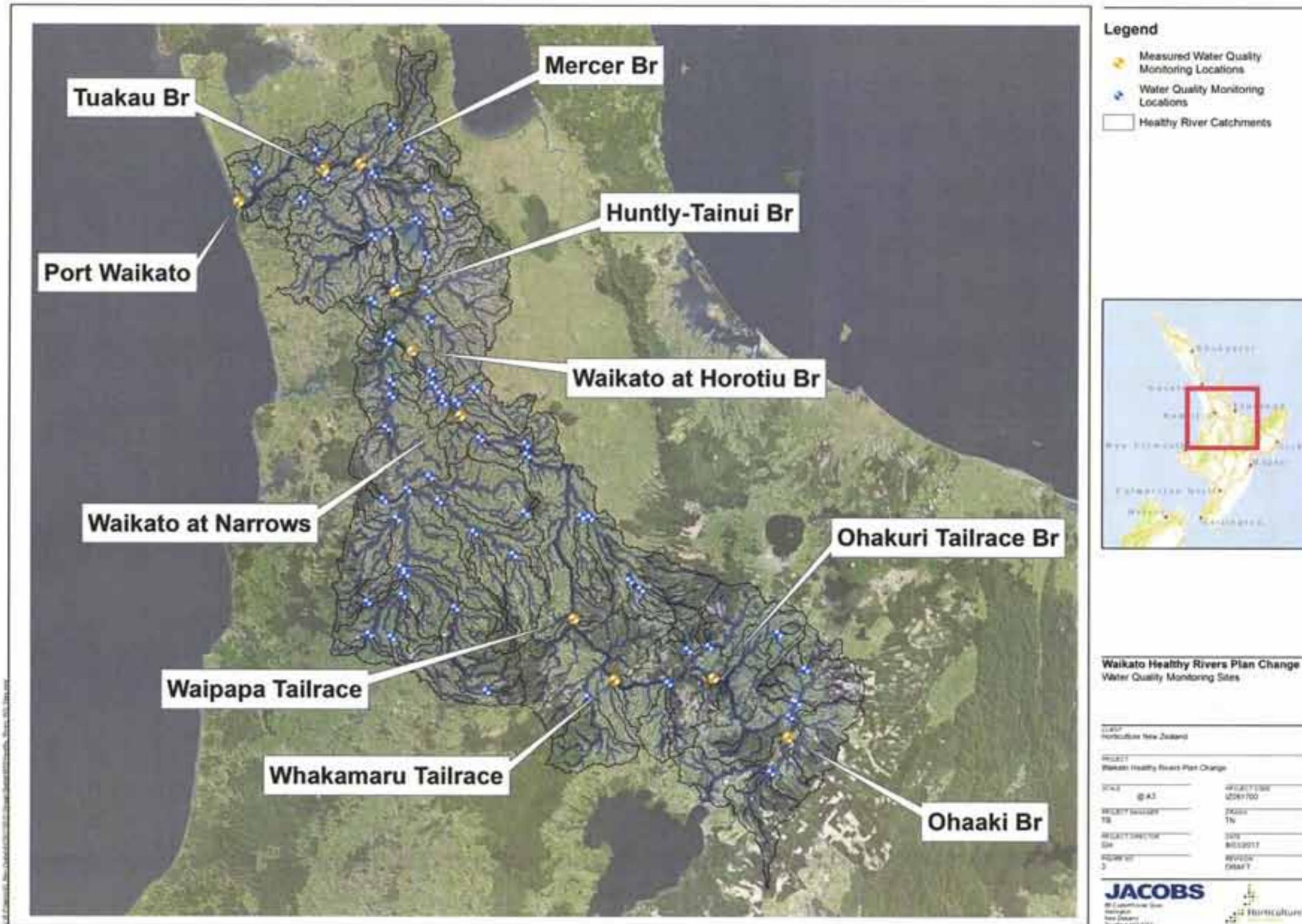


Figure 3.1: Water quality monitoring sites.

3.1 Nitrogen

Total nitrogen (TN) is a measure of the state of ecosystem health, and can in-directly impact on the state of the water body for human health for recreation in respect to the influence of nitrogen on chlorophyll *a* and the impact of chlorophyll *a* on clarity.

In the nutrient modelling undertaken for the Healthy Rivers process, horticulture had the highest nitrogen leaching value compared to all other land uses (see the table in Section 4.1 on pg. 22 of this report).

PC1 provides water quality targets at the subcatchment scale for the short term (10 years) and long term (80 years), the short term target being 10% of the long term target. These targets have been based on the measured median values at those sites, with the aim to improve water quality within the 10 and 80 year timeframes. These targets are listed alongside the median measured TN values (2010 to 2014) for Waikato River monitoring sites in Table 3-1 (listed upstream to downstream) and graphed in Figure 3.2 on the following page.

Median TN concentrations in the upper catchments measured at Waikato at Ohaaki with a median value of 0.134 mg/L increase almost five fold to 0.595 mg/L at Waikato at Tuakau Bridge.

Table 3-1: 2010 – 2014 median measured TN values for each Waikato River monitoring site and associated short and long term water quality targets from PC1.

HRWO sub-catchment monitoring sites	TN median measured values (mg/L)	WQ targets (mg/L)	
		Short Term	Long Term
Waikato at Ohaaki	0.134	0.134	0.134
Waikato at Ohakuri	0.211	0.206	0.160
Waikato at Whakamaru	0.271	0.260	0.160
Waikato at Waipapa	0.336	0.318	0.160
Waikato at Narrows	0.41	0.404	0.350
Waikato at Horotiu Br	0.441	0.432	0.350
Waikato at Huntly-Tainui Br	0.585	0.562	0.350
Waikato at Mercer Br	0.662	0.631	0.350
Waikato at Tuakau Br	0.595	0.571	0.350

These values are graphed and displayed in Figure 3.2 along the approximate location of other major waterbodies draining to the Waikato River in relation to monitored water quality sites; the hydro lakes and the Waipa River.

Median TN concentrations steadily increase from Ohakuri to Horotiu, followed by a marked increase between Horotiu and Huntly-Tainui Br, which is also where the Waikato and Waipa Rivers meet, increasing still between Huntley-Tainui and Mercer, which is also where the Whangamarino Wetland discharges to the Waikato River, and a decrease in concentrations between Mercer and Tuakau Br. Overall, the median concentrations measured from Ohaaki increase three fold by Horotiu, and almost five fold by Mercer Br.

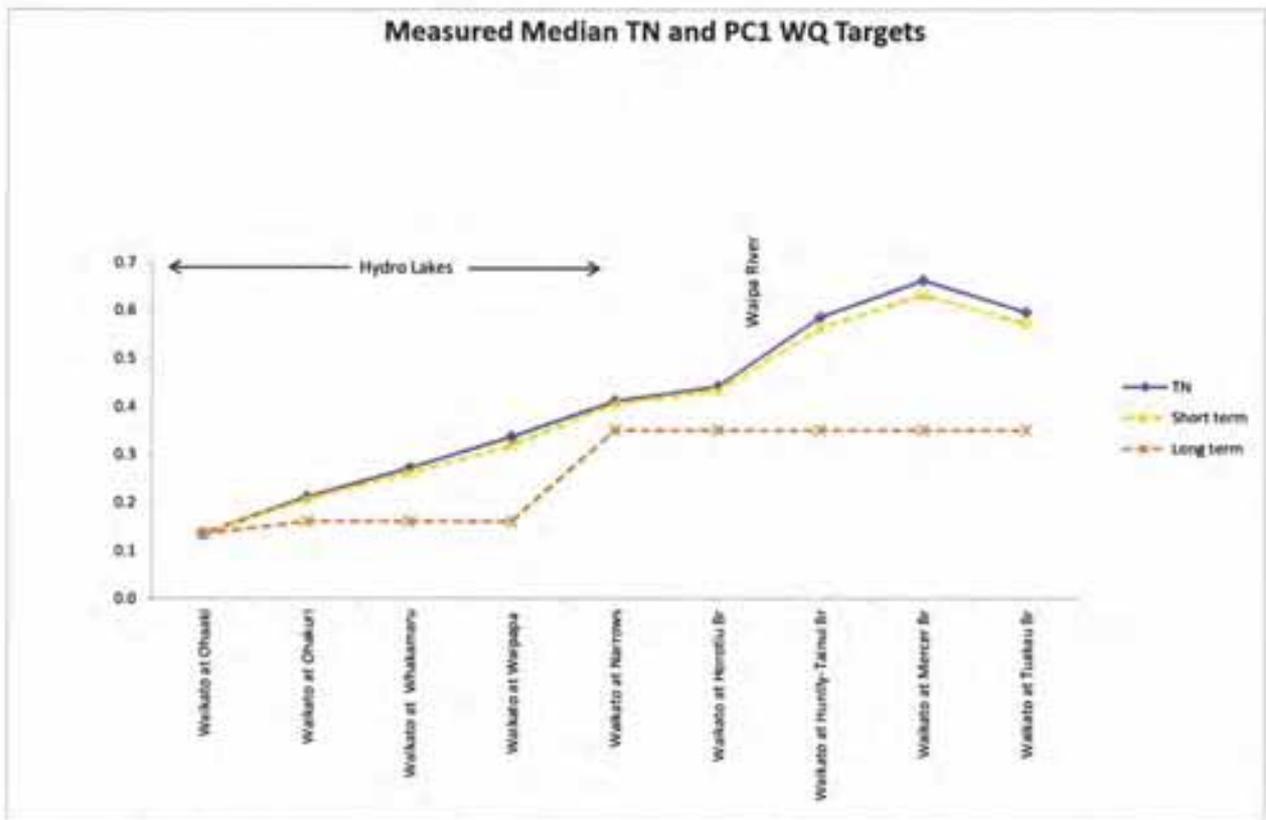


Figure 3.2: Graph of Total nitrogen measured median values (2010-2014) and associated short term and long term water quality targets from PC1.

Based on data provided by NIWA, in total, horticultural land occupies 0.6% of the total area of the Waikato River catchment, and accounts for 2.6% of the TN loads in the overall Waikato River catchment. Figure 3.3 on the following page illustrates the percentage contribution of TN loads from horticulture per subcatchment. Pie charts illustrating the proportion of horticulture N loads in each subcatchment compared to other land use types are provided in Appendix B and C.

The majority of the horticultural property in the Waikato is in the lower catchment of the Waikato River, meaning the impact of nitrogen leaching from horticultural enterprises covers a small proportion of the overall Waikato River catchment.

Figure 3.3 illustrates the percentage of the nitrogen load attributed to horticulture used in the NIWA water quality modelling. (Semadeni-Davies, September 2015). Note the NIWA modelling simplified the landuse assumptions compared with landuse layer supplied to Jacobs by NIWA. In some catchments no horticulture was assumed in the nutrient modelling, where the landuse layer indicates horticulture is present.

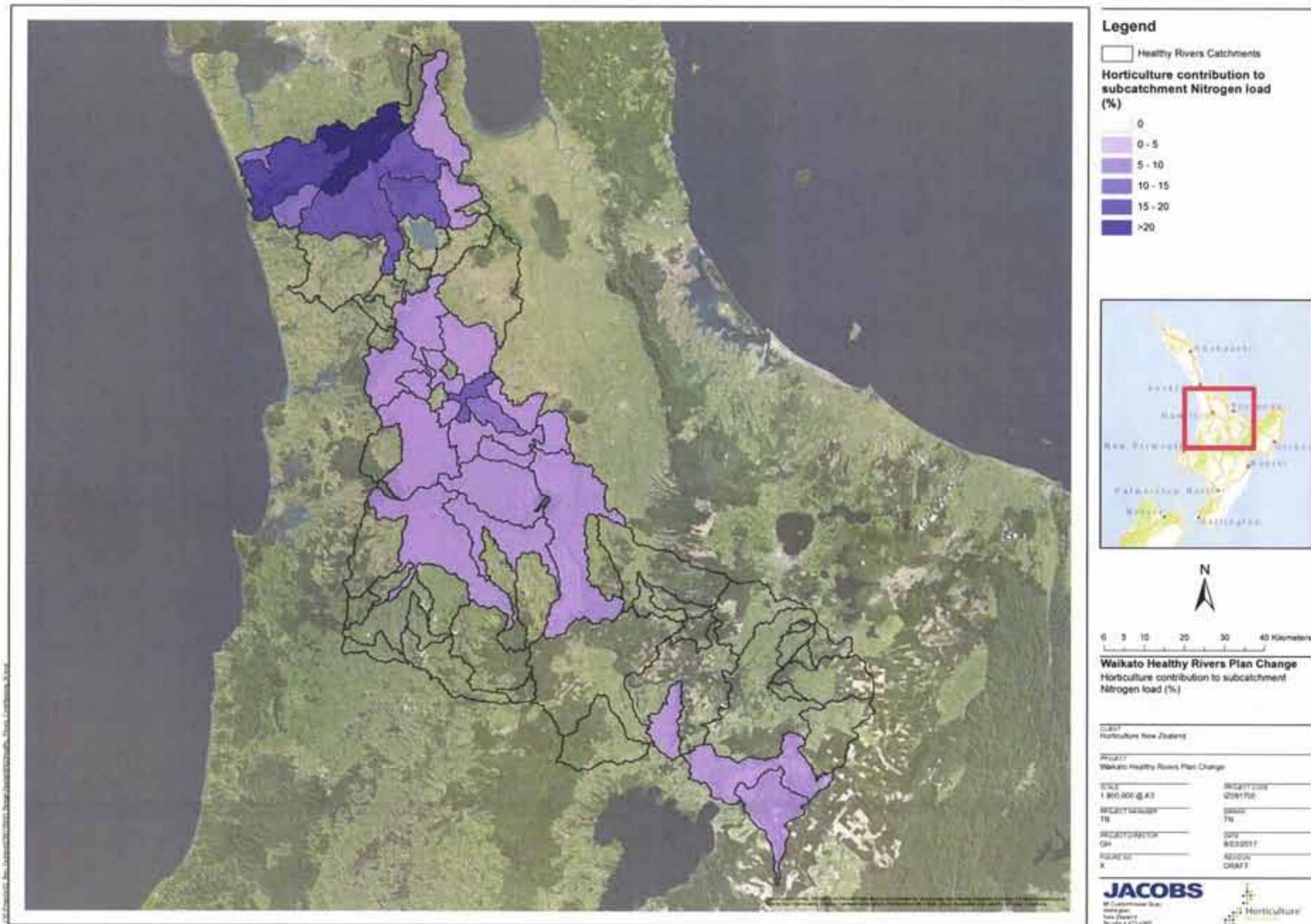


Figure 3.3: Contribution of unattenuated nitrogen loads from horticulture land use on a subcatchment scale.

3.2 Phosphorous

Like nitrogen, phosphorous (P) is used to measure the state of the ecosystem health and can in-directly impact on the state of the water body for human health for recreation in respect to the influence of phosphorus on phytoplankton biomass and therefore chlorophyll *a* concentrations, and the impact of chlorophyll *a* on clarity.

PC1 short term (10 years) and long term (80 years) water quality targets for each subcatchment scale are based on the measured median values at those sites. These targets are listed alongside the median measured total phosphorous (TP) values for Waikato River monitoring sites from 2010 to 2014 in Table 3-2 and graphed in Figure 3.4.

Measured median TP concentrations in the upper catchments at Waikato at Ohaaki, with a median value of 0.010 mg/L, increase over fivefold to 0.053 mg/L at Tuakau Bridge. This increase is of the same magnitude as we observed for TN.

Table 3-2: 2010 – 2014 median measured TP values for each Waikato River monitoring site and associated short and long term water quality targets from PC1.

HRWO sub-catchment	Median measured values 2010-2014 (mg/L)	WQ targets - Median TP (mg/L)	
	TP	Short Term	Long Term
Waikato at Ohaaki	0.010	0.010	0.010
Waikato at Ohakuri	0.017	0.017	0.017
Waikato at Whakamaru	0.020	0.020	0.020
Waikato at Waipapa	0.025	0.025	0.020
Waikato at Narrows	0.028	0.028	0.020
Waikato at Horotiu Br	0.036	0.034	0.020
Waikato at Huntly-Tainui Br	0.045	0.043	0.020
Waikato at Mercer Br	0.052	0.049	0.020
Waikato at Tuakau Br	0.053	0.050	0.020

These values are graphed and displayed in Figure 3.4 with the approximate location of other major waterbodies draining to the Waikato River in relation to monitored water quality sites; the hydro lakes and the Waipa River.

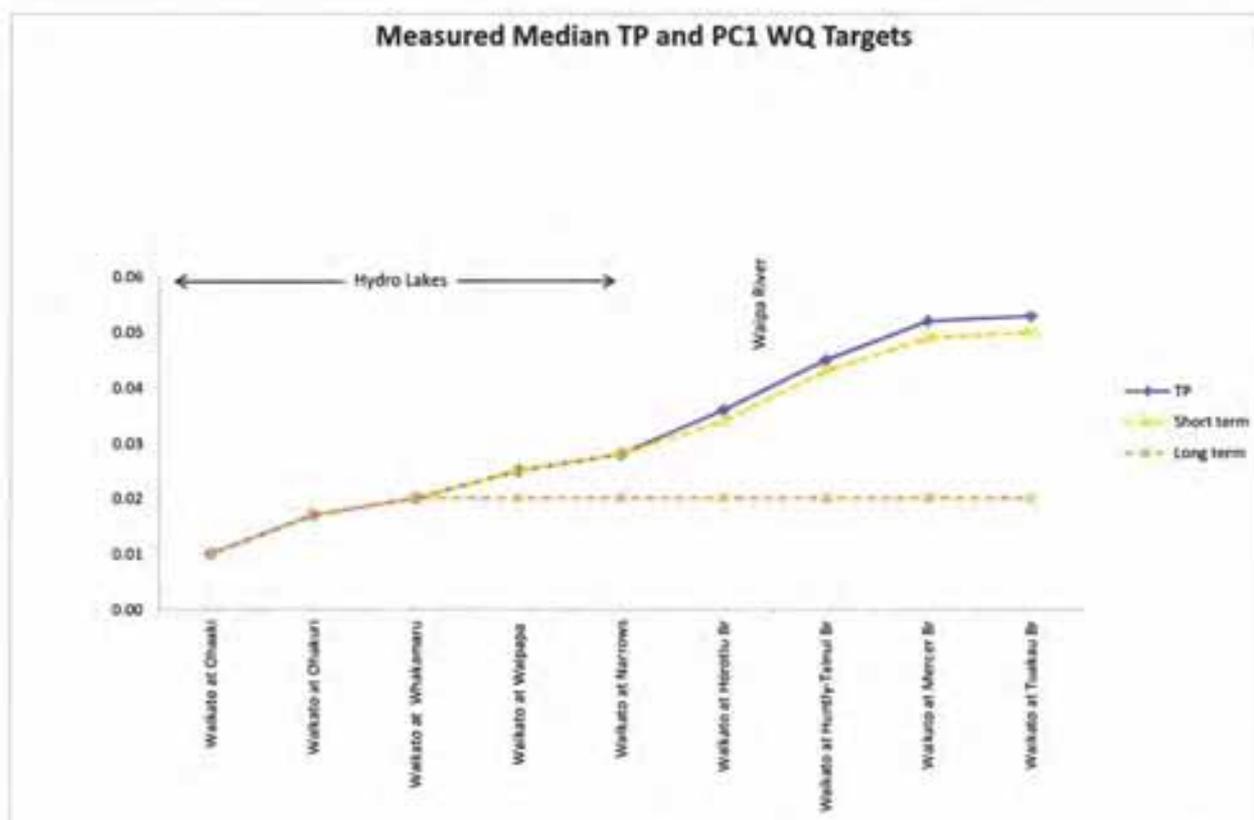


Figure 3.4: Graph of TP measured median values (2010-2014) and associated short term and long term water quality targets from PC1.

TP median concentrations steadily increase from Ohaaki to Narrows, continuing at an increasing rate between Narrows and Mercer, between which the Waikato and Waipā Rivers meet and the Whangamarino Wetland discharges to the Waikato River. There is a slight increase in concentration between Mercer and Tuakau Br. No concentrations are listed for sites below the Tuakau Br. Overall, the median concentrations measured from Ohaaki increase almost fivefold by Tuakau Br.

Horticultural land occupies 0.6% of the total area of the Waikato River catchment, and accounts for 0.9% of the TP load in the overall catchment, as modelled by NIWA. Figure 3.5 below illustrates the percentage contribution of TP loads from horticulture per subcatchment. Pie charts illustrating the proportion of horticulture TP loads in each subcatchment compared to other land use types are provided in Appendix B and C.

The majority of the horticultural property in the Waikato is in the lower catchment of the Waikato River, meaning the impact of phosphorous leaching from horticultural enterprises covers a small proportion of the overall Waikato catchment, similar to what is observed for nitrogen.

Figure 3.4 illustrates the percentage of the phosphorus load attributed to horticulture used in the NIWA water quality modelling. (Semadeni-Davies, September 2015). Note the NIWA modelling simplified the landuse assumptions compared with landuse layer supplied to Jacobs by NIWA. In some catchments no horticulture was assumed in the nutrient modelling, where the landuse layer indicates horticulture is present.

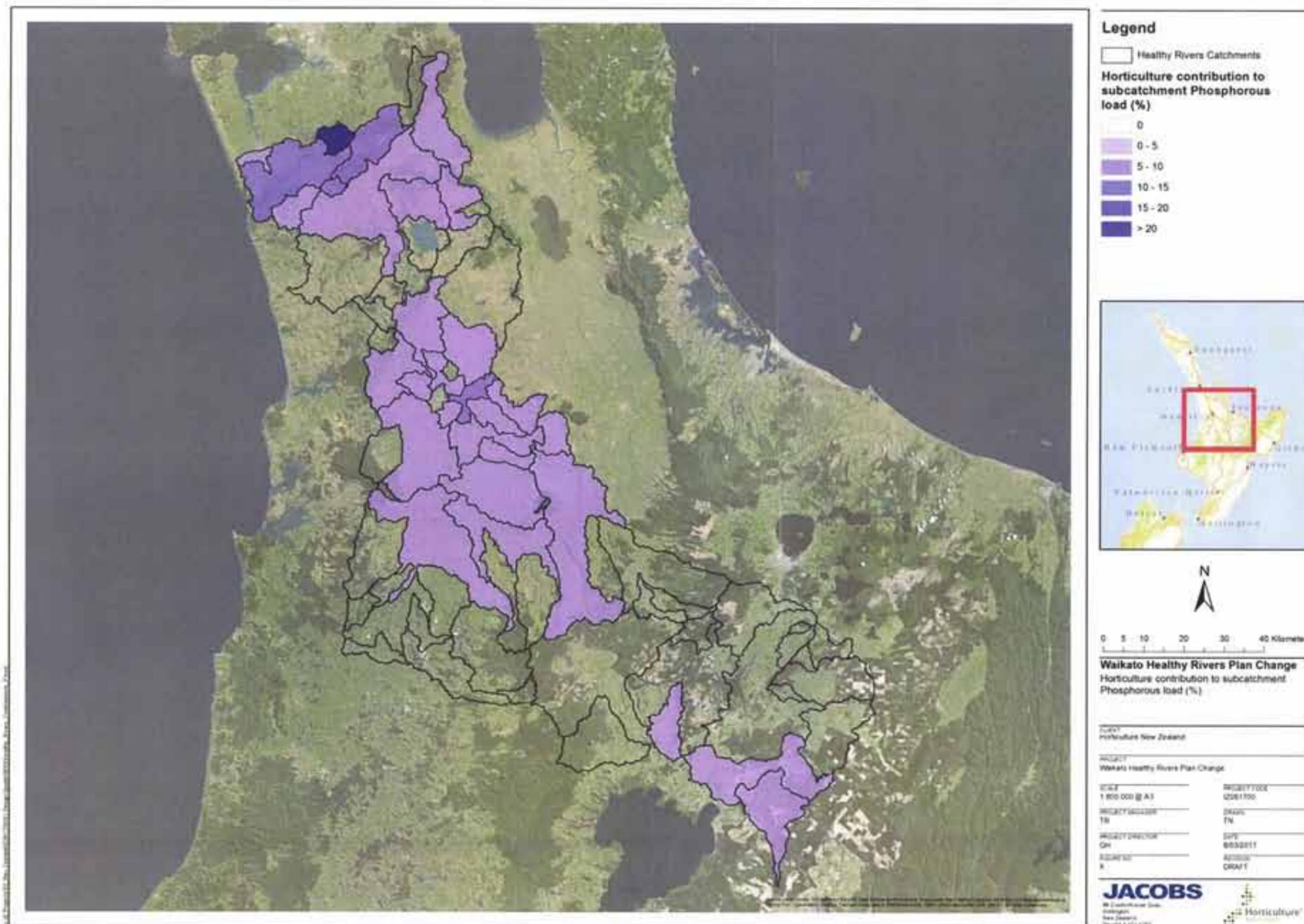


Figure 3.5 : Contribution of unattenuated phosphorus loads from horticulture land use on a subcatchment scale.

3.3 Sediment

Fine sediments like silts and clays are key light attenuating constituents that contribute to the impact on water clarity.

NIWA (Hughes, 2015) modelled annual sediment loads separately for each subcatchment using the New Zealand Empirical Erosion Model (NZEEM), for the purposes of representing annual average sediment loads lost from the land for PC1.

The NZEEM uses annual rainfall, land cover and erosion terrain (rock, soil, slope erosion process) to inform the prediction of sediment yield. The NZEEM does not differ between pasture and bare earth and therefore does not account for the sediment generated from bare earth associated with horticulture and arable farming. Figure 3.6 displays the subcatchments and sediment yield across the greater catchment in tonnes per square kilometre per year.

The majority of horticultural land is located downstream of Mercer. The sediment concentrations in the Lower Waikato are influenced by the inflow of the Waipa River at Ngaruawahia. In addition between Rangiriri and Mercer, there are three significant tributaries that contribute high sediment loads. These are the Whangape Lake Catchment and Opuatia to the west, and the Whangamarino River to the east. Figure 3.7 maps the sediment yield in these areas, Figure 3.9 illustrates the relatively high sediment yield in the catchments that drain to Lake Waikare and Lake Whangape.

The contribution of horticulture land to sediment loads predicted from each sub-catchment is very low, as illustrated in Figure 3.8. Note the NIWA modelling simplified the landuse assumptions compared with landuse layer supplied to Jacobs by NIWA for nutrient modelling. When calculating the sediment load attributable to horticultural land Jacobs used the supplied landuse layer.

Pie charts illustrating the proportion of horticulture land contributing to sediment loads in each subcatchment compared to other land use types are provided in Appendix B and C.

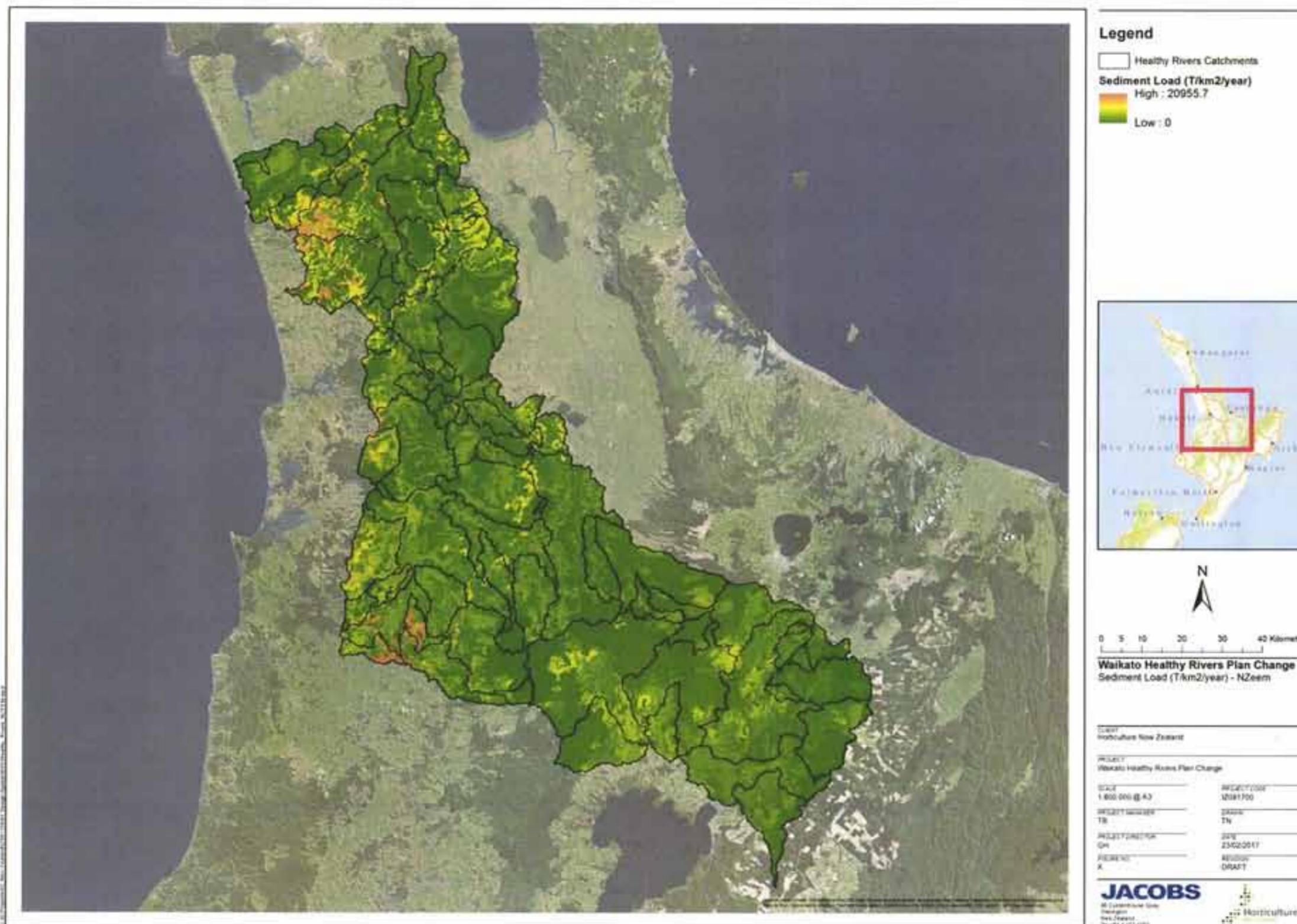


Figure 3.6 NZEEM sediment yield tonnes/km²/year

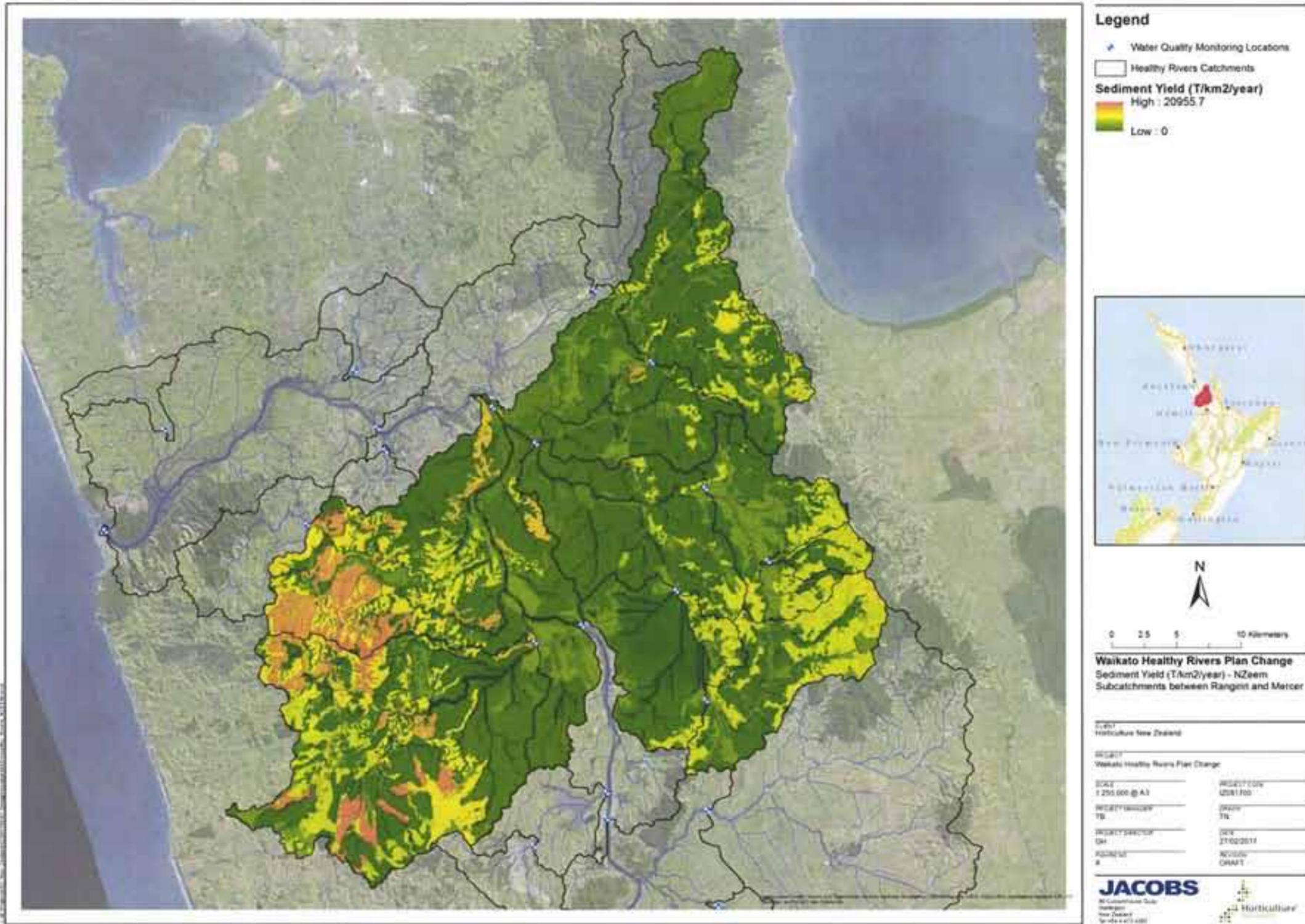


Figure 3.7 NZEEM sediment yield Tonnes/km²/year for the sub- catchments between Rangiriri and Mercer.

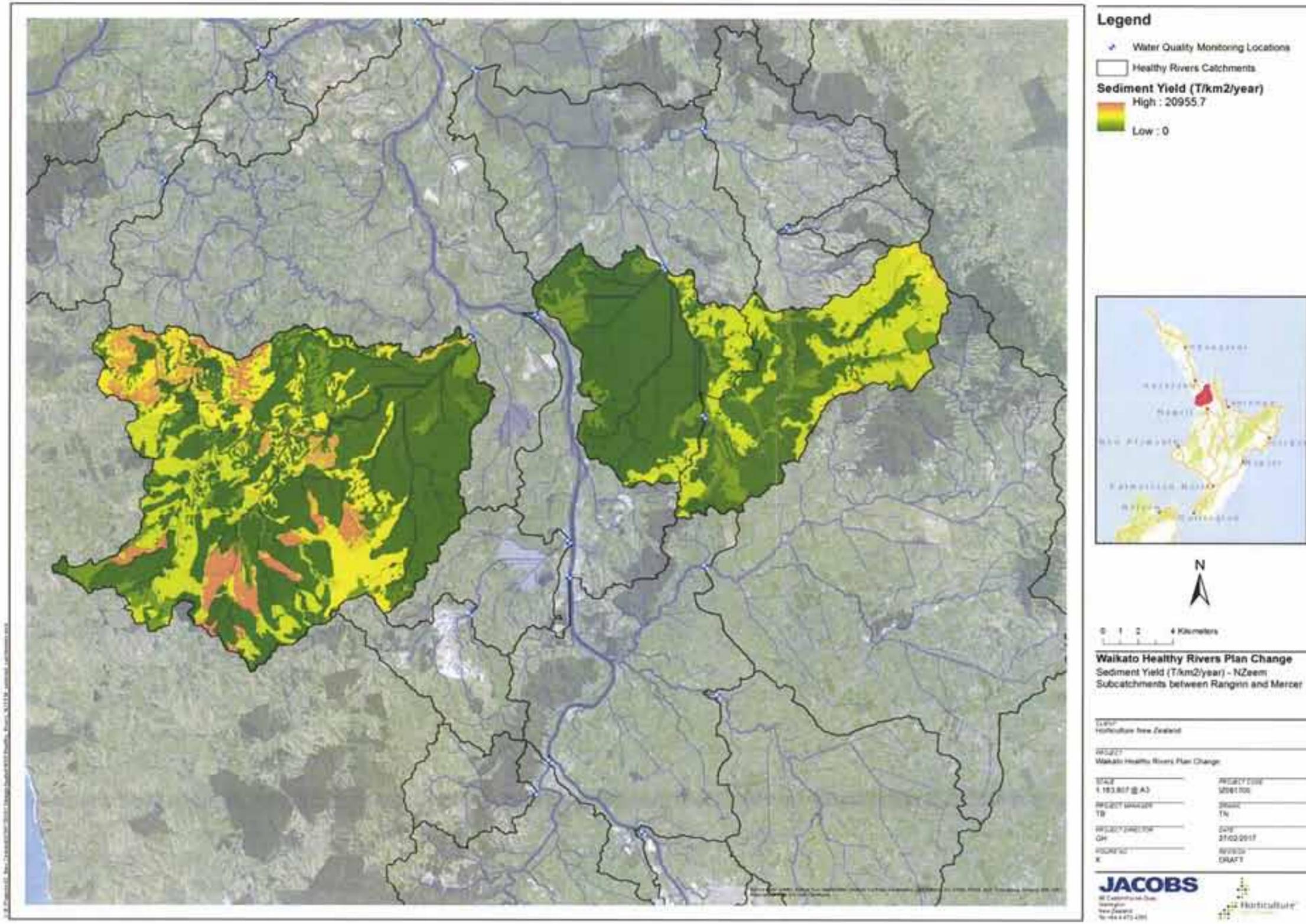


Figure 3.8 NZEEM sediment yield Tonnes/km²/year for the Lake Whangape and Lake Waikare catchments

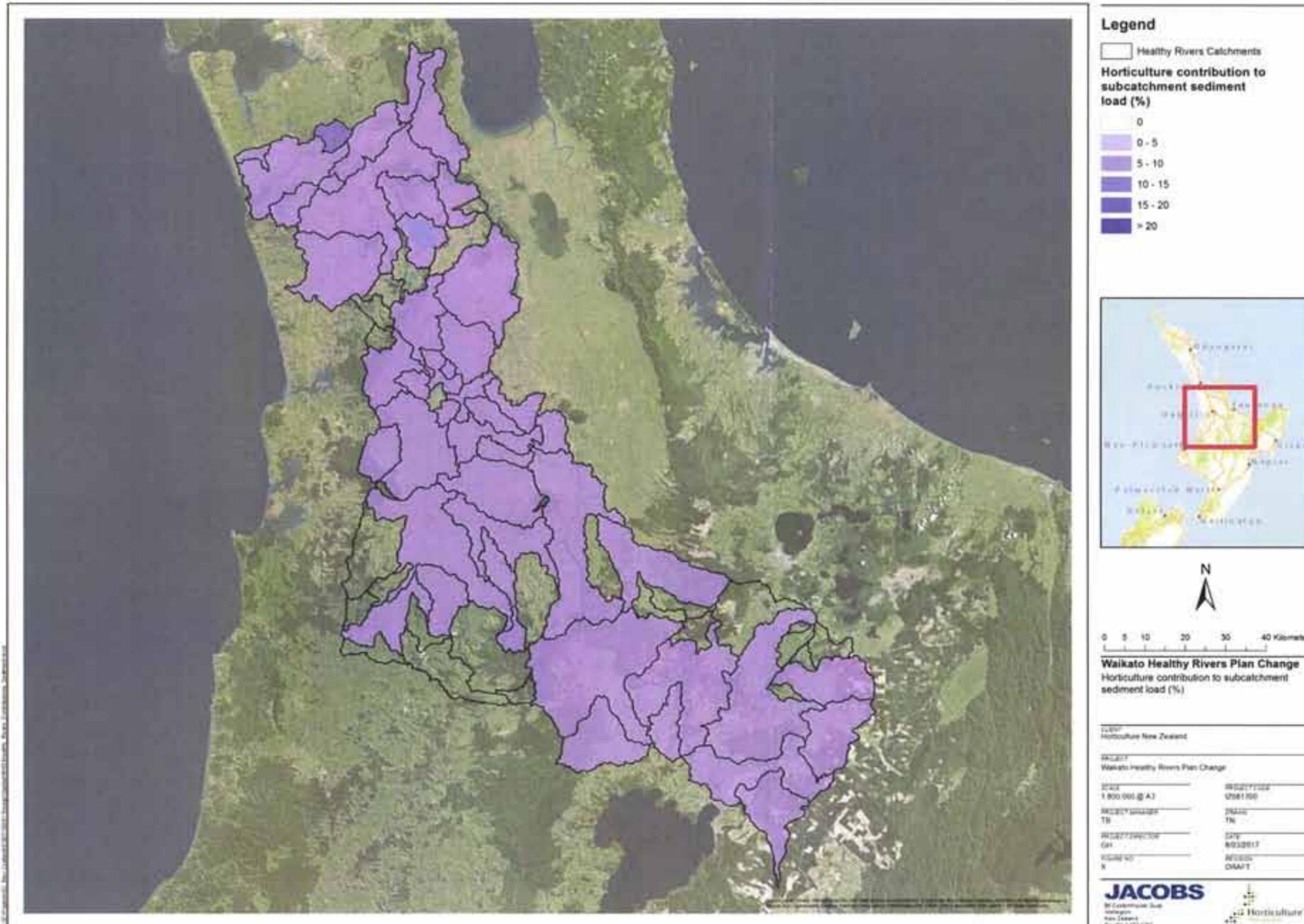


Figure 3.9 : Contribution of sediment loads from horticulture land use on a subcatchment scale.

3.4 Chlorophyll a

Phytoplankton (floating/planktonic algae) is a natural part of river and lake food webs, providing energy to the food chain and cycling nutrients. Chlorophyll a (chl-a) is a component of phytoplankton cells and therefore increases in phytoplankton biomass production causes an increase in chl-a concentrations. Phytoplankton also contributes to the degradation of water clarity (by increases in chl-a concentrations), taste and smell, and alters water colour, and blooms of certain algal species can cause skin irritation and may be toxic.

Phytoplankton only becomes problematic in the main stem of the Waikato, and are monitored there as chl-a. The Waipa is too turbid and lacks the residence time for phytoplankton to develop. Phytoplankton biomass in the Waikato main stem is influenced by a number of factors including: the residence time which is influenced by the hydrodams, light, temperature, inputs from the shallow riverine lakes and nutrients (both N and P) which can limit growth if the supply is limited.

Chl-a is used in PC1 as a measure of all three core values (e.g. human health for recreation, ecosystem health, and mahinga kai).

PC1 short term (10 years) and long term (80 years) water quality targets for each subcatchment scale are based on the measured median values at those sites. These targets are listed alongside the median measured chl-a values for Waikato River monitoring sites in Table 3.3.

Median chl-a values measured in the Waikato River from 2010 to 2014 (Table 3-3 and Figure 3.9) show that concentrations in the upper catchments measured at Waikato at Ohaaki with a median value of 0.0015 mg/L, increase eight fold to 0.012 mg/L at Waikato at Tuakau Bridge.

Table 3-3: 2010 – 2014 median measured chl-a values for each Waikato River monitoring site and associated short term and long term water quality targets from PC1.

HRWO sub-catchment	Median measured values 2010-2014 (mg/L)	WQ targets - Median chl-a (mg/L)	
	Chl-a	Short Term	Long Term
Waikato at Ohaaki	0.0015	0.0015	0.0015
Waikato at Ohakuri	0.0032	0.0032	0.0032
Waikato at Whakamaru	-	-	0.0050
Waikato at Waipapa	0.0041	0.0041	0.0041
Waikato at Narrows	0.0055	0.0055	0.0050
Waikato at Horotiu Br	0.0062	0.0061	0.0050
Waikato at Huntly-Tainui Br	0.0060	0.0059	0.0050
Waikato at Mercer Br	0.0105	0.0100	0.0050
Waikato at Tuakau Br	0.012	0.0113	0.0050

These values are graphed and displayed in Figure 3.9, and the approximate location of other major waterbodies draining to the Waikato River in relation to monitored water quality sites; the hydro lakes and the Waipa River.

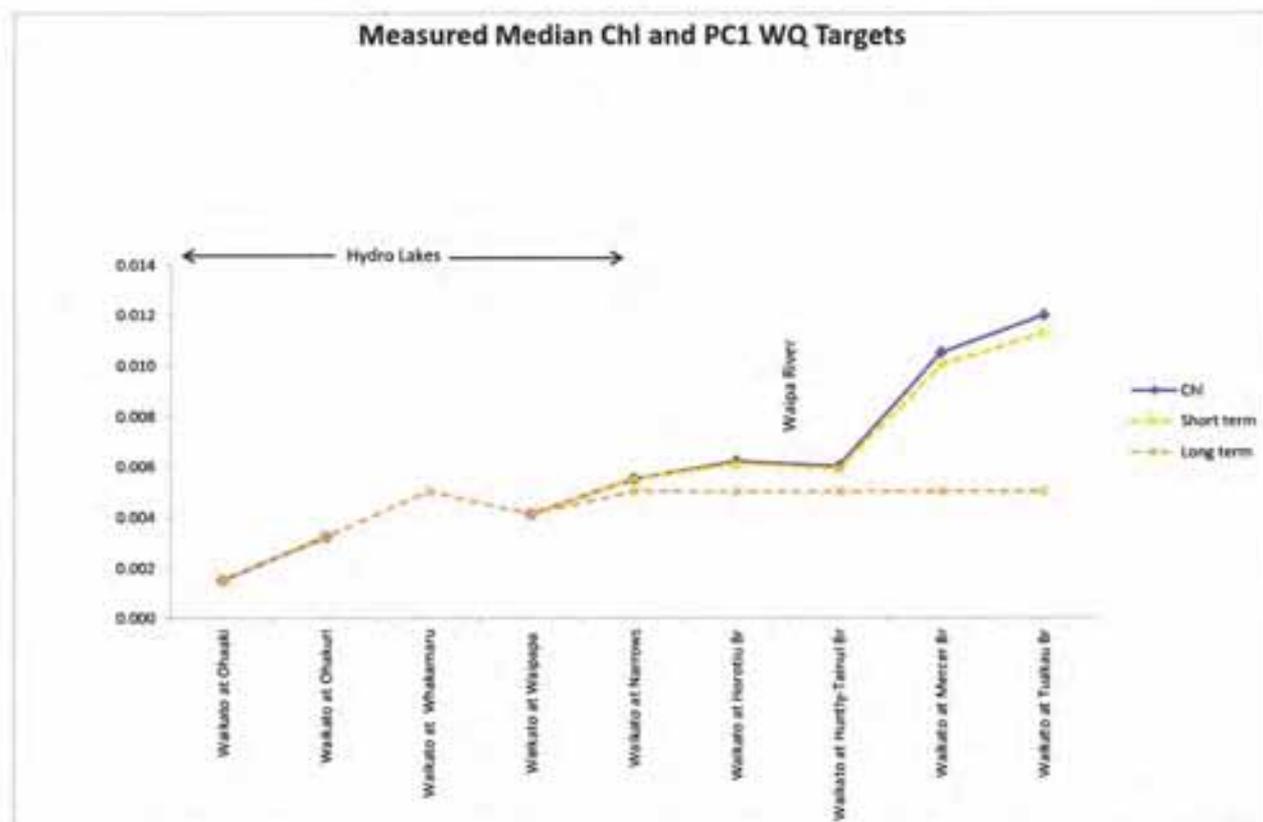


Figure 3.10: Graph of chl-a measured median values (2010-2014) and associated short term and long term water quality targets from PC1.

Chl-a median concentrations quadruple from Ohaaki to Narrows, likely demonstrating the influence of the hydrodams and nutrient loads in the upper catchment. A small decrease can be seen between Horotiu and Huntly-Tainui where the inflow from the Waipa River occurs, which does not support phytoplankton. There is a marked increase in concentration between Huntly-Tainui and Tuakau, likely a response to the inflows from the hypertrophic riverine lakes - Lake Whangape and Lake Waikare.

3.5 Water Clarity

The visual clarity of water, i.e. how far an observer can see through the water, is primarily determined by its water quality; in particular the concentrations of light-attenuating constituents. Water clarity is directly measured in the water body as the horizontal sighting range of a black disc under base flow conditions. The main light-attenuating constituents are yellow substance (coloured dissolved organic suspended material), fine sediment (silts and clays) and phytoplankton (floating algae), and water itself. N and P are the key nutrients that contribute to phytoplankton growth, which is measured as chlorophyll *a*. Therefore the factors affecting water clarity can also be understood by measuring N, P, chlorophyll *a*, and sediment. Water clarity, encompassing all of these constituents, is a measurement of ecosystem health; and both water clarity and *E.coli* are used to assess the suitability of water for human health for recreation and mahinga kai practices.

PC1 short term (10 years) and long term (80 years) water quality targets for each subcatchment scale are based on the measured median values at those sites. These targets are listed alongside the median water clarity values measured from 2010 to 2014 for Waikato River monitoring sites in Table 3-4 and graphed in Figure 3.10.

Median water clarity values measured in the upper catchments of the Waikato River at Waikato at Ohaaki with a median value of 3.83 m, decreases over six fold to 0.61 m (median value) at Waikato at Tuakau Bridge.

Table 3-4 : 2010 – 2014 median measured water clarity values for each Waikato River monitoring site and associated short term and long term water quality targets from PC1.

HRWO sub-catchment	Median measured values 2010-2014 (m)	WQ targets - Median Clarity (m)	
	Clarity	Short Term	Long Term
Waikato at Ohaaki	3.83	3.8	3.8
Waikato at Ohakuri	3.44	3.4	3.4
Waikato at Whakamaru	1.87	2.0	3.0
Waikato at Waipapa	1.92	2.0	3.0
Waikato at Narrows	1.68	1.7	1.7
Waikato at Horotiu Br	1.35	1.4	1.6
Waikato at Huntly-Tainui Br	0.87	0.9	1.0
Waikato at Mercer Br	-	-	-
Waikato at Tuakau Br	0.61	0.7	1.0

These values are graphed and displayed in Figure 3.10, and the approximate location of other major waterbodies draining to the Waikato River in relation to monitored water quality sites; the hydro lakes and the Waipa River.

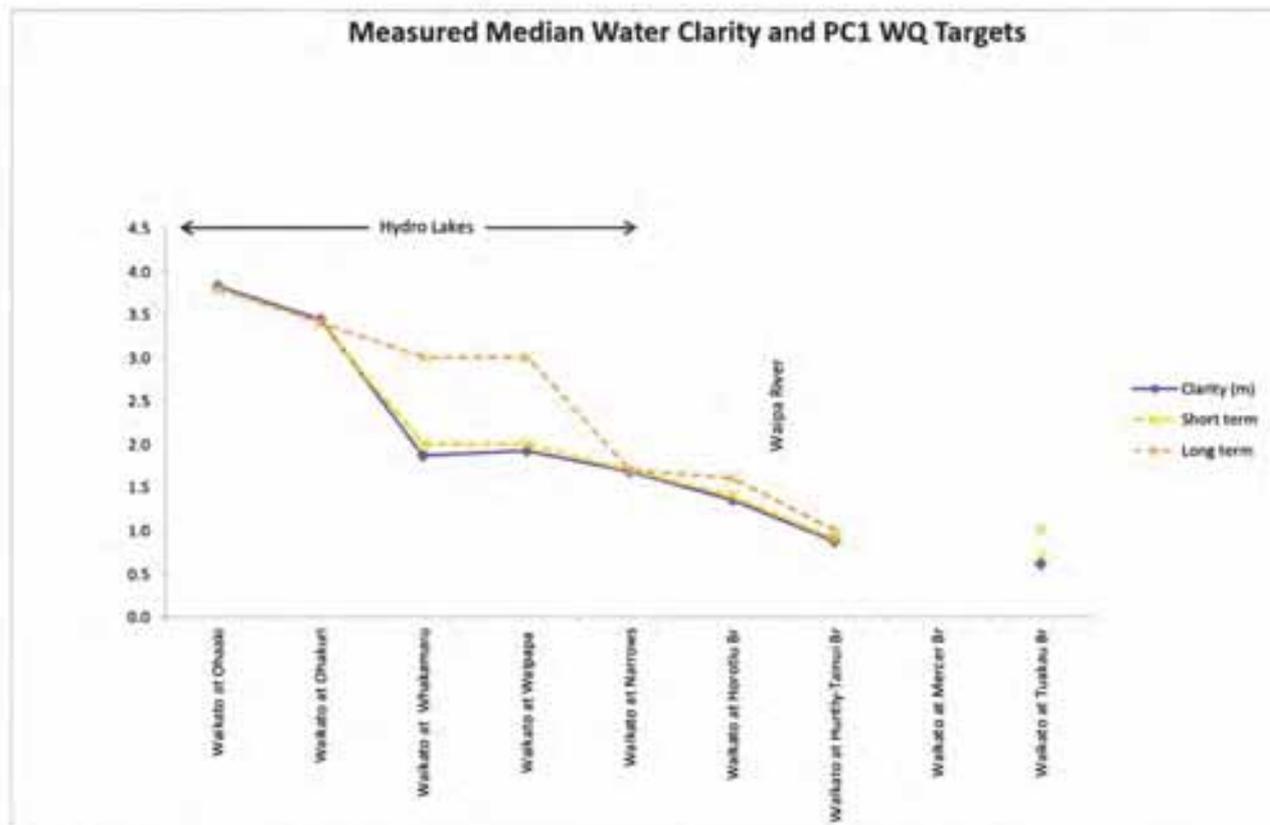


Figure 3.11 : Graph of water clarity measured median values (2010-2014) and associated short term and long term water quality targets from PC1.

Median water clarity measurements halve in value from Ohaaki (3.83 m) to Whakamaru (1.87 m). The decline in clarity slows down between Whakamaru and Waipapa before declining with greater speed between Waipapa and Huntley-Tainui. There is no data for Mercer; however the median clarity value at Tuakau Br is the lowest median value of 0.61 m.

Decreasing water clarity trends throughout the catchment generally reflect the increasing concentrations of other constituents that influence it, including nitrogen, phosphorous, sediment and chlorophyll *a*.

Horticultural land is concentrated in the Lower Waikato with poor water clarity largely influenced by upstream landuse and lakes processes. Horticultural land can be expected to have some impact with the discharge of sediment and nutrients.

3.6 E.coli

E. coli is used in PC1 as a measure of human health for recreation and mahinga kai, but is not a direct measure of ecosystem health. Unlike other land uses such as dairy or drystock farming, horticulture practices contribute very little to negligible amounts of *E. coli* in water ways, as illustrated in Figure 3.11 on the next page.

Note the NIWA modelling simplified the landuse assumptions compared with landuse layer supplied to Jacobs by NIWA for nutrient modelling. When calculating the *E. coli* load attributable to horticultural land Jacobs used the supplied landuse layer

Pie charts illustrating the proportion of horticulture land contributing to *E. coli* yields loads in each sub-catchment compared to other land use types are provided in Appendix B and C.

Horticulture has a minimal impact on *E. coli* loads in the overall Waikato River catchment and contributes less *E. coli* yields compared with dairy, sheep and beef and urban land use.

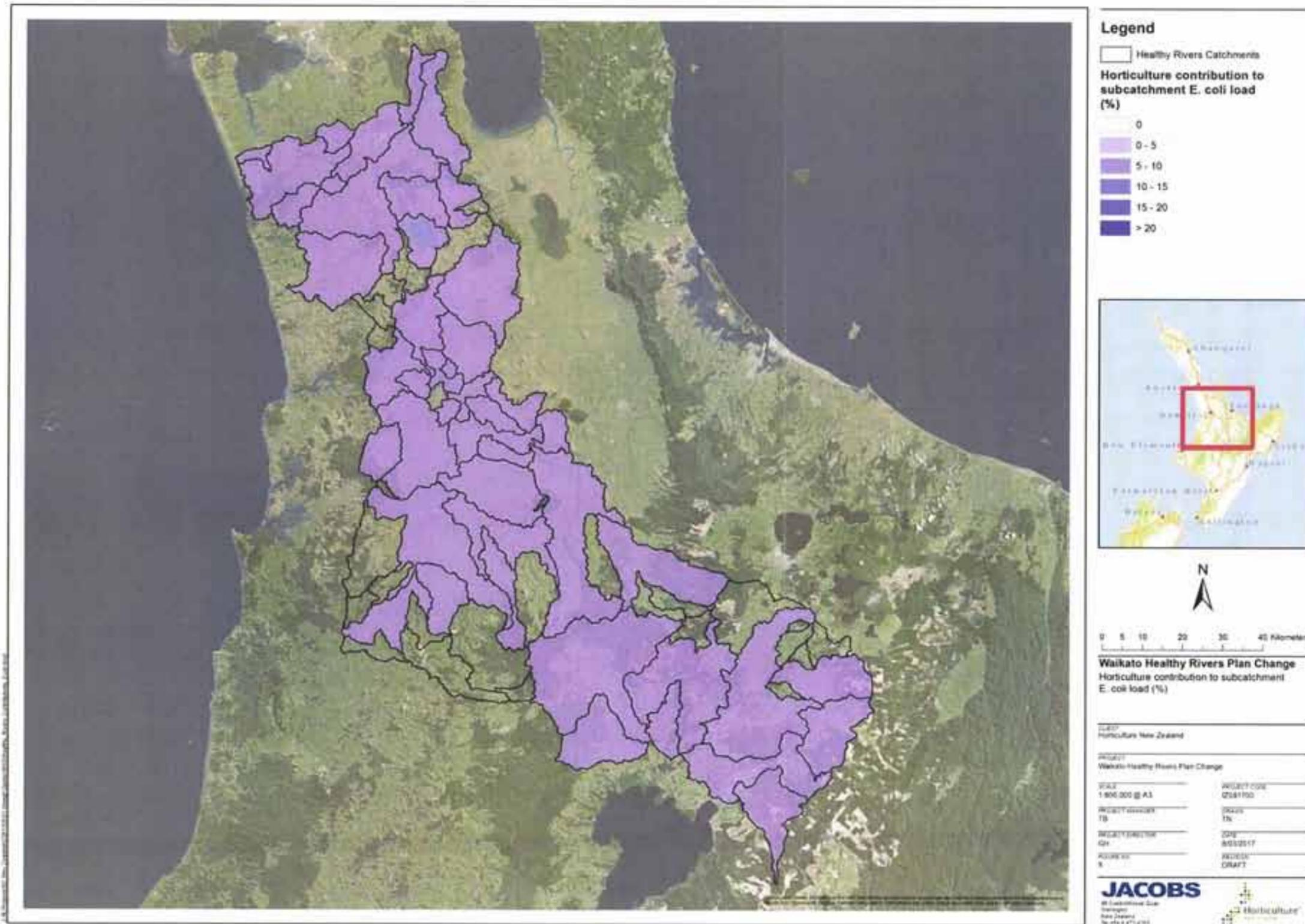


Figure 3.12: Contribution of E.coli loads from horticulture land use on a subcatchment scale.

4. Current allocation of responsibility for contaminant discharge

This section discusses three cases that discuss the proposed regime in PC1 to allocate responsibility for reducing contaminant discharges across activities and provides technical support for the Horticulture New Zealand submission.

The Horticulture New Zealand submission includes a range of proposed changes to the allocation regime proposed in the PC1 objectives, policies and rules.

The Horticulture New Zealand submission seeks an amendment of Objective four to 'recognise that PC1 is a transitional plan by inserting new c) "recognising that this plan change is transitional, to provide time to develop the tools required to more efficiently allocate responsibility for achieving contaminant reduction targets in the long-term."

Horticulture New Zealand has submitted, that Policy 3 should be amended proposing:

Manage and require reductions in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens from commercial vegetable production through a tailored, property or enterprise-specific approach to consenting discharges where:

- a. *Flexibility is provided to undertake crop rotations on changing parcels of land for commercial vegetable production, while reducing average contaminant discharges over time; and*
- b. *The maximum area in production for a property or enterprise is established and capped utilising commercial vegetable production data sourced from the 10 years up to 2016; and*
- c. *Establishing a Nitrogen Reference Point for each property or enterprise; and*
- d. *A tailored reduction A-40% decrease in the diffuse discharge of nitrogen, phosphorus, and sediment across the sector recognising:*
 - *the low risk of discharges of microbial pathogens from commercial vegetable production;*
 - *the need to preserve aspects of commercial vegetable production required to maintain domestic supply of vegetables;*
 - *the pressure on and scarcity of land suitable for commercial vegetable production. This pressure has recently increased as a result of greenfields expansion onto versatile land in the Auckland region.*
 - *The level of prior implementation of Best or Good Management Practices; and*
- e. *Identified mitigation actions that are set out and implemented within timeframes specified in either a Farm Environment Plan and associated resource consent, or in specific requirements established by participation in a Certified Industry Scheme or a collective enterprise managing discharges as a group.*
- f. *Commercial vegetable production enterprises that can demonstrate an overall reduction in the combined discharges of nitrogen, phosphorus, sediment and microbial pathogens (compared to the existing activity) are enabled; and*
- g. *The degree of reduction in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens is proportionate to the amount of current discharge (those discharging more are expected to make greater reductions), and the scale of water quality improvement required in the sub-catchment.*
- h. *Consent will generally be granted for a term greater than 15 years*

- i. An offset measure may be proposed in an alternative location or locations to the non-point source discharge, for the purpose of ensuring positive effects on the environment to lessen any residual adverse effects of the discharge(s) that will or may result from allowing the activity provided that the:
 - i. Primary discharge does not result in any significant toxic adverse effect at the non-point source discharge location; and
 - ii. Offset measure provides an equivalent benefit to the values of freshwater specified in this plan; and
 - iii. Offset measure occurs preferably within the same sub-catchment in which the primary discharge occurs and if this is not practicable, then within the same Freshwater Management Unit or a Freshwater Management Unit located upstream, and
 - vi. Offset measure remains in place for the duration of the consent and is secured by consent condition.

4.1 Leaching Rate Assumptions in the Water Quality Modelling

Horticulture New Zealand’s submission seeks the removal of the proposed 10 % reduction in N, proposing instead *tailored reduction in the diffuse discharge of nitrogen, phosphorus, and sediment across the sector.*

The case study below discusses the leaching rate assumptions used in the nutrient modelling used to inform PC1. In our view the water quality modelling has limitations and while it is a useful tool for informing the impact of proposed policy and rules on water quality outcomes, care should be taken to avoid limitations in the modelling, driving policy development. In our view the leaching rates used in the water quality modelling are not comparable and that it is important to acknowledge that the water quality in the river is impacted by the load of contaminants rather than the leaching concentrations, and therefore targeting commercial vegetable growing with the highest N leaching reduction target, will achieve minimal environmental benefit.

Case Study – Nitrogen – Horticulture and Dairy Case Study	
Background	<p>PC1 proposes an approach where a Nitrogen Reference Point is established for each property or enterprise and requires a degree of reduction in nitrogen (N) over time across the Waikato and Waipa catchments.</p> <p>Under Rule 3.11.5.5 existing commercial vegetable production is a controlled activity, subject to matters of control including provisions to achieve Policy 3(d). Policy 3(d) requires a 10% decrease in the diffuse discharge of nitrogen and that a tailored reduction in the diffuse discharge of phosphorus, sediment and microbial pathogens is achieved across the sector through the implementation of Best or Good Management Practices.</p> <p>Under Rule 3.11.5.3 dairy farming is a permitted activity where landuse is certified under a Certified Industry Scheme. Where the farm is not part of a Certified Industry Scheme the activity is controlled under Rule 3.11.5.4 subject to a range of matters. Under both the permitted and controlled rule, where a Nitrogen Reference Point exceeds the 75th percentile nitrogen leaching value, actions, timeframes and other measures are required to ensure the diffuse discharge of nitrogen is reduced so that it does not exceed the 75th percentile nitrogen leaching value by 1 July 2026.</p> <p>The development of policies and rules was informed by nutrient modelling undertaken by NIWA. The nutrient modelling methodology is described in the report: Modelling nutrient loads in the Waikato and Waipa River Catchments (Semadeni-Davies et al., 2015). One of the key assumptions in the nutrient modelling is that the nutrient leaching rates for the various landuses have been calculated in a manner that makes them comparable.</p>

Nitrogen Leaching Rate Assumptions

The leaching rates assumed for the Horticultural sector were informed by the report: Nutrient Performance and Financial Analysis of Lower Waikato Horticulture Growers (Agribusiness Group, 2014); this report summarises Overseer modelling of typical Pukekohe vegetation rotations and the effectiveness of mitigation options. It also discusses the limitations of Overseer modelling for Horticulture. As is noted in paras 4.57 and 4.58 of the Horticulture NZ submission, the report models "worst case" rotations including winter cropping as a significant part of the rotation.

The nitrogen leaching rate assumed in the Healthy River nutrient modelling for all land classified as horticultural in the Waikato catchment was between 65 and 67 kg/ha/year.

Uncertainty exists in the modelling of nitrogen leaching from the dairy sector due to the non-disclosure of the data. As stated in Doole et al. (2016), detailed nitrogen-loss levels exist for individual dairy farms throughout the catchment; however, these are held by Fonterra and are unavailable for the purposes of policy simulation due to privacy restrictions.

Dairy data used for the Healthy River nutrient model was not released to Jacobs due to confidentiality agreements between Waikato University and Dairy NZ (pers. comms. Doole 2017). We note the report "Simulation of the proposed policy mix for the Healthy Rivers Wai Ora process" (Doole et al., 2016) refers to 410 farms; it's unclear whether these are a sub-set of the 498 farms described in (Doole G. J., 2011). The nitrogen leaching rates from the 498 farms is reproduced from Doole et al. (2011) and presented in Figure 4.1: below.

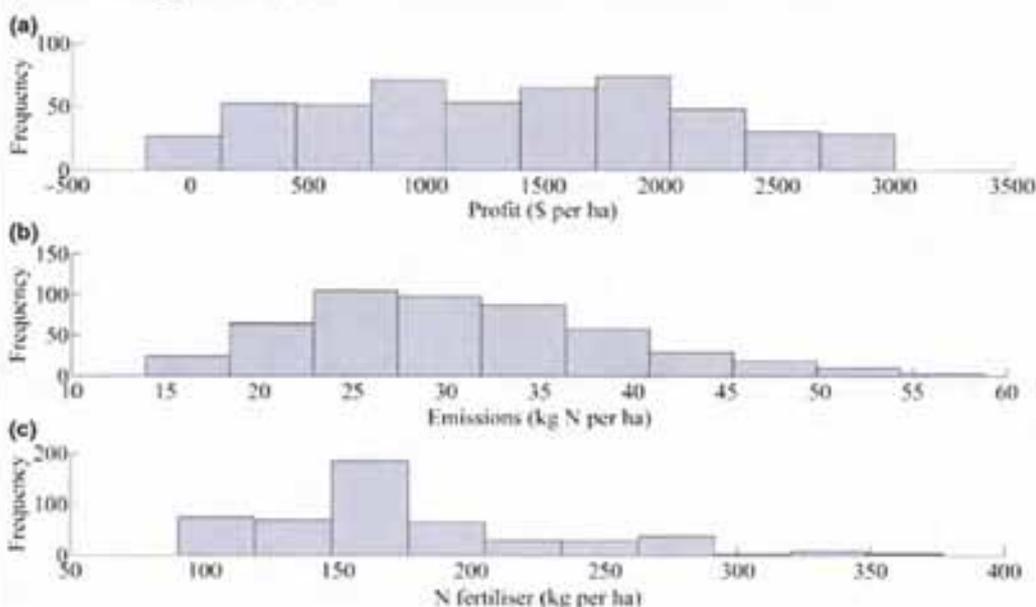


Figure 4.1: Probability distributions for (a) farm profit, (b) emissions, and (c) nitrogen fertiliser use from model output. Note that the histogram bin above the \$0 per ha label on the x-axis in (a) contains a range of positive and negative values. (Source: Doole et al., 2011)

While the underlying data used for the nutrient modelling was not supplied, NIWA supplied the baseline average nutrient leaching rates for each sub-catchment by landuse. This data is summarised in Table 4-1.

Table 4-1: Statistics of nitrogen leaching rates assumed in the Healthy Rivers Nutrient Modelling. Source: Table 4-2 in Semadeni-Davies et al. (2015).

Land Use Type	Nitrogen leaching rates (N/kg/Ha)		
	Min	Max	Mean
Dairy	18.0	44.3	31.0
Forest	4.0	4.0	4.0

Horticulture	64.5	66.8	65.8
Misc	2.5	2.5	2.5
Dairy Support	15.6	27.2	22.0
Sheep and beef	10.2	11.8	10.9
Urban	12.0	12.0	12.0

When the dairy leaching rates are compared with those developed for Environment Canterbury (Lilburne et al., 2013), the leaching rates in the Environment Canterbury study have a much greater range from 9 kg N/ha/yr to 132 kg N/ha/year, with most values exceeding the Waikato study. In the same Lilburne study the vegetable leaching rates range from 9 – 70 kg N/ha/year. There are many reasons the results may differ between the Lilburne and Waikato dairy OVERSEER results, these include; climate, soils and farming systems, the reasons also include the version of OVERSEER used and the assumptions made when undertaking the OVERSEER modelling.

Mr Keenan from HortNZ has indicated to us he was shown a data table by a DairyNZ officer on 28 April 2016 containing nitrogen leaching minima and maxima and a 75th percentile for the Upper Waikato, Middle, Lower Waikato and Waipa. Mr Keenan was told these were from a more complete data set for the Waikato Region than the farms used in the modelling by Doole and presented above. The numbers provided by Mr Keenan were:

Catchment	75th Percentile	Min	Max
Central Waikato	34	12	99
Lower Waikato	30	8	83
Upper Waikato	59	8	155
Waipa	47	12	104

The data described by Mr Keenan, is more similar to the Environment Canterbury leaching assumptions, (Lilburne et al., 2013)

Given that the leaching rates developed for the various land uses were developed at different times, by different people for different purposes, caution should be applied when comparing leaching rates to one another. When considering the effects of diffuse discharges the load of the discharge is important. The loads is calculated by multiplying the leaching rate by land area, and while it is also uncertain given the limitations of the underlying leaching data, it does illustrate the proportion of the contribution to water quality per sector in a more meaningful way than comparing leaching data directly.

The PC1 baseline nutrient leaching assumptions on a sector basis are graphed in Figure 4.2. When the leaching assumptions used for the PC1 modelling are adopted, Horticulture contributes 3% of the N load discharged into the Waikato catchment, while 62% is contributed by the dairy sector (dairy and dairy support combined).

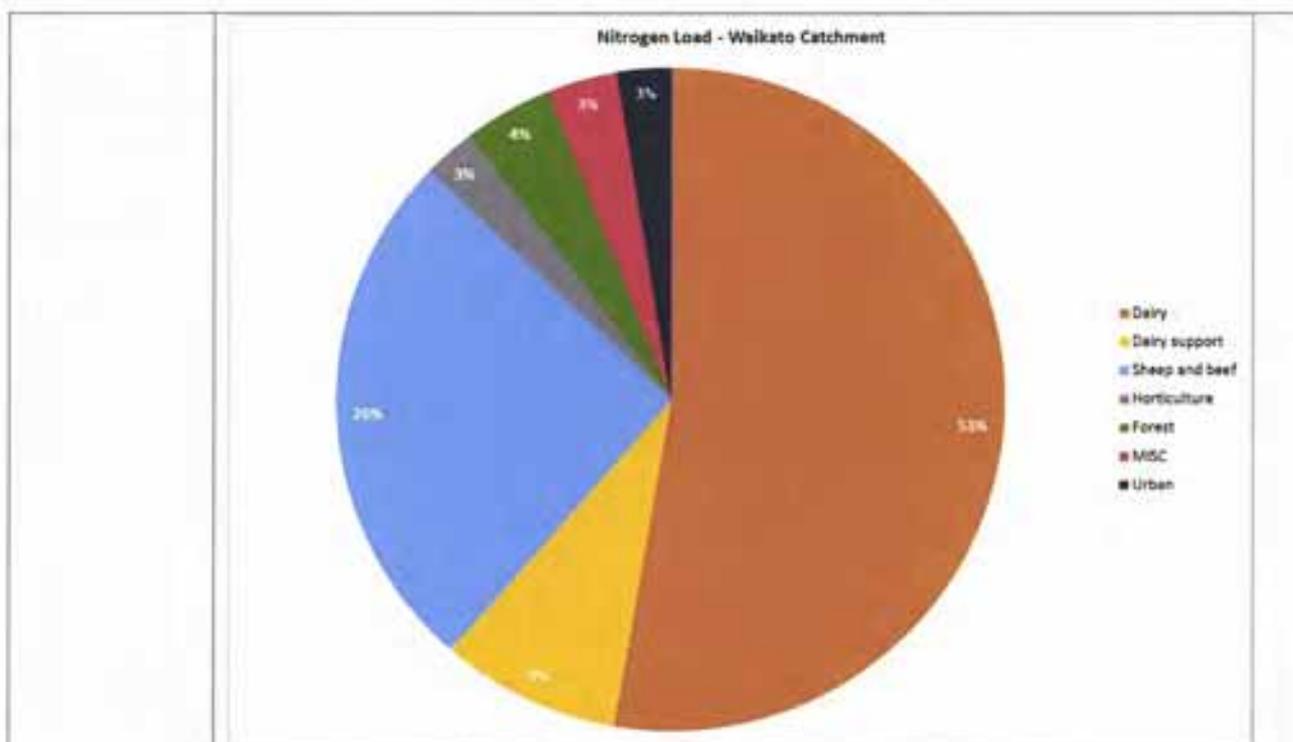


Figure 4.2 : Nitrogen Load contributed by each sector - Waikato Catchment.

<p>Nitrogen reduction by the horticultural sector</p>	<p>The 10% nitrogen reduction by the horticultural sector proposed in Rule 3.11.5.5 would result in a reduction of 0.2% in nitrogen load to the Waikato catchment. The horticultural land is concentrated in the Lower Waikato catchment. Within the sub-catchments of the Lower Waikato, a greater proportional reduction would be expected.</p> <p>The Section 32 Evaluation Report (WRC, 2016a) discusses why the 75th percentile approach of Rule 3.11.5.4(iv) applied to dairy was not applied to horticulture stating; <i>“applying the concept of the 75th percentile to commercial vegetable production across the sector would effectively eliminate the growing of certain high-leaching crop types”</i>. The report refers to economic information from the sector indicating that a 10% reduction in nitrogen would have a significant income effect on the sector, so this was considered to be the limit for how much reduction could be made in the sector during this first stage of change.</p> <p>While the 10% nitrogen reduction is described as a “limit” for how much reduction could be made in the Section 32 evaluation, achieving this level of reduction is a matter of control under Rule 3.11.5.5.</p> <p>We note that the water quality modelling report that informed the policy direction states that <i>“a 5–10% reduction in nitrogen loss on horticulture farms is attained through improving the timing of nitrogen-fertiliser application and reducing the total amount applied (by around 10–15%)”</i> (Doole et al., 2016, p.17).</p> <p>It is unclear what, if any environmental benefit would be achieved by increasing the nitrogen leaching reduction requirement for horticultural land above what was modelled. The economic consequences of achieving the reduction are discussed in Agribusiness Group (2014).</p> <p>The “Mitigation 2” technique described in (Agribusiness Group, 2014) did achieve N leaching reductions in the order of 10%. It was described as having <i>“a substantial financial effect as the amount of N applied decreases from 10 to 40% due to the associated reductions in yield. It causes losses to be occurred from a point between the 10% and 20% reduction in N application which reflects the relative profitability of growing the crops”</i> (Agribusiness Group, 2014).</p>
<p>Nitrogen reduction by</p>	<p>The assumptions around the modelling of nitrogen reductions for dairy are described in Doole et al. (2016, p.8): <i>“A part of the proposed policy states that all dairy farmers with a leaching rate currently</i></p>

<p>the dairy sector</p>	<p><i>above the 75th percentile, assessed per Freshwater Management Unit (FMU), must reduce their nitrogen leaching level to that consistent with the 75th percentile by 2026.</i></p> <p>This modelling assumption is consistent for farming activities with a Farm Environment Plan.</p> <p>The policy modelling report (Doole et al., 2016) describes the methodology for estimating the reduction in nitrogen leaching by applying the 75th percentile rule. They found that approximately a 4 - 6% reduction in nitrogen leaching for Dairy farms on FMU or grouped sub-catchment basis would be achieved.</p> <p>We tested this finding, using the baseline leaching data supplied by NIWA (averaged at sub-catchment level). We have assumed the mean nitrogen leaching rate of 31 kg N/ha and standard deviation 8.5 kg N/ha from the 498 Waikato dairy farms (Doole et al., 2011), with a normal distribution we calculated an estimated 75th percentile leaching rate of 36.8 kg N/ha. When this value is used to truncate the average leaching values we calculated a reduction of 5% overall. The total saving of nitrogen estimated by applying the 75th percentile to the dairy leaching data used for the Healthy Rivers nutrient modelling is 397 tonnes per year. This is equivalent to the whole of the nitrogen load for the horticultural sector assumed in the Healthy Rivers nutrient modelling (396 tonnes N /year).</p> <p>The modelling used for the Healthy Rivers process assumes the dairy leaching is normally distributed and states <i>"an assumption that nitrogen leaching is normally distributed within each FMU is justified by the fact that it cannot be rejected that the data for 410 individual farms generated by Doole (2012) is consistent with a normal distribution, at a 5% level of statistical significance."</i> (Doole et al., 2016, p.10).</p> <p>As we do not have access to the data used for the modelling we cannot review the suitability of the distribution selection, however we have undertaken some approximate calculations assuming mean and standard deviation for the 498 Waikato dairy farms (Doole et al., 2011) and a log-normal distribution. In this case we calculated a 75th percentile value leaching rate of 35.9 kg N/ha.</p> <p>The difference between using a log-normal distribution compared with a normal distribution (and assuming the mean and standard deviation from Doole et al., 2016), is a nitrogen reduction of a further 1% (i.e., 6% for log-normal compared with 5% reduction for a normal distribution), which equates to a further 57 tonnes N/year. This equates to 14% of the nitrogen loss from the horticultural sector.</p> <p>Doole et al. (2016, p.16) discussed the economic impact of nitrogen reductions on dairy farms: <i>"There is broad anecdotal understanding that profit can increase or stay the same on dairy farms if reductions in nitrogen are low to moderate (Holland and Doole, 2014; Doole and Kingwell, 2015). Doole (2012) identified that a 10% reduction in nitrogen across a population of 410 actual dairy farms allowed a number of them to experience win-win outcomes"</i>.</p>
<p>Conclusion</p>	<p>The proposed 10% reduction in nitrogen leaching from the horticultural sector was not tested in the modelling report. A 10% reduction is likely to have negligible benefits over the 5% - 10% modelled reduction, given the small contribution of horticulture to the nitrogen load in the Waikato River. However, achieving a 10% reduction in nitrogen leaching for horticulture is predicted to have substantial financial effects (Agribusiness Group, 2014).</p> <p>The benefit from reducing nitrogen leaching from dairying is more tangible compared with reductions from horticulture; given a 5% reduction in dairy nitrogen leaching is equivalent to the total nitrogen leaching from horticulture in the catchment. The economic assessment of the modelled 5% reduction indicated dairy sector profits may be unaffected.</p>

4.2 Nitrogen Mitigation and influence of Variation 6

Horticulture New Zealand's submission seeks recognition of the impact of Variation 6 on achieving the water quality targets in PC1.

This case study considers the impact of Variation 6 on the ability to reduce N leaching.

Case Study - Water Quality and Water Quantity – Water Care Abstraction

<p>Background</p>	<p>For vegetable growers, the ability of use targeted irrigation to respond to market demand influences leaching and production. Variation 6 will see a drop in the allocation of irrigation water to farmers (including Horticulture) in the Waikato as a result of the increase in allocation granted to Watercare for Municipal Supply to Auckland City. The Watercare resource consent application to take 200,000 m³/day from the Waikato River is currently being processed by Waikato Regional Council.</p> <p>This abstraction and the consequential change in reliability will impact on Mana Atua values and Mana Tangata values. We discuss a scenario that will assess the changes in N leaching as a result of a 60% reduction in irrigation water availability, and how the Healthy Rivers seeks to manage the impact associated with this activity.</p>												
<p>Variation 6 - Watercare Abstraction</p>	<p>Watercare has submitted a resource consent application to take 200,000 m³/day from the Waikato River, in addition to the present authorised net water take of 150,000 m³/day. This is a new proposed total of 350,000 m³/day from the Waikato River. The proposed take will be approximately 36 km upstream of the river mouth in the vicinity of the existing Watercare Waikato River water supply intake location at Hayward Road, Tuakau.</p> <p>Variation 6 sets allocation limits for all rivers and streams in the Waikato Region. During times of low flow, rates of take are reduced. Levels of priority apply during water shortages:</p> <ol style="list-style-type: none"> i. Priority SW-A activities: takes which have a zero net take, or for firefighting; ii. Priority SW-B activities: stock watering supplies, takes for animal welfare and sanitation (including shed wash down and milk cooling), takes for perishable food processing, takes associated with electricity generation, all permitted and s14(3)(b) RMA takes, and takes for domestic or municipal supply; iii. Priority SW-C activities: all other takes allocated within the primary allocable flow – will include the irrigation takes in the Lower Waikato; iv. Priority SW-D activities: all other takes allocated water above the primary allocable flow – not applicable as there is no secondary allocation on the main-stem of the Waikato River; v. Priority SW-E activities: takes for water harvesting. <p>Watercare already takes 150,000 m³/day from the Waikato River, but the additional take would mean that the primary allocable flow of the lower river catchment would be exceeded or close to being exceeded (Table 4-3). There is also no secondary allocation available in the Waikato River. Because of this any additional water for irrigation in the future will be a non-complying activity due to the exceedance in primary allocation. Water takes for municipal and domestic supplies has a higher priority than irrigation. The current irrigation takes are priority SW-C which means that greater restrictions are placed on these users during times of water shortage rather than the SW-B for municipal supply.</p> <p>The Government has also set targets to phase out over-allocation of water in catchments by 2030, which will cause further cutbacks in the volume of surface water takes for irrigation. Horticulture NZ has received information from WRC (pers comms Keenan 2017) which states that following the approval of the Watercare application, surface water takes will be reduced by up to 60 percent in 2030 in the Lower Waikato catchment.</p> <p>Table 4-3: Allocable flow at Waikato River at coastal marine area (CMA)¹.</p> <table border="1" data-bbox="395 1753 1461 1877"> <thead> <tr> <th>Location</th> <th>Allocable Flow (m³/s)</th> <th>Allocated (m³/s)</th> <th>Allocation sought by Watercare (m³/s)</th> <th>Total allocation (m³/s)¹</th> <th>Remaining allocation (m³/s)¹</th> </tr> </thead> <tbody> <tr> <td>Waikato at CMA</td> <td>18.7930</td> <td>16.2205</td> <td>2.314</td> <td>18.535</td> <td>0.258</td> </tr> </tbody> </table> <p>¹This does not take into account any consent applications that are currently being processed.</p>	Location	Allocable Flow (m ³ /s)	Allocated (m ³ /s)	Allocation sought by Watercare (m ³ /s)	Total allocation (m ³ /s) ¹	Remaining allocation (m ³ /s) ¹	Waikato at CMA	18.7930	16.2205	2.314	18.535	0.258
Location	Allocable Flow (m ³ /s)	Allocated (m ³ /s)	Allocation sought by Watercare (m ³ /s)	Total allocation (m ³ /s) ¹	Remaining allocation (m ³ /s) ¹								
Waikato at CMA	18.7930	16.2205	2.314	18.535	0.258								
<p>Current Horticultural</p>	<p>There is a total of 242 active (or current) water takes in the Waikato Region specifically for irrigation on horticultural properties². This includes from both groundwater and surface water sources. These takes</p>												

¹ Information sourced from the Waikato Regional Council Water Allocation Calculator: <https://www.waikatoregion.govt.nz/environment/natural-resources/water/water-allocation-levels/>, accessed on 23 February 2017.

<p>Irrigation Use</p>	<p>are mainly located in the Lower Waikato catchment, with some located in the Tamahere/Cambridge area.</p>
<p>Water Quality – the influence of irrigation on leaching</p>	<p>HortNZ is currently involved in projects to collect data on the link between irrigation, plant growth (nutrient uptake) and leaching. The Ministry for Primary Industries (MPI) Sustainable Farming Fund (SFF) Root Zone Reality Project and the HortNZ Northern Fluxmeters Project commenced in July 2014. The aim of these projects is to establish a network of passive-wick tension fluxmeters in commercial cropping farms in Canterbury, Manawatu, Hawke's Bay, and Matamata/Pukekohe, and use these to measure nutrient concentrations of N and P in leachate water. Sites provide a range of cropping systems, soil types, climatic conditions and management practices relevant to each region (Johnstone et al., 2015; Norris et al., 2016).</p> <p>The aim of the Root Zone Reality Project is to study long term patterns of N and P losses across a range of cropping farms and seasons, with the intent that these trials will continue until more data is collected across multiple crop rotations. The data will help to ensure good management practices are communicated and adopted by growers and regional councils (Norris et al., 2016).</p> <p>There are direct and documented links between irrigation, plant growth (nutrient uptake) and leaching. Understanding the relationship between these factors is important to enable an assessment of the effects that reduced irrigation availability will have on nitrogen leaching, and therefore water quality. These relationships are discussed in detail in this section, however the following overarching points are provided in order to provide context to the discussion:</p> <ul style="list-style-type: none"> • Crop yield (growth) is controlled by the availability of water • The greater the yield, the greater the nutrient demand • Reduced plant available water can result in reduced yield, and therefore reduced nutrient uptake • Reduced nutrient uptake can result in increased risk of leaching • Increased leaching can result in water quality effects <p>The above points are discussed in more detail below.</p>
<p>Plant available water and yield</p>	<p>WRC engaged Aqualinc (2009; 2013) to develop irrigation guidelines that better reflect the range of climate, soil conditions, crop rotations, and irrigation methods in the Waikato Region. Aqualinc (2009) used water balance computer modelling to determine these guidelines and the next stage (Aqualinc, 2013) involved field verification of the water use guidelines. Field investigations were conducted at six irrigated sites, which included four vegetable and two pasture sites. IRRICALC was used to model soil moisture response to irrigation.</p> <p>The study by Aqualinc (2013) shows that in field case studies on vegetable crops, irrigation water reliability increased crop production by an average of 29% in the 2010/2011 irrigation season, with production on a single farm increasing by up to 89%. It has also shown that the quality of the production of vegetables was higher in irrigated vegetables versus non-irrigated vegetables. The effect of irrigation was higher for vegetables because their water stress tolerance is lower than for pasture and the irrigation trigger for vegetable crops is 20% higher than the plant available water (PAW) value for pasture (Aqualinc, 2013).</p> <p>Graphs (Figure 6.1) from Aqualinc (2013) indicate how soil moisture fluctuates between field capacity, wilting point, and the 'preferred minimum soil moisture'. The field capacity is the maximum level of soil water available for plant extraction after gravitational drainage from a saturated condition falls to a rate that is insignificant. Wilting point is when soil profile is very dry and no soil water is available for plant extraction at -1,500 kPa (Aqualinc, 2013). By the time soil moisture reaches wilting point, vegetable crop plants are seriously damaged. Even when soil moisture drops below the 'preferred minimum soil moisture' plants become stressed and damage can occur resulting lower crop yields (pers comms Keenan 2017).</p> <p>If water shortages occur early in the crop's development, maturity may be delayed and yields are often reduced. If water shortage occurs late in the growing season, quality is often reduced even though total yields may not be affected. Therefore, water stress will always reduce the financial returns due to either</p>

² Information sourced from the Waikato Regional Council Data Catalogue: <https://www.waikatoregion.govt.nz/services/data-catalogue/>, accessed 13 February 2017. ALLOC_IRIS_WATER_TAKE_SEASONAL

	<p>low yield or poor quality (Kemble, 2000 as quoted in Aqualinc, 2013). Therefore it is considered best practice to manage soil moisture levels in the optimum range, between field capacity and the 'preferred minimum soil moisture', in order to maintain crop yields (identified on Figure 6.1 below) (pers comms Keenan 2017).</p> <p>The amount of fertiliser that is applied to a vegetable crop is determined based on the average yield that is expected to be grown that year. This average yield is based on average climatic conditions that can be expected in the region that the property is located in. Irrigation is used to maintain yields when drought conditions occur, and to provide a buffer from the natural variability of the weather. Irrigation doesn't necessarily result in soil drainage and corresponding N leaching events, if it is used to maintain soil moisture in the optimum range (Figure 6.2).</p> <p>N fertiliser is applied to vegetable crops and ideal conditions will result in the maximum uptake of applied N. The amount of applied fertiliser N remaining in the soil is less than would otherwise be under water stress conditions. As a result, there is likely to be less N leaching once additional rain drains through the soil. If water stress has occurred in the growth cycle of the vegetable crop, then crop quality is reduced and ideal conditions for growth will not occur resulting in lower production, lower plant uptake of N and greater potential for N leaching (pers comms Keenan 2017).</p> <p>If more rain falls than the average year, then it is expected that there will be more than average drainage through the soil profile and therefore greater than average N leaching. If irrigation is not available during droughts (or a drier than average year) then soil moisture is not maintained in optimum range for crop growth. There is then the potential for the additional N that has been applied for an average year, and has not been taken up by the poorly performing crop, to be leached through the soil profile when rain eventually does fall. By reducing the volume of water available for irrigation on horticultural properties, WRC has taken away one method of mitigating N leaching in the drier than average years.</p> <p>A Nitrogen Reference Point is required to be produced for the horticultural properties in accordance with Schedule B. The reference period for commercial vegetable production is the annual average N leaching loss from 1 July 2006 to 30 June 2016. It is accepted that there will be wet, dry and average years amongst this reporting period. WRC reserves control over the actions and timeframes to ensure that the diffuse discharge of nitrogen does not increase beyond the Nitrogen Reference Point for the property or enterprise. They also reserve control over the monitoring, record keeping, reporting and information provision requirements for the holder of the resource consent to demonstrate and / or monitor compliance with the Farm Environment Plan. Therefore it is unknown how often growers will be required to submit N leaching values to council once the Farm Environment Plans have been submitted and whether this will take into account dry or wet years.</p>
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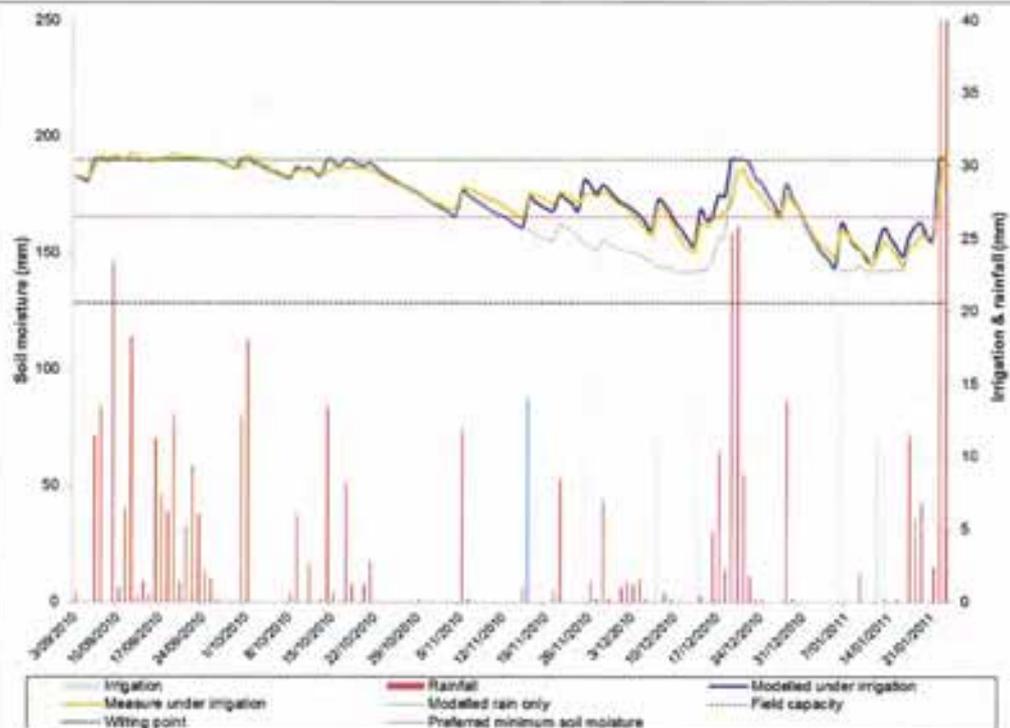


Figure 4.3: Modelled and measured change in soil-moisture, and soil-water parameters from Vege-4 site in Year 2 (from Aqualinc, 2013).

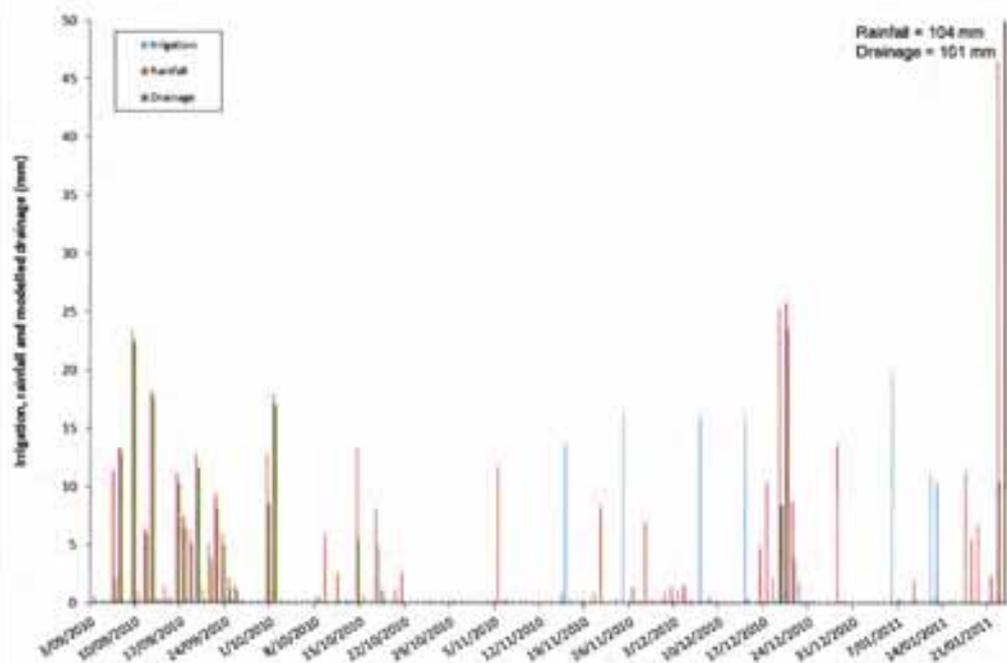


Figure 4.4: Measured irrigation and rainfall events, and modelled drainage under the rooting zone for Vege-4 site in Year 2 (from Aqualinc, 2013).

Targeted irrigation and control of

Target irrigation and how it can be used to control leaching was highlighted in a report by Agribusiness Group (2014). Three representative horticultural systems were modelled using OVERSEER, each characterised by a different rotation of vegetables, for the Lower Waikato region. The rotations that were modelled were an extensive rotation, intensive rotation, and traditional market-garden

<p>leaching</p>	<p>arrangement. In general, leaching values ranged from 64 to 73 kg N/ha/yr (Table 4-4).</p> <p>Three mitigation techniques were also applied to each system based on information from industry experts, prior research, and growers. The mitigations were limiting nitrogen fertiliser application, reducing nitrogen fertiliser application, and improved water management through altering standard irrigation practices. OVERSEER was used to estimate the nitrogen losses associated with these enterprises, while gross-margin analysis was used to assess the financial implications of adopting these alternative mitigation practices across the different farm systems.</p> <p>The third mitigation technique modelled by Agribusiness Group (2014) was Active Water Management. It involved setting the option in OVERSEER from defining the actual amount of irrigation water applied to choosing the option to actively manage the application of irrigation water. In this way the model chooses to apply only the amount of water which is required by the crop and therefore limits the amount of excessive water running out the bottom of the soil profile or runoff from the top of the soil profile. The table below outlines that Mitigation 3 (M3) resulted in worthwhile amounts of N leaching mitigation in rotations which were heavily summer and therefore irrigation dependent.</p> <p>Table 4-4: Whole Farm N leaching results (kg N/ha/yr) taken directly from Agribusiness Group (2014).</p> <table border="1" data-bbox="405 860 1450 1032"> <thead> <tr> <th></th> <th>Status Quo</th> <th>M1</th> <th>M2 10%</th> <th>M2 20%</th> <th>M2 30%</th> <th>M2 40%</th> <th>M3</th> </tr> </thead> <tbody> <tr> <td>Rotation 1</td> <td>64</td> <td>66</td> <td>59</td> <td>57</td> <td>53</td> <td>49</td> <td>59</td> </tr> <tr> <td>Rotation 2</td> <td>65</td> <td>61</td> <td>57</td> <td>54</td> <td>51</td> <td>47</td> <td>63</td> </tr> <tr> <td>Traditional Market Garden</td> <td>73</td> <td>69</td> <td>65</td> <td>59</td> <td>51</td> <td>44</td> <td>65</td> </tr> </tbody> </table> <p>Agribusiness Group (2014) states that Mitigation 3 is more of a theoretical improvement in efficiency of water use as it is unlikely to be carried out in practice because it requires static irrigation systems. The report also states that static irrigation systems are unlikely to be adopted because of the short crop rotational cycles in horticulture production. However a site visit to Southern Fresh in Tamahere recently showed that static irrigation systems were in use at this site and the implications of this will be discussed at a later date in our Farm Case Studies.</p>		Status Quo	M1	M2 10%	M2 20%	M2 30%	M2 40%	M3	Rotation 1	64	66	59	57	53	49	59	Rotation 2	65	61	57	54	51	47	63	Traditional Market Garden	73	69	65	59	51	44	65
	Status Quo	M1	M2 10%	M2 20%	M2 30%	M2 40%	M3																										
Rotation 1	64	66	59	57	53	49	59																										
Rotation 2	65	61	57	54	51	47	63																										
Traditional Market Garden	73	69	65	59	51	44	65																										
<p>Leaching and water quality</p>	<p>We have discussed that if water stress has occurred in the growth cycle of the vegetable crop, then crop quality is reduced and ideal conditions for growth will not occur resulting in lower production, lower plant uptake of N, greater volumes of fertiliser N remaining in the soil, and greater potential for N leaching. This is more likely to happen during the summer period, and will occur if irrigation water is unavailable.</p> <p>A study by Verburg (2016) that analysed chlorophyll, TP, and TN concentrations in the Waikato River shows that:</p> <ul style="list-style-type: none"> • Chl-a is typically lowest in winter and higher in spring, summer and autumn. • In contrast, dissolved inorganic nitrogen and dissolved reactive phosphorus show seasonal patterns of higher concentrations in winter and minima in summer (dissolved nutrients show stronger patterns than TP and TN). • TN:TP ratios are lowest in summer and autumn and highest in winter at all sites from Ohakuri downstream to Tuakau. This is evidence that occasional N limitation may occur during summer and autumn. <p>The outcome of the study by Verburg (2016) is that phosphorus is more important than nitrogen in controlling the annual median phytoplankton biomass in the Waikato at present and efforts to control phytoplankton biomass should focus most on controlling phosphorus. However, nitrogen limitation on phytoplankton biomass during summer and autumn can occur when N levels are reduced by catchment retention processes. The secondary focus should be on nitrogen control to help control summer/autumn chlorophyll a levels.</p> <p>Therefore the lack of access of irrigation water during the summer months for horticultural properties will lead to an increase in N leaching. This may impact on water quality within the Waikato River at the critical time when the system may be N limited. This can exacerbate the chlorophyll problem during the</p>																																

	summer/autumn period in the Waikato River.
Conclusion	<p>The impact that the proposed Watercare surface water take will have on leaching losses from the horticultural sector were not testing in the modelling undertaken to inform PC1.</p> <p>Irrigation on horticultural properties during dry periods keeps N leaching under control without reducing yield. The combination of Variation 6 and the Healthy Rivers Plan Change combines to reduce the amount of horticultural food produced, however it will not necessarily deliver better water quality in the future.</p>

4.3 Offset mitigation

Horticulture New Zealand proposes an amendment to Policy 3 to allow for offset mitigation for diffuse discharges from commercial vegetables.

A similar offset policy is proposed in the Plan for point-source discharges. Horticultural landuse has some parallels to urban land-uses associated with point-source offset policy, in that both activities are intensive with small land footprints, and therefore limited opportunities to achieve reductions in discharges without impacting in the viability of the activity.

The case study below discusses the water quality impact of the discharge from Lake Waikare on the Lower Waikato compared with horticulture and discusses how the effects of the point source discharge from Lake Waikare could be mitigated through the proposed off-set mitigation.

Case Study – Riverine Lakes and River Clarity	
Background	PC1 set targets for river clarity. The clarity attribute is an indicator for ecological health and for swimming.
Light-attenuating constituents	<p>The visual clarity of the water in the Waikato and Waipa Rivers reflects the varying concentrations of the light-attenuating constituents present in it. The main constituents are dissolved yellow substance, phytoplankton, organic detritus and suspended silts and clays. The concentrations of these constituents vary in both time and space, and so too does the visual clarity of the river waters.</p> <p>On average, yellow substance was a minor contributor (c. 2%) to beam attenuation in the Waikato River during 2005–14. Even in the Waipa River its contribution was usually small (<5%), apart from at the most upstream site (where it was c. 8%).</p> <p>On average, phytoplankton contributed an estimated 50–60% of the observed beam attenuation in the section of the Waikato River upstream of the confluence with the Waipa River (at Ngaruawahia). Further downstream, phytoplankton contributed about one-third of beam attenuation on average.</p> <p>Non-algal beam attenuation, which can be mainly attributed to suspended silts and clays, is apparently responsible for the other 40–50% of the beam attenuation in the section of the Waikato River upstream of Ngaruawahia, and most of the beam attenuation in the reach downstream of there. Non-algal attenuation is expected to dominate beam attenuation in the Waipa River (Vant, 2015).</p> <p>NIWA (Yalden & Elliot, 2015) developed a model to predict change in clarity in the main stem of the Waikato in relation to PC1. In the clarity model, the key contributors to visual clarity in this study were considered to be yellow substance, phytoplankton and 'other' (assumed to be dominated by fine sediment). The contribution to visual clarity due to yellow substance was assumed to remain constant. Changes to nutrient concentrations affect changes to visual clarity through increased or decreased chlorophyll concentrations which provide an indicator of phytoplankton growth. Changes to sediment loads affect changes to visual clarity through the 'other' contributor.</p>
Black disc visual clarity	Black disc visual clarity for the HRWO subcatchments were estimated from monitoring data provided by WRC as well as from the National Rivers Water Quality Network (NRWQN) run by NIWA. The median black disc values were calculated over a 5 year period 2010-2014 and are displayed in Table 4-5

below. For each black disc measurement ($y_{BD}[m]$), the beam attenuation coefficient was calculated as $c = 4.8/y_{BD}$. The beam attenuation coefficient is made up of 3 key constituents: yellow substance, phytoplankton, and fine sediment. The contribution to beam attenuation from phytoplankton is estimated as $c_p = 0.47(Chl)^{0.65}$, where Chl is the chlorophyll concentration in $mg\ m^{-3}$.

Table 4-5: Median visual clarity and percent contribution to beam attenuation from each of the three key constituents.

HRWO sub-catchment	Visual clarity		Constituent contribution (%)			Median measured values 2010-2014			
	y_{BD} (m)	c (m^{-1})	c_y - yellow substance	c_p - phytoplankton	c_s - fine sediment	TN (mg/L)	TP (mg/L)	TN/TP ratio	Chl-a(mg/L)
Waikato at Ohaaki (3)	-	-	-	-	-	-	-	-	-
Waikato at Ohakuni	2	2.4	0	44	56	0.215	0.018	11.9	0.0032
Waikato at Whakamaru (5)	-	-	-	-	-	-	-	-	-
Waikato at Waipapa	1.6	3	1	36	63	0.336	0.026	13.1	0.0041
Waikato at Karapiro	-	-	-	-	-	-	-	-	-
Waikato at Narrows	1.6	3	1	52	47	0.41	0.029	14.3	0.0055
Waikato at Bridge St Br (1)	1.4	3.5	1	52	47	0.437	0.035	12.5	-
Waikato at Horolliu Br	1.4	3.6	1	47	52	0.441	0.038	11.8	0.0062
Waikato at Huntly-Tainui Br	0.9	5.5	2	31	67	0.585	0.047	12.5	0.006
Waikato at Rangiriri (4)	0.8	6.2	1	31	68	0.602	0.056	10.8	-
Waikato at Mercer Br (2)	0.6	8	1	28	71	0.662	0.054	12.2	0.0105
Waikato at Tuakau Br	0.5	9.4	1	27	72	0.595	0.056	10.6	0.012
Waikato at Port Waikato	-	-	-	-	-	-	-	-	-

Notes: 1. Chlorophyll is not measured at this site. The contribution to visual clarity resulting from phytoplankton is assumed to be the same as for Waikato at Narrows. 2. Black disc measurements are not available for this site. Median black disc visual clarity is estimated from Waikato at Huntly-Tainui Br. 3. Measured chlorophyll concentrations are consistently below detection at this site. 4. Chlorophyll is not measured at this site. The contribution to visual clarity resulting from phytoplankton is assumed to be the same as for Waikato at Huntly-Tainui Br. 5. Measured chlorophyll concentrations are considered unreliable for this site (see Verburg, 2015).

Chlorophyll conc. and clarity

An empirical relationship was developed to predict changes in chlorophyll concentrations in response to TN and TP concentrations. The coefficients of this relationship are weighted as a function of the TN/TP ratio, which allows the model to respond to changes in both nutrients at different levels of sensitivity under different nutrient-limitation regimes. Separate models were fitted for individual sites along the main-stem of the Waikato River. Chlorophyll concentrations are not measured in the tributaries or along the main-stem of the Waipa River, and contributions to visual clarity resulting from phytoplankton are considered negligible for these sites.

The model indicates contribution due to phytoplankton for the upper main stem Waikato River sites is generally high with Ohakuni at 44% and Waipapa at 36% before increasing to 52% at the Narrows site. The Narrows site is downstream from Karapiro dam, which is the final dam on the Waikato River.

	<p>Downstream of the dams, the contribution of phytoplankton starts to decrease and drops to 27% at Tuakau. This implies that the relative contribution to phytoplankton has dropped by half by the time the flow reaches Tuakau, with the sediment contribution increasing below Narrows.</p> <p>The model uses median data, and makes assumptions around N-P limitation. The monitoring data and bioassay studies indicate inter-seasonal variability that the model does not represent, both in respect of nutrient limitation, and in respect of the relative contribution of fine sediment and chl-a to clarity, with chl-a having a greater influence on clarity in summer and low flow conditions (TLG, 2015).</p> <p>In the Lower Waikato the chl-a population is influenced by the main chl-a concentration in the main stem, which is influenced by a number of factors, including the residence time in the hydrodams and river and the upstream nutrient loads.</p> <p>Between Rangiriri and Mercer, the chl-a loads from Lake Waikare and Lake Whangape discharge to the Lower Waikato and contribute 27% of the summer-average chl-a, with approximately 8% contributed from Lake Waikare and 19% from Lake Whangape (Vant, 2015).</p> <p>The influence of the shallow lakes is therefore very significant on the clarity in the Lower Waikato. The clarity model used to inform PC1 was focused on the main stem, it is not clear modelled mitigations account for the ongoing contribution from the shallow lakes.</p>
<p>Visual clarity targets and management</p>	<p>PC1 requires a reduction in N and P from diffuse sources to improve the Waikato River clarity. In the short term, the Lake Freshwater Management targets are set only at the 80 year time horizon with the development of lake catchment plans over the next 10 years.</p> <p>The catchments for Lake Whangape and Lake Waikare contain some of the highest sediment yielding land in the Waikato catchment, as illustrated on the next page in Figure 5.1, and therefore catchment management for these lake catchments is likely to be critical in achieving the water quality targets for the Riverine Lakes FMU and also in reducing the impact of the discharges from these lakes on downstream receiving environments.</p> <p>The clarity targets set out in PC1 outline no short-term improvement in clarity at Huntly, but an improvement at Tuakau from the current level of 0.5 m to 0.6 m.</p> <p>It is unclear, to what degree the catchment management of other improvements identified for the Riverine Lakes will have been implemented in the next 10 years.</p> <p>The management of Lake Waikare to achieve its long-term water clarity target and to reduce its impact on downstream values is complicated by its function as part of the Lower Waikato Flood Scheme.</p> <p>In 1965 Lake Waikare was artificially lowered, and re-directed to flow away from the Waikato River and into the Whangamarino Wetland via the Pungarehu Canal. The water level in the lake is controlled within a small range (stipulated by a consent conditions) to provide flood storage in large and infrequent Waikato River floods, and to enable farming on the low lying land surrounding the lake and river (including horticultural land use).</p> <p>The modifications to Lake Waikare are likely to reduce the water quality discharges via the Pungarehu canal include:</p> <ul style="list-style-type: none"> • The altered residence time in the lake due to the water level control rules on Lake Waikare, which require the Lake is kept artificially low to allow for flood storage. The consented minimum water level results in the Lake outlet gate on the Pungarehu canal closed for long-periods generally in summer. • The shallow water depth of the lake results in high turbidity due to wind re-suspension of lake bed sediment. The re-suspension of sediment results in the discharge of sediment in phosphorus into the Whangamarino Wetland and subsequent adverse ecological effects. The high turbidity also contributes to the challenge in re-establishing macrophytes in the Lake which, if established may improve the trophic state of the Lake • The flood protection of the "found" land surrounding the Lake and subsequent farming of this land, contributing the ongoing bank erosion on the lake edge.

	<p>The discharge of waters from Lake Waikare into the Pungarehu Canal is controlled by a discharge consent (currently under review), which requires the management of sediment discharged from the lake. The focus on the effect of the Lake Waikare discharge are on the Whangamarino Wetland, rather than accounting for the impact of the Lake Waikare discharge on achieving the downstream (Whangamarino River and Waikato River) water quality targets.</p> <p>Policy 10 provides for discharges of regional significance, Policy 11 provides for offsetting, and Policy 12 provides for the best practicable option. These policies may provide a mechanism for the influence that the management of Lake Waikare for flood protection has on the water quality of Lake Waikare and the effects of the discharge of Lake Waikare on downstream water quality.</p>
<p>Conclusion</p>	<p>The contribution the Riverine lakes make to River clarity in the Waikato is significant and is likely to far exceed the impact of discharges from horticultural land.</p> <p>PC1 sets long term water quality targets for improvements for the Lakes, recognises that the improvement in the quality of the Lakes is likely to require both catchment management and lake interventions.</p> <p>For Lake Waikare, the offsetting policy provides a mechanism for addressing the contribution the flood protection scheme makes to the water quality in Lake Waikare and the subsequent downstream river water quality. The offset policy also provides a mechanism for the effects of the poor quality water from Lake Waikare to be addressed more quickly, than the timeframe that may be required to achieve the lake water quality targets.</p> <p>In the same way that an offset policy is likely to be useful for mitigating the effects of point source discharges it could also be useful in reducing the effects from horticultural land, which due to the intensity and small footprint, has fewer on-farm mitigation options compared with pastoral farming.</p>

4.4 Farm Management Plans

Horticulture New Zealand seeks amendments to the Farm Management Plan Schedule1, part of Horticulture New Zealand's issue with the current plan is the lack of focus on managing losses from cultivation practices across broader rural land than that occupied by the vegetable sector. Horticulture New Zealand considers that a range of practices could be mandated across cultivated land.

Horticulture New Zealand's submission seeks changes to Schedule 1. The proposed schedule 1a includes a number of amendments and includes recognition of cultivated land outside of the horticultural sector, in Schedule 1a. The proposed Schedule 1b sets out specific criteria for commercial vegetable growers, including reference to *the Horticulture New Zealand Erosion & Sediment Control Guidelines for Vegetable Production Version 1.1 June 2014*. The proposed Schedule 1C, sets out specific criteria for sub catchment scale management plans.

The case study below utilises infra-red satellite imagery to identify bare earth within one sub-catchment, the Mangaone, where horticulture and other land uses take place.

Case Study – Bare Earth and Sediment Management – Mangaone Catchment	
Background	PC1 set targets for river clarity. The clarity attribute is an indicator for ecological health and for swimming. Sediment influences the clarity value, both due to turbidity and because erosion of soil contributes phosphorus load.
Farm Management Plan	The method used to estimate sediment generated from land was NZEEM. The NZEEM method does not differentiate between pasture and bare earth, however bare earth does generate more sediment than pasture and is recognised in the requirements for Farm Management Plans. Farm Management Plans include requirements for the identification of actively eroding areas, erosion prone areas, and areas of bare soil and appropriate measures for erosion and sediment control and re-vegetation.
Landuse analysis	<p>In order to examine the bare earth in the Mangaone catchment, infra-red satellite imagery was analysed to identify bare earth in the Mangaone catchment and to classify it by landuse.</p> <p>Figure 4.5 illustrates the bare earth in the Mangaone catchment captured by satellite imagery. Bare earth was derived using the Normalised Difference Vegetation Index in ArcGIS from Sentinel-2A imagery (captured 22/11/2016, 10m resolution). Bare earth areas less than 0.25 ha were ignored.</p> <p>The bare earth has been intersected with the landuse data used for the Healthy Rivers modelling. The landuse GIS layer was supplied to Jacobs by NIWA.</p> <p>We analysed the supplied landuse map against the satellite imagery. There are areas of bare earth classified as sheep and beef intensive and native vegetation that appear to be in horticultural production.</p> <p>The landuse category "other" includes arable. Our analysis of the satellite imagery indicates there is arable land within this catchment. Similarly bare earth within dairy and sheep and beef landuse appears to be classified correctly.</p> <p>Table 4-6 below provides the area and percentage of bare earth in the Mangaone catchment using the supplied landuse layer. Table 4-7 provides the same analysis, but with some of the land that was identified as either, native forest, sheep and beef or urban in the supplied land use layer, re-classified as horticulture.</p> <p>Table 4-6: Bare earth proportion for the Mangaone Catchment using default WRC landuse data</p>

Land use	Total Area (ha)	Bare Earth (ha)	Proportion of bare earth in catchment
All other land uses	715	68	20%
Dairy	2150	53	16%
Horticulture	113	29	9%
Maize	224	65	19%
Native forest and scrub	216	19	6%
Plantation forest	39	0.2	0%
Sheep and beef - intensive	2089	79	24%
Urban	1215	22	6%

Table 4-7: Bare earth proportion for the Mangaone Catchment using adjusted horticultural landuse

Land use	Total Area (ha)	Bare Earth (ha)	Proportion of bare earth in catchment
All other land uses	708	60.5	18%
Dairy	2150	52.7	16%
Horticulture	182	97.3	29%
Maize	221	61.6	18%
Native forest and scrub	199	1.7	1%
Plantation forest	39	0.2	0%
Sheep and beef - intensive	2052	42.0	13%
Urban	1210	17.5	5%

Conclusion

The landuse and bare soil analysis indicates that horticultural land, while likely to have a higher proportion of bare earth compared with other land uses is likely to make up only small fraction of the bare earth on farm land within the Waikato Region, due to its small footprint.

In the Mangaone catchment, horticulture makes up 2% of the landuse, bare earth makes up 5% of the land within the catchment. Our estimate is the horticultural landuse makes up approximately 30% of the bare earth within the catchment, which means that 70% of the bare earth is within other land uses.

Managing the effect of soil erosion from cultivated land, will require measures are implemented on all land uses, including horticultural land.

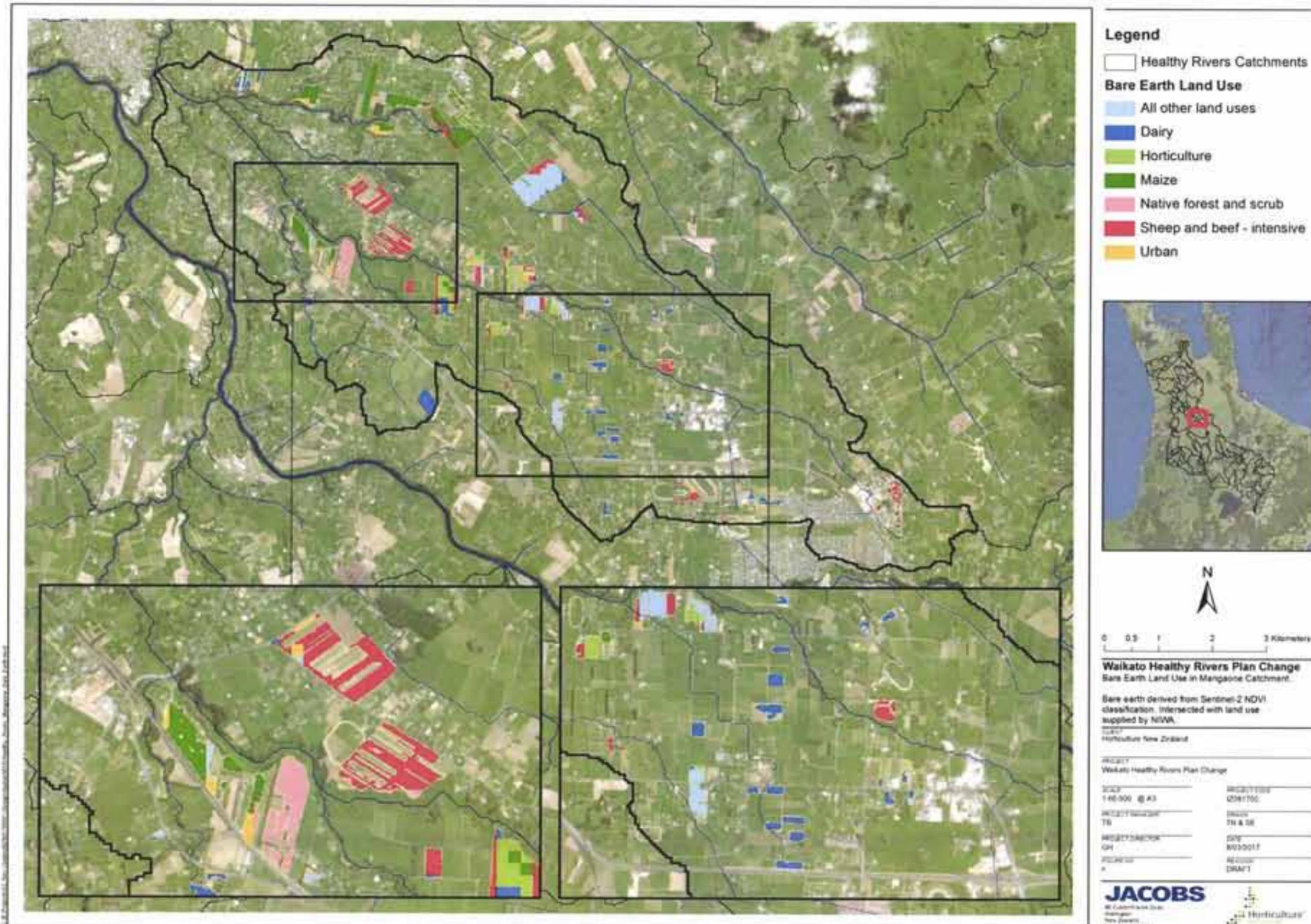


Figure 4.5 Mangaone Catchment, bare earth classified by the Healthy Rivers Landuse layer. (Landuse layer supplied to Jacobs by NIWA)

4.5 Sub-catchment Allocations

The Horticulture New Zealand submission proposes a change to Objective 3 to add the *or achievement of the contaminant load reduction targets specified for each subcatchment in Table 3.11.*

We requested catchment loads that were associated with the 10 year water quality targets from Waikato University, at the time of submission these loads have not been made available.

Graeme Doole suggested that we calculate them from the baseline leaching data supplied by NIWA and the documented mitigations.

We have attempted to calculate loads for TN, TP and E.coli, for those sites where it was possible. These loads should be updated with the modelled loads. It was not possible to calculate a catchment load for CHI-a from the data available.

4.5.1 The methodology for calculating the TN, TP and nitrate load was as follows:

- Take the baseline unattenuated sub-catchment loads for pastoral and horticulture landuses, supplied by NIWA, and apply the attenuation factors described in the nutrient modelling report (Semadeni-Davies, September 2015). The load for the additional landuses was added, and the routing factors were applied (TN only), point sources, geothermal inputs (TN only) and sediment-P loads were then added in each sub-catchment. Finally the reservoir attenuation factors were applied where applicable. The resultant load equalled attenuated cumulative sub-catchment loads described in the nutrient modelling report by Semadeni-Davies (2015).
- The baseline attenuated loads for each sub catchment, were consistent with those supplied to the CSG in the spreadsheet named:
 - EWDOCS_n3625036_v1_Load_data_for_CSG_including_minus_forestry
- The baseline and 10% reduction concentration for TN, TP, and nitrate loads were supplied in a spreadsheet named:
 - Concentration data for CSG
- The 10 year water quality concentration targets in PC1 are between the baseline concentrations and the 10% concentrations described in the CSG spreadsheet.
- For those sub-catchments where baseline concentration data was available, a linear relationship was assumed between the baseline and 10% concentration and this ratio was applied to the loads to calculate the attenuated load associated with the PC1 concentration. Where PC1 targets were not available for TN concentrations, the linear relationship between the baseline and 10% concentrations of nitrate was developed. This ratio was applied to the TN load, to calculate the attenuated nitrate load associated with the PC1 concentration. Using this method we have assume that the nitrate load per sub-catchment is similar to the TN load per catchment.
- The attenuation calculation described in step 1, was reversed, to calculate the unattenuated sub-catchment load. The unattenuated sub-catchment load does not include point source, geothermal inputs, or sediment-P loads from the catchment. For TN, the ultimate attenuation factor was applied to estimate N loads to come through groundwater lag.
- These calculations assume that:
 - Mitigations have been undertaken on pastoral and horticultural land only; and
 - Point source, geothermal, and sediment-P loads remain unchanged.

4.5.2 The methodology for calculating the E. coli load was as follows:

- Take unattenuated landuse E. coli yields supplied in Table 3-1 in the E.coli modelling report (Semadeni-Davies et al., September 2015). Multiply these by the land area per each land use in each sub-catchment. Sum these together to get total unattenuated yield per sub-catchment. Land use by area per sub-catchment was supplied from NIWA in the spreadsheet named:
 - Ecoli yields_Supplied by NIWA
- The unattenuated yields were converted to attenuated yields by a ratio, so that they matched the attenuated yields supplied in the spreadsheet, named above. Point sources of E.coli, and farm dairy effluent discharges (FDE) were added to each sub-catchment load. Reservoir attenuation factors were applied so that calculated total attenuated E.coli sub-catchment loads were consistent with the loads in the Semadeni-Davies et al. (2015) report and those supplied to the CSG in the spreadsheet named:
 - EWDOCS_n3625036_v1_Load_data_for_CSG_including_minus_forestry
- The baseline and 10% reduction concentration for E.coli was supplied in a spreadsheet named:
 - Concentration data for CSG
- The 10 year water quality concentration targets in PC1 are between the baseline concentrations and the 10% concentrations for 95th percentile E.coli described in the CSG spreadsheet. A linear relationship was assumed between the baseline and 10% concentration for 95th percentile E.coli and this ratio was applied to the loads to calculate the attenuated load associated with the PC1 concentration.
- The attenuation calculation described in step 1 and step 2 above, was reversed, to calculate the unattenuated sub-catchment load.
- These calculations assume that:
 - Point source and FDE loads remain unchanged.

Table 4-8 Estimated Subcatchment unattenuated loads for the short-term water quality targets (excluding point sources)

Site	FMU	Annual Median Chlorophyll a (mg/m3)		Annual Maximum Chlorophyll a (mg/m3)		Annual Median Total Nitrogen (mg/m3)		Annual Total Nitrogen Load t/yr		Annual Median Total Phosphorus (mg/m3)		Annual Total Phosphorus Load t/yr		Annual Median Nitrate (mg NO3-N/L)		Annual 95th percentile Nitrate (mg NO3-N/L)		Annual Nitrate load t/yr		Annual Median Ammonia (mg NH4-N/L)		Annual Maximum Ammonia (mg NH4-N/L)		Annual Ammonia Load t/yr		95th percentile E. coli (E.coli/100ml)		Annual E. coli Load 10 ¹⁵ organisms/yr		Clarity (m)	
		Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year	Short term	80 year
		Upper Waikato Freshwater Management Unit																													
Waikato River at Ohaaki Br	Upper Waikato	1.5	1.5	13	13	134	134	255	10	10	18	0.039	0.039	0.062	0.062	255	0.002	0.002	0.013	0.013					70	70	1.00	3.8	3.8		
Waikato River at Ohakuri Tailrace Br	Upper Waikato	3.2	3.2	11	11	206	160	554	17	17	50	0.084	0.084	0.172	0.172	555	0.003	0.003	0.017	0.017					15	15	2.16	3.4	3.4		
Waikato River at Whakamaru Tailrace	Upper Waikato		5		25	260	160	364	20	20	31	0.101	0.101	0.23	0.23	364	0.003	0.003	0.01	0.01					60	60	1.39	2	3		
Waikato River at Waipapa tailrace	Upper Waikato	4.1	4.1	25	25	318	160	552	25	20	48	0.164	0.164	0.32	0.32	552	0.007	0.007	0.017	0.017					162	162	2.23	2	3		
Pueto Strm at Broadlands Rd Br	Upper Waikato											0.45	0.45	0.53	0.53	129	0.003	0.003	0.009	0.009					92	92	0.49	1.8	3		
Torepatutahi Strm Valle Rd Br	Upper Waikato											0.5	0.5	0.8	0.8	79	0.002	0.002	0.011	0.011					216	216	0.69				
Waiotapu Strm Homestead Rd Br	Upper Waikato											1.257	1	1.563	1.5	229	0.112	0.03	0.176	0.05					281	281	0.66				
Mangakara Strm (Reporoa) SH5	Upper Waikato											1.27	1	1.59	1.5	24	0.008	0.008	0.062	0.05					1584	540	0.07	0.9	1		
Kawaunui Strm SH5 Br	Upper Waikato											2.58	2.4	2.85	1.5	32	0.006	0.006	0.079	0.05					2335	540	0.08	1.4	1.6		
Waiotapu Strm Campbell Rd Br	Upper Waikato											0.915	0.915	1.1	1.1	48	0.291	0.24	0.315	0.05					18	18	0.18	1.2	1.6		
Otamakokore Strm Hossack Rd	Upper Waikato											0.74	0.74	1.19	1.19	60	0.006	0.006	0.024	0.024					680	540	0.23	1.2	1.6		
Whirinaki Strm Corbett Rd	Upper Waikato											0.77	0.77	0.87	0.87	10	0.002	0.002	0.012	0.012					98	98	0.06	2.7	3		
Tahunaaara Strm Ohakuri Rd	Upper Waikato											0.555	0.555	0.83	0.83	204	0.003	0.003	0.015	0.015					783	540	0.69	1.3	1.6		
Mangaharakeke Strm SH30 (Off jct SH1)	Upper Waikato											0.525	0.525	0.75	0.75	35	0.003	0.003	0.015	0.015					684	540	0.11	1.1	1.6		
Waipapa Strm (Mokai) Tirohanga Rd Br	Upper Waikato											1.189	1	1.5	1.5	102	0.003	0.003	0.005	0.005					1147	540	0.52	1.2	1.6		
Mangakino Strm Sandel Rd	Upper Waikato											0.65	0.65	0.86	0.86	222	0.003	0.003	0.012	0.012					251	251	0.77	1.8	3		
Whakauru Strm SH1 Br	Upper Waikato											0.26	0.26	0.45	0.45	86	0.003	0.003	0.033	0.033					2106	540	0.23	0.8	1		
Mangamingi Strm Paraonui Rd Br	Upper Waikato											2.76	2.4	3.12	1.5	113	0.091	0.03	0.296	0.05					2151	540	0.29	0.8	1		
Pokaiwhenua Strm Arapuni - Putaruru Rd	Upper Waikato											1.68	1	2.04	1.5	484	0.002	0.002	0.02	0.02					1363	540	1.23	1.3	1.6		
Little Waipa Strm Arapuni - Putaruru Rd	Upper Waikato											1.522	1	2.04	1.5	210	0.002	0.002	0.085	0.05					1377	540	0.69	1.5	1.6		
Central Waikato Freshwater Management Unit																															
Waikato River Narrows Boat Ramp	Central Waikato	5.5	5	23	23	404	350	204	28	20	10	0.235	0.235	0.5	0.5	204	0.009	0.009	0.018	0.018					340	260	0.76	1.7	1.7		
Waikato River Horobu Br	Central Waikato	6.1	5	23	23	432	350	78	34	20	3	0.26	0.26	0.53	0.53	78	0.007	0.007	0.029	0.029					774	540	0.50	1.4	1.6		
Karapiro Strm Hickey Rd Bridge	Central Waikato											0.52	0.52	1.689	1.5	94	0.008	0.008	0.031	0.031					4518	540	0.75	0.9	1		
Mangawhero Strm Cambridge-Ohaupo Rd	Central Waikato											1.99	1	2.49	1.5	94	0.041	0.03	0.072	0.05					2920	540	0.30	0.3	1		
Mangaonua Strm Hoeka Rd	Central Waikato											1.455	1	1.878	1.5	126	0.036	0.03	0.051	0.05					6372	540	0.44	1	1		
Mangaone Strm Annebrooke Rd Br	Central Waikato											2.58	2.4	2.94	1.5	105	0.009	0.009	0.02	0.02					2052	540	0.35	0.9	1		
Mangakotukutuku Strm Peacocks Rd	Central Waikato											0.8	0.8	1.788	1.5	55	0.077	0.03	0.132	0.05					11394	540	0.15	0.5	1		
Waitawhiriwhiri Strm Edgecumbe Street	Central Waikato											0.88	0.88	1.24	1.24	36	0.256	0.24	0.318	0.05					5922	540	0.14	0.4	1		
Kirikiriua Strm Tauhara Dr	Central Waikato											0.815	0.815	1.572	1.5	14	0.096	0.03	0.183	0.05					2124	540	0.11	0.5	1		
Lower Waikato Freshwater Management Unit																															
Waikato River Huntly-Taimu Br	Lower Waikato	5.9	5	19	19	562	350	314	43	20	9	0.365	0.365	0.9	0.9	314	0.005	0.005	0.015	0.015					1944	540	0.99	0.9	1		
Waikato River Mercer Br	Lower Waikato	10	5	30	25	631	350	484	49	20	31	0.365	0.365	0.87	0.87	484	0.003	0.003	0.01	0.01					1494	540	2.82				

Values and Current Allocation of Responsibility for Contaminant Discharges



Waikato River Tuakau Br	Lower Waikato	11.3	5	37	25	571	350	156	50	20	9	0.325	0.325	0.88	0.88	156	0.003	0.003	0.008	0.008		1584	540	0.46	0.7	1
Komakorau Strm Henry Rd	Lower Waikato											1.279	1	4.4	3.5	414	0.25	0.24	0.419	0.4		3474	540	0.97	0.3	1
Mangawara Strm Rutherford Rd Br	Lower Waikato											0.765	0.765	2.76	1.5	695	0.103	0.03	0.172	0.05		4955	540	1.78	0.3	1
Awaroa Strm (Rotowaro) Sansons Br @ Rotowaro-Huntly Rd	Lower Waikato											0.7	0.7	1.19	1.19	35	0.021	0.021	0.089	0.05		1800	540	0.33	0.8	1
Matahuru Strm Waiterimu Road Below Confluence	Lower Waikato											0.715	0.715	1.689	1.5	113	0.016	0.016	0.059	0.05		6147	540	0.73	0.4	1
Whangape Strm Rangiriri-Glen Murray Rd	Lower Waikato											0.004	0.004	0.69	0.69	386	0.006	0.006	0.134	0.05		584	540	3.17	0.3	1
Waerenga Strm SH2 Maramarua	Lower Waikato											0.82	0.82	1.41	1.41	17	0.005	0.005	0.022	0.022		5098	540	0.18	0.9	1
Whangamarino River Jefferies Rd Br	Lower Waikato											0.625	0.625	1.842	1.5	117	0.012	0.012	0.147	0.05		4712	540	0.54	0.6	1
Mangatangi River SH2 Maramarua	Lower Waikato											0.11	0.11	1.12	1.12	174	0.005	0.005	0.038	0.038		5567	540	0.66	0.5	1
Mangatawhiri River Lyons Rd Buckingham Br	Lower Waikato											0.013	0.013	0.37	0.37	20	0.003	0.003	0.011	0.011		5108	540	0.08	1.6	1.6
Whangamarino River Island Block Rd	Lower Waikato											0.075	0.075	0.7	0.7	135	0.011	0.011	0.054	0.05		655	540	0.47	0.3	1
Whakapipi Strm SH22 Br	Lower Waikato											3.39	2.4	5.12	3.5	99	0.006	0.006	0.081	0.05		1773	540	0.25	1.1	1.1
Ohaeroa Strm SH22 Br	Lower Waikato											1.473	1	1.806	1.5	29	0.003	0.003	0.015	0.015		4667	540	0.10	0.8	1
Opuatia Strm Pongau Rd	Lower Waikato											0.74	0.74	1.06	1.06	71	0.005	0.005	0.016	0.016		2898	540	0.73	0.6	1
Awaroa River (Waikuku) Otara Rd Br Moseley Rd	Lower Waikato											1.369	1	2.31	1.5	32	0.021	0.021	0.135	0.05		1017	540	0.12	0.4	1

Waipa Waikato Freshwater Management Unit																											
Waipa River Mangaokewa Rd	Waipa												0.38	0.38	0.6	0.6	17	0.003	0.003	0.017	0.017		2417	540	0.18	1.5	1.6
Waipa River Otewa	Waipa												0.228	0.228	0.502	0.502	224	0.003	0.003	0.008	0.008		2036	540	1.76	2.1	2.1
Waipa River SH3 Otorohanga	Waipa												0.37	0.37	1.05	1.05	301	0.004	0.004	0.02	0.02		3289	540	0.94	1.2	1.6
Waipa River Pirongia-Ngutu Rd Br	Waipa												0.565	0.565	1.27	1.27	977	0.008	0.008	0.023	0.023		4441	540	2.56	0.7	1
Waipa River Whatawhata Bridge	Waipa												0.673	0.673	1.319	1.319	612	0.009	0.009	0.026	0.026		3657	540	1.94	0.6	1
Ohote Strm Whatawhata/Horotiu Rd	Waipa												0.495	0.495	1.37	1.37	57	0.023	0.023	0.052	0.05		2142	540	0.19	0.6	1
Kaniwhaniwha Strm Wright Rd	Waipa												0.35	0.35	0.89	0.89	116	0.007	0.007	0.022	0.022		1917	540	0.53	0.9	1
Mangapiko Bowman Rd Strm	Waipa												1.369	1	2.49	1.5	592	0.022	0.022	0.076	0.03		7074	540	1.92	0.6	1
Mangaohoi Strm South Branch Maru Rd	Waipa												0.23	0.23	0.39	0.39	2	0.003	0.003	0.008	0.008		943	540	0.05	1.6	1.6
Mangauike Strm Te Awamutu Borough W/S intake	Waipa												0.21	0.21	0.28	0.28	4	0.002	0.002	0.003	0.003		1008	540	0.01	3.3	3.3
Puniu River Bartons Corner Rd Br	Waipa												0.65	0.65	1.28	1.28	511	0.007	0.007	0.029	0.029		2790	540	1.50	0.9	1
Mangatutu Strm Walker Rd Br	Waipa												0.38	0.38	0.88	0.88	152	0.003	0.003	0.012	0.012		738	540	0.61	1.5	1.6
Waitomo Strm SH31 Otorohanga	Waipa												0.52	0.52	0.83	0.83	45	0.008	0.008	0.025	0.025		1453	540	0.28	0.6	1
Mangapu River Otorohanga	Waipa												0.86	0.86	1.36	1.36	236	0.015	0.015	0.057	0.05		4284	540	1.34	0.7	1
Waitomo Strm Tumutumu Rd	Waipa												0.63	0.63	0.8	0.8	33	0.004	0.004	0.013	0.013		2241	540	0.23	1.1	1.6
Mangaokewa Strm Lawrence Street Br	Waipa												0.53	0.53	0.98	0.98	165	0.004	0.004	0.013	0.013		6224	540	1.87	1.4	1.6

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Appendix A. Healthy Rivers Catchments

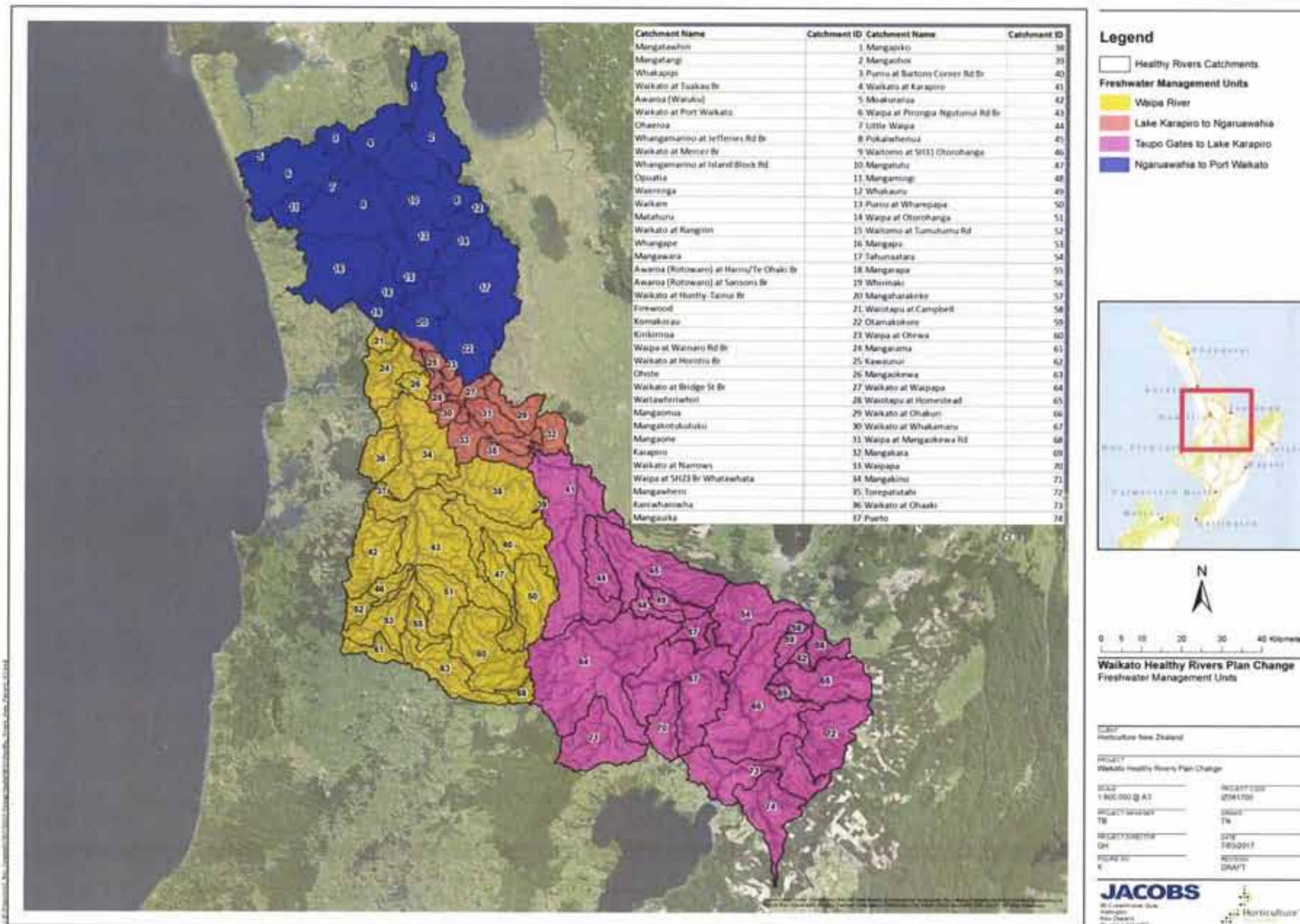
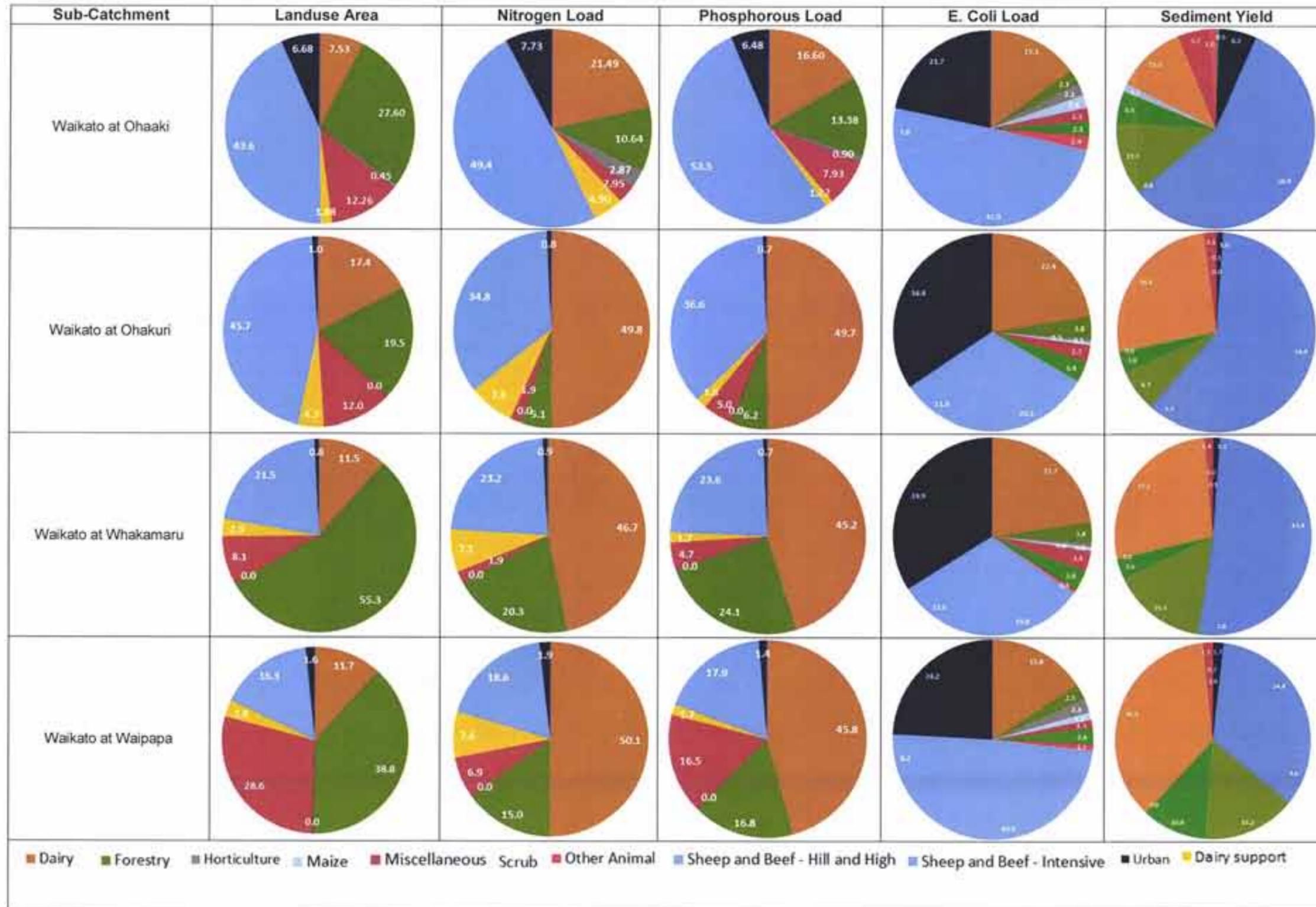


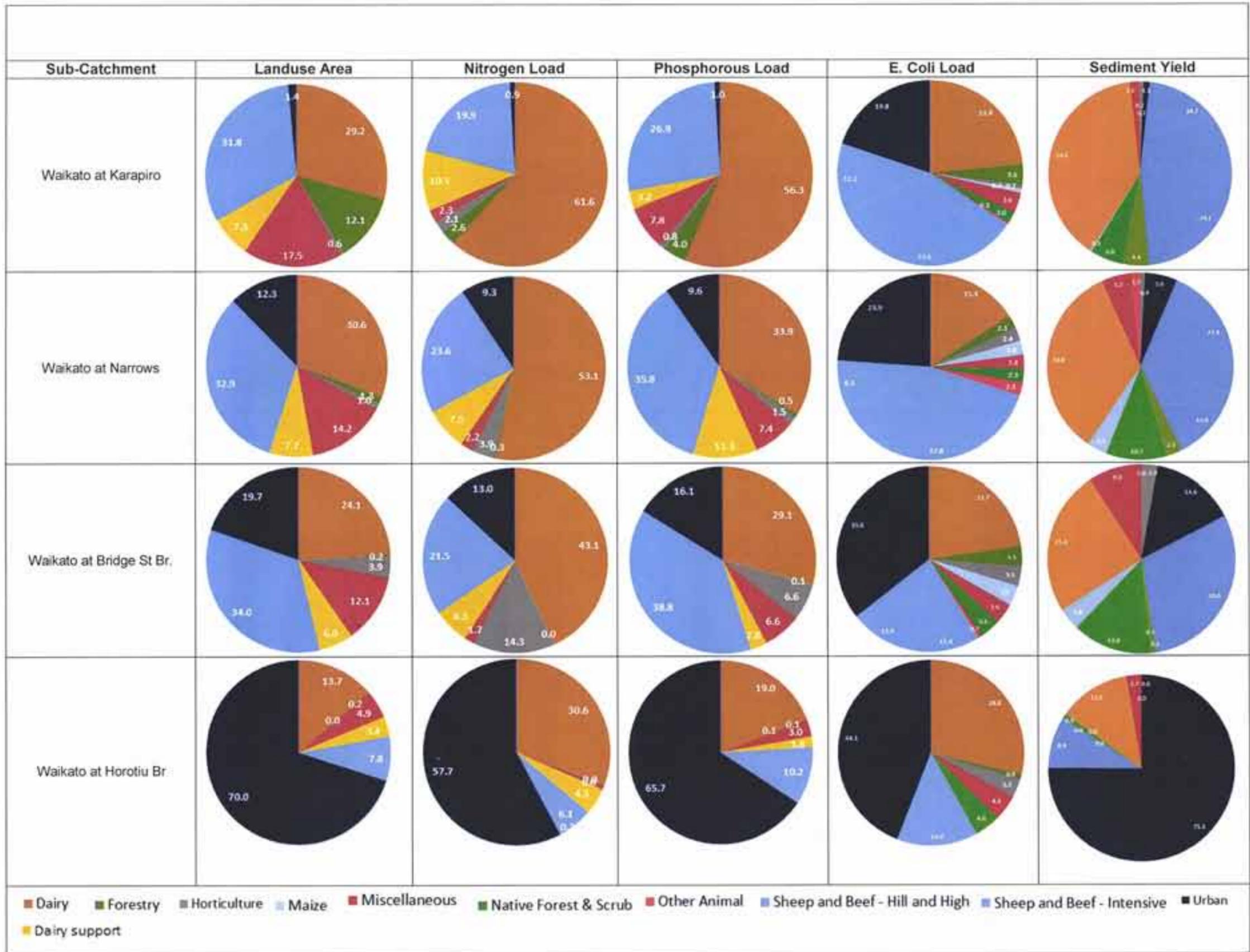
Figure 4.6 Healthy Rivers Subcatchments and Freshwater Management Units.

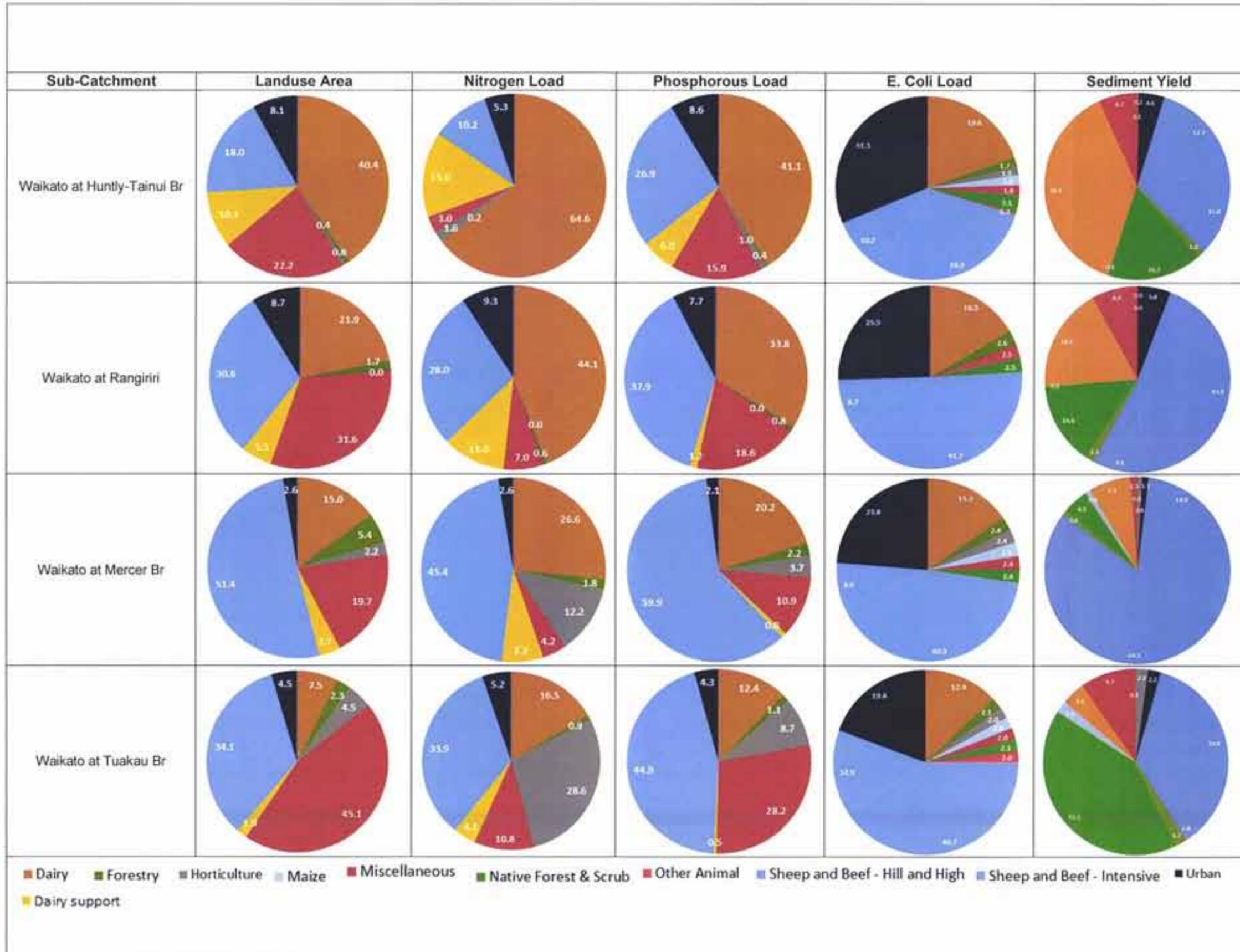
**Appendix B. Proportions of land use and water quality
constituent loads in selected subcatchments of the
Waikato River Catchment**

Appendix B: Proportion of land use type and unattenuated loads of nitrogen, phosphorus, and sediment and attenuated E.coli (excluding point-sources) in selected sub-catchments in the Waikato River Catchment

Units: Percentage







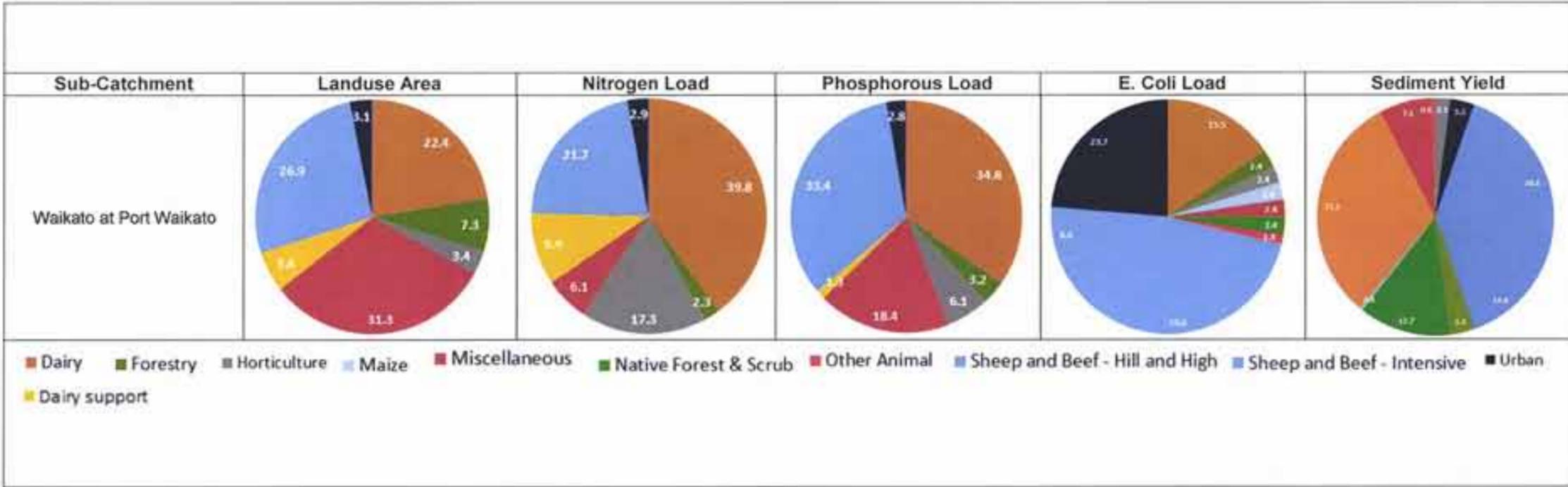


Table 4-9 Horticulture N and P unattenuated load as a percentage of total sub-catchment unattenuated load. (taken from NIWA supplied spreadsheet)

Subcatchment	Horticulture Area as a percentage of subcatchment area	N load as percentage of total sub-catchment load	P load as a percentage of total sub-catchment load
Pueto	0.1%	0.5%	0.1%
Waikato at Ohaaki	0.4%	2.9%	0.9%
Waikato at Ohakuri	0.0%	0.0%	0.0%
Torepatutahi	0.0%	0.0%	0.0%
Mangakara	0.0%	0.0%	0.0%
Waiotapu at Homestead	0.0%	0.0%	0.0%
Kawaunui	0.0%	0.0%	0.0%
Waiotapu at Campbell	0.0%	0.0%	0.0%
Otamakokore	0.0%	0.0%	0.0%
Whirinaki	0.0%	0.0%	0.0%
Waikato at Whakamaru	0.0%	0.0%	0.0%
Waipapa	0.2%	1.1%	0.3%
Tahunaaatara	0.0%	0.0%	0.0%
Mangaharakeke	0.0%	0.0%	0.0%
Waikato at Waipapa	0.0%	0.0%	0.0%
Mangakino	0.0%	0.0%	0.0%
Mangamingi	0.0%	0.0%	0.0%
Whakauru	0.0%	0.0%	0.0%
Pokaiwhenua	0.0%	0.0%	0.0%
Little Waipa	0.0%	0.0%	0.0%
Waikato at Karapiro	0.6%	2.1%	0.8%
Karapiro	0.5%	2.5%	0.8%
Waikato at Narrows	1.0%	3.9%	1.5%
Mangawhero	0.9%	3.1%	1.3%
Waikato at Bridge St Br	3.9%	14.3%	6.6%
Mangaonua	1.1%	4.6%	1.7%
Mangakotukutuku	0.0%	0.1%	0.1%
Mangaone	1.7%	7.0%	2.7%
Waikato at Horotiu Br	0.0%	0.2%	0.1%
Waitawhiriwhiri	0.0%	0.0%	0.0%
Kirikiroa	0.0%	0.0%	0.0%
Waipa at Mangaokewa Rd	0.0%	0.0%	0.0%
Waipa at Otewa	0.0%	0.0%	0.0%
Mangaokewa	0.0%	0.0%	0.0%
Mangarapa	0.0%	0.0%	0.0%
Mangapu	0.0%	0.0%	0.0%
Mangarama	0.0%	0.0%	0.0%
Waipa at Otorohanga	0.0%	0.0%	0.0%

Values and Current Allocation of Responsibility for Contaminant Discharges



Waipa at Pirongia-Ngulumui Rd Br	0.4%	1.1%	0.6%
Waikato at Tumutumu Rd	0.0%	0.0%	0.0%
Waikato at SH31 Otorohanga	0.0%	0.0%	0.0%
Moakutarua	0.0%	0.0%	0.0%
Puniu at Bartons Corner Rd Br	1.3%	3.7%	2.2%
Puniu at Wharepapa	0.0%	0.0%	0.0%
Mangatutu	0.0%	0.0%	0.0%
Mangapiko	0.1%	0.4%	0.2%
Mangaohoi	0.0%	0.0%	0.0%
Waipa at SH23 Br Whatawhata	0.4%	1.3%	0.8%
Mangauika	0.0%	0.0%	0.0%
Kaniwhaniwha	0.0%	0.0%	0.0%
Waipa at Waingarō Rd Br	0.7%	3.7%	1.4%
Ohote	0.3%	1.4%	0.5%
Firewood	0.0%	0.0%	0.0%
Waikato at Huntly-Tainui Br	0.4%	1.6%	1.0%
Komakorau	0.1%	0.4%	0.2%
Mangawara	0.0%	0.0%	0.0%
Waikato at Rangiriri	0.0%	0.0%	0.0%
Awaroa (Rotorua) at Harris	0.0%	0.0%	0.0%
Awaroa (Rotorua) at Sansons Br	0.0%	0.0%	0.0%
Waikato at Mercer Br	2.2%	12.2%	3.7%
Whangape	0.0%	0.0%	0.0%
Whangamarino at Island Block Rd	1.4%	10.0%	2.8%
Whangamarino at Jefferies Rd Br	0.3%	1.7%	0.6%
Waeringa	0.0%	0.0%	0.0%
Matahuru	0.0%	0.0%	0.0%
Waikare	0.7%	0.0%	0.0%
Opuatia	1.3%	8.8%	2.4%
Mangatangi	0.0%	0.2%	0.1%
Waikato at Tuakau Br	4.5%	28.6%	8.7%
Ohaeroa	6.1%	27.3%	9.5%
Mangatawhiri	0.0%	0.0%	0.0%
Whakapipi	21.4%	64.6%	32.7%
Awaroa (Waikuku)	1.1%	5.3%	1.7%
Waikato at Port Waikato	3.4%	17.3%	6.1%

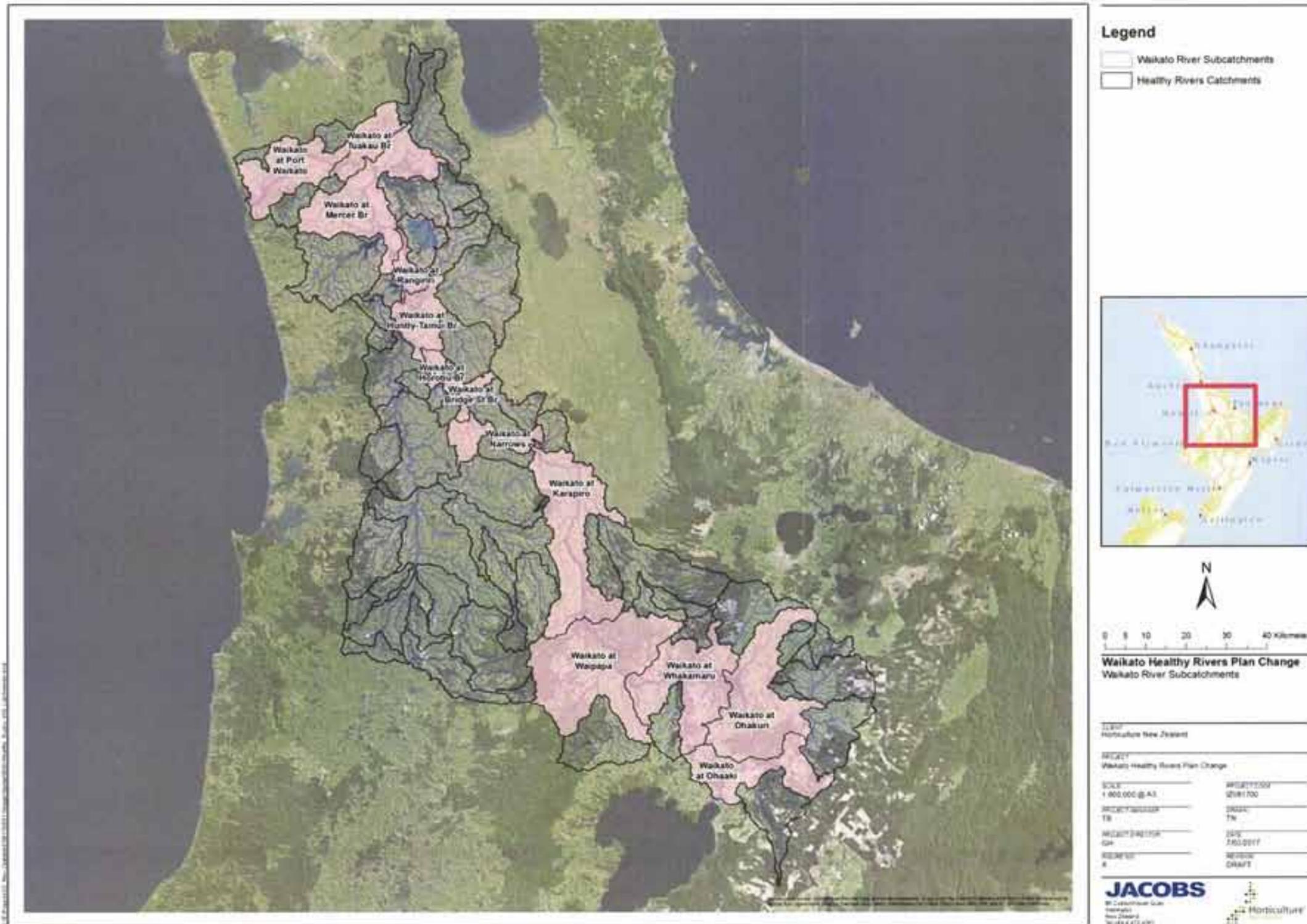
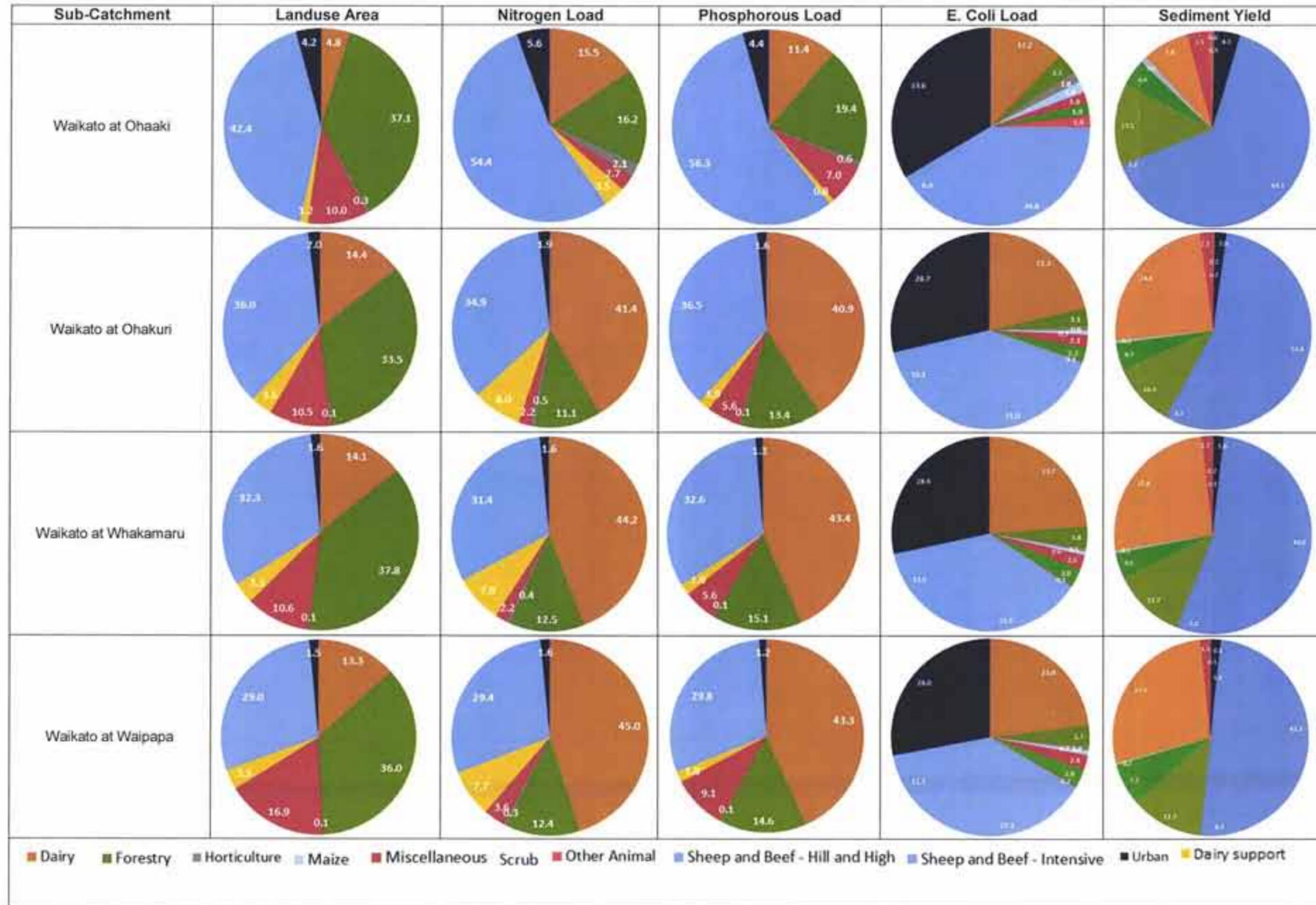


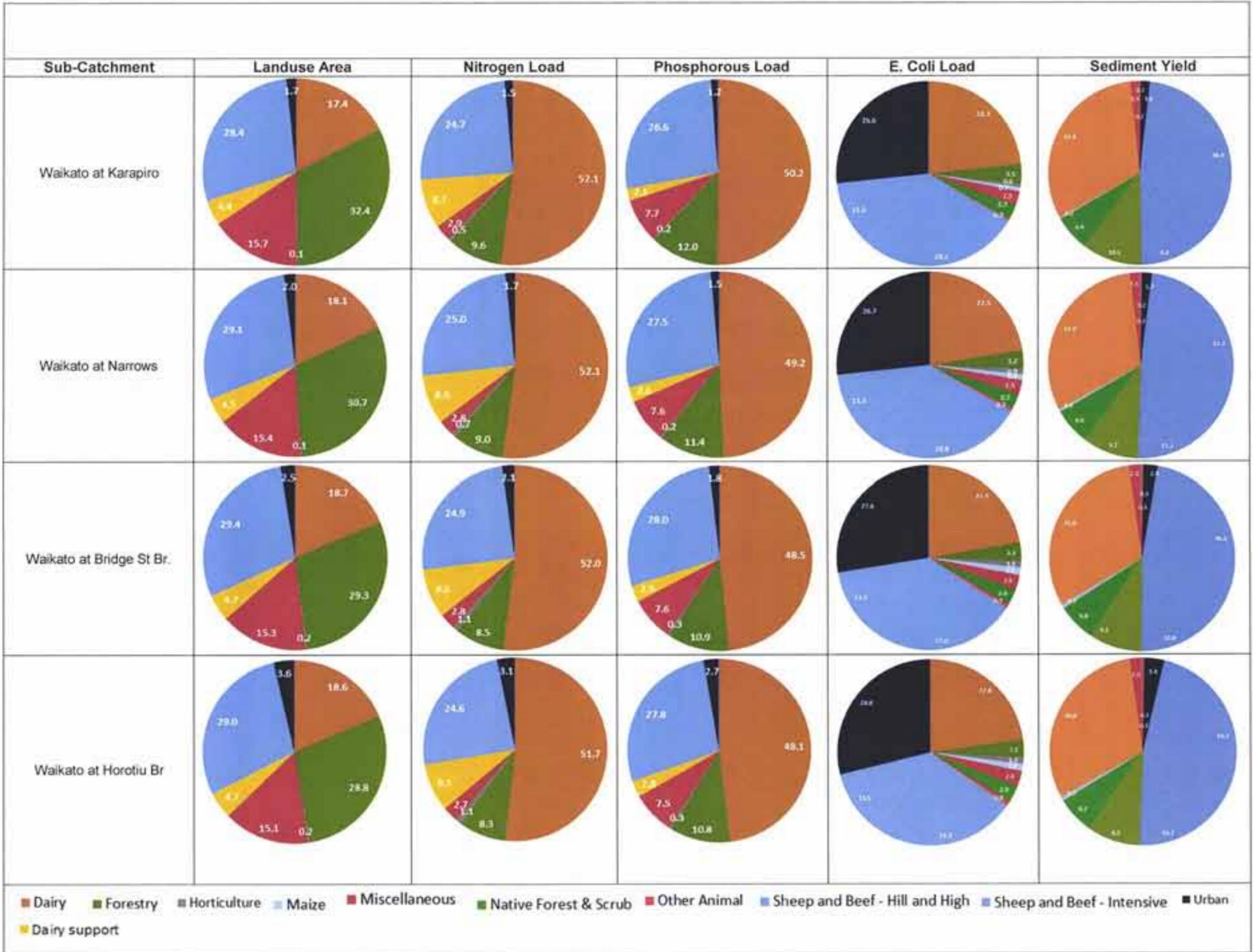
Figure 4.7 Selected subcatchments where unattenuated baseline contaminant loads for N, P and sediment and attenuated E.coli (supplied by NIWA and Landcare) have been graphed.

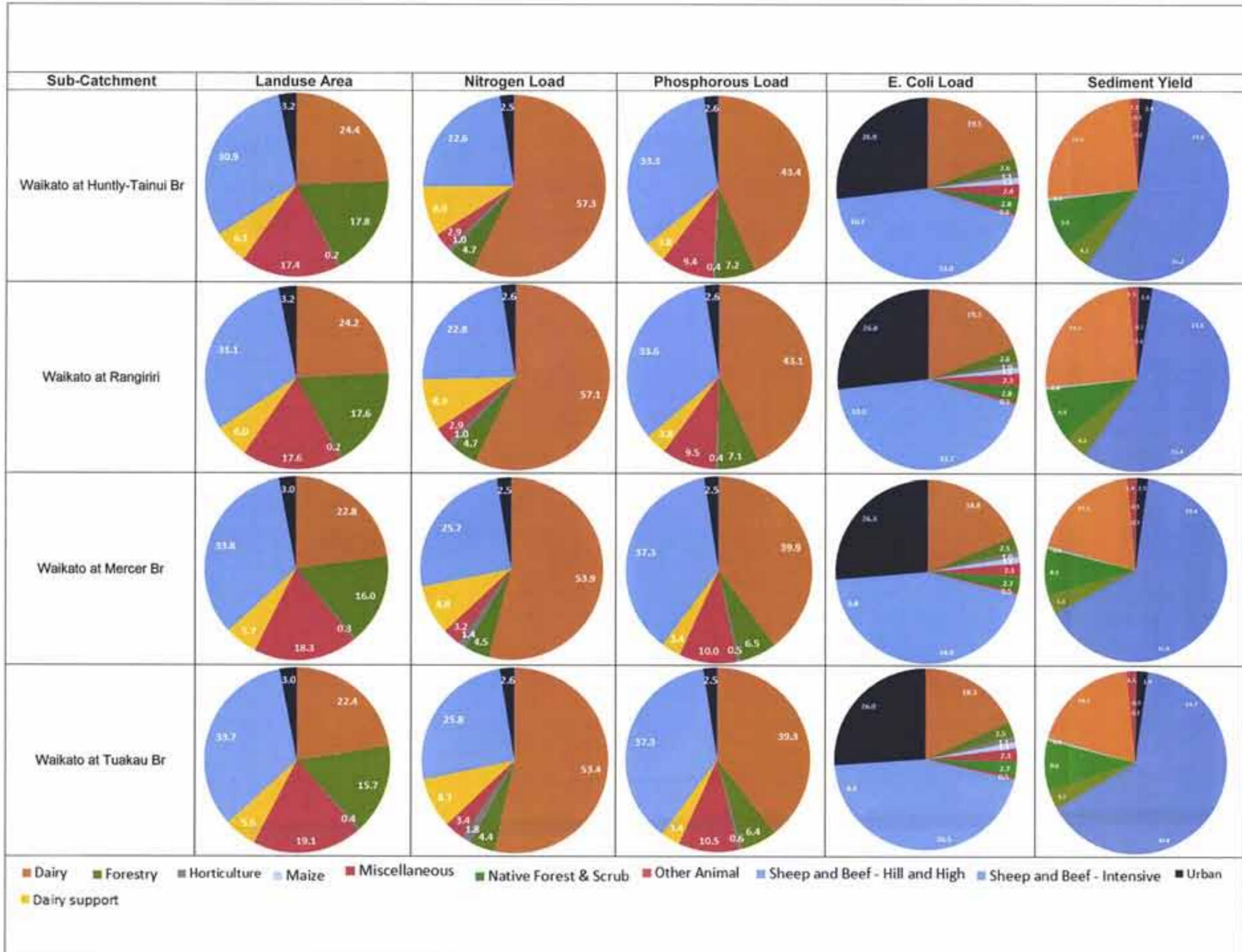
**Appendix C. Graphed proportions of land use and water quality
constituent cumulative loads along the Waikato
River**

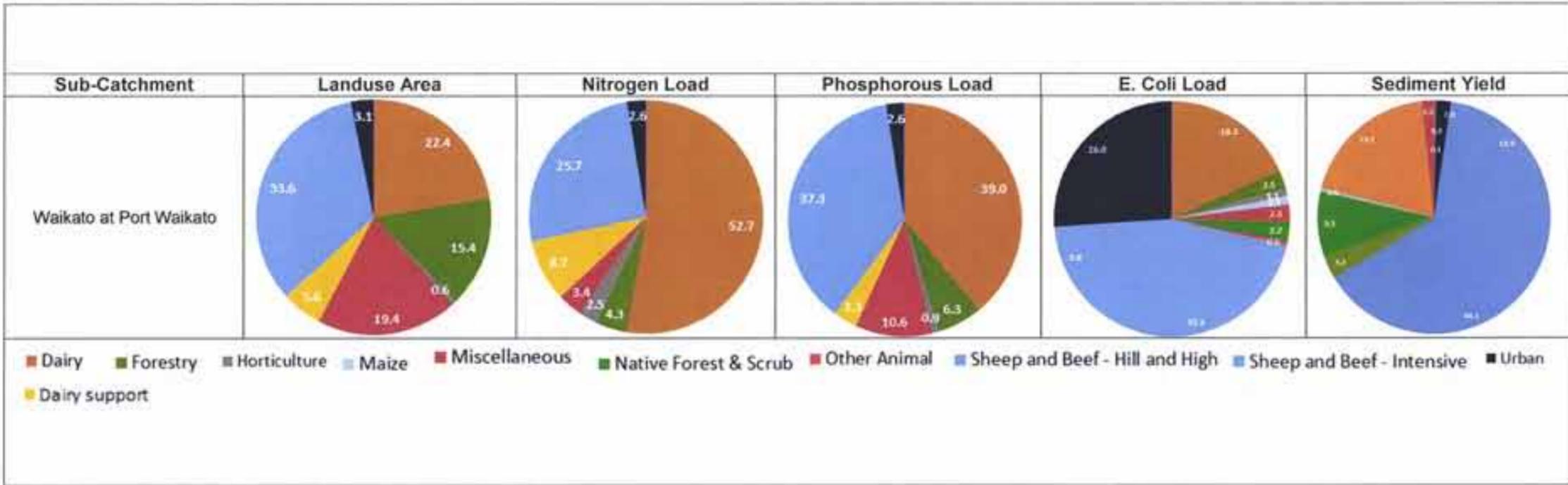
Appendix C: Proportion of land use type and unattenuated cumulative loads of nitrogen, phosphorus and sediment and attenuated E.coli loads (excluding point-sources) in selected sub-catchments along the Waikato River

Units: Percentage









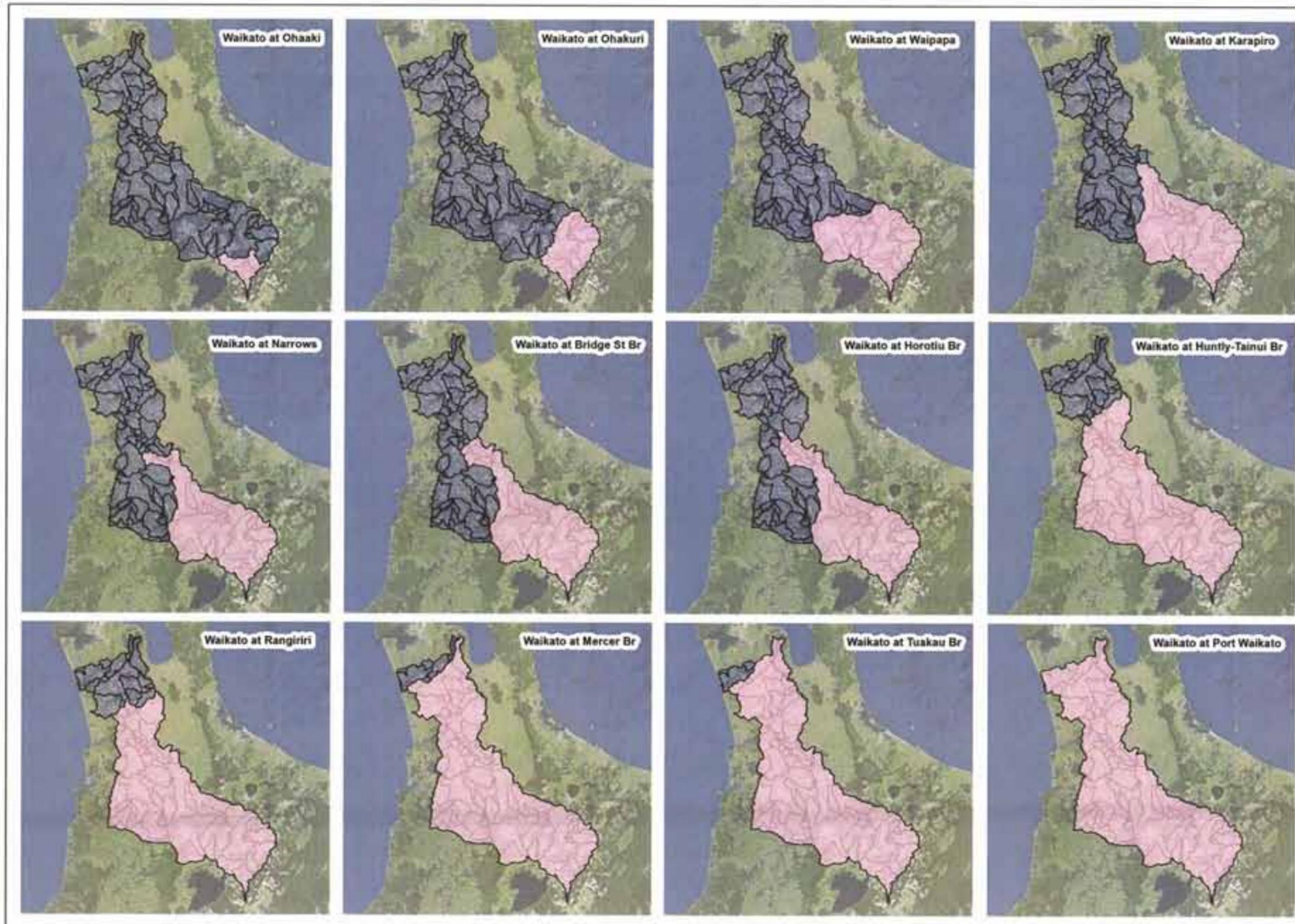


Figure 4.8 Selected subcatchments where unattenuated baseline cumulative contaminant loads for N, P and sediment and attenuated E.coli (supplied by NIWA and Landcare) have been graphed.