BEFORE THE HEARINGS PANEL
FOR THE CANTERBURY REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of Plan Change 5 of the Canterbury Land and Water Regional Plan

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STATEMENT OF EVIDENCE OF GAIL TEWARU TIPA ON BEHALF OF NGĀ RŪNANGA (TE RŪNANGA O KAIKŌURA, TE NGĀI TŪĀHURIRI RŪNANGA, TE HAPŪ O NGĀTI WHEKE, TE RŪNANGA O KOUKOURĀRATA, ŌNUKU RŪNANGA, WAIREWA RŪNANGA, TE TAUMUTU RŪNANGA, TE RŪNANGA O AROWHENUA, TE RŪNANGA O WAIHAO AND TE RŪNANGA O MOERAKI), NGĀI TAHU FARMING LIMITED, AND TE RŪNANGA O NGĀI TAHU (TE RŪNANGA)

22 JULY 2016

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TABLE OF CONTENTS

1. INTRODUCTION

1.1 My name is Gail Tewaru Tipa.

1.2 I whakapapa to a number of the marae in the Ngāi Tahu rohe. My father's whānau was originally from Tuahiwi before they moved down to Moeraki. My mother (who was non-Maori) is part of the Colquhoun and Tuft families who farmed on the Lower Taieri.

1.3 I am actively engaged in the affairs of Te Rūnanga o Moeraki. I have represented the interests of Moeraki in many resource management forums for the last twenty years.

1.4 I graduated from the University of Otago with a Bachelor of Arts (majoring in Geography), a Master of Regional and Resource Planning, and a Doctor of Philosophy (in Geography). I am the director and shareholder of Tipa and Associates Limited. We contract social science services to Crown Research Institutes. For example, my experience includes:

(a) developing a Cultural Health Index which is a method Maori can apply to assess stream health, including whether a stream supported cultural use, which has been adapted for use in the Murray Darling Basin;

(b) developing a process for undertaking Cultural Flow Assessments. This is a method to help whānau identify flows they want to see provided in rivers. It includes a consideration of the impact of flows on mahinga kai. This has been applied in more than 40 streams across New Zealand;

(c) developing values based report cards which is an approach that enables agencies to report against a range of indicators that relate to the attributes of taonga / practices / beliefs that whānau value;

(d) restoration of aquatic systems, usually involving the restoration of mahinga kai;

(e) linking mātauranga Maori with ecotoxicology which enables scientists to test sites whānau gather from and the species whānau gather. Understanding this information, along with data about how much is eaten by whānau and how often, enables

food safety limits to be investigated. Studies have been completed for the Rotorua lakes, Te Waihora, and the streams of South Canterbury;

(f) developing a cultural component to a Decision Support System (DSS) for urban waterways that is intended to help decision-makers plan the expansion of a city, taking account of waterways and estuarine areas; and

(g) our latest project is examining how to utilise both mātauranga Maori and western science to enable more effective participation of Maori in scenario planning processes (such as limit setting). Our focus to date has been the processes employed by Environment Canterbury.

1.5 We also continue to work in resource management:

(a) preparing applications for resource consent (usually subdivision consents);

(b) preparing impact assessments; and

(c) advising Councils in limit setting processes.

1.6 For my rūnanga (Te Rūnanga o Moeraki) my work mainly consists of:

(a) responding to applications for resource consent (subdivision);

(b) participating in plan change processes (both district and regional);

(c) establishing and maintaining relationships with resource users in our catchment;

(d) helping to implement rūnanga based projects; and

(e) representing the rūnanga on different komiti and forums.

1.7 I am an independent Director on the Bio-Protection Research Centre and I am on the Governance Group for the Biological Heritage National Science Challenge.

1.8 I am a Director of Kāi Tahu Ki Otago Ltd (**KTKO**), a resource management company owned by the four papatipu rūnanga in Otago.

1.9 I am also a Director of Ngāi Tahu Farming Limited, but I am not presenting evidence on their behalf today. I will not be mentioning Ngāi Tahu Farming Ltd in my evidence.

1.10 I am not a farm advisor and I am not presenting evidence as a technical farming expert. I am presenting evidence as a human geographer who has had the privilege of working with Ngā Rūnanga on a range of mahinga kai and freshwater management projects. More recently I have worked alongside whānau members from the Canterbury papatipu rūnanga who are engaged in limit setting processes.

1.11 Most recently, I worked with a number of the Canterbury Rūnanga in preparation of a report prepared for Environment Canterbury entitled *Water Quality, GMPs and Mahinga Kai,* prepared by Tipa and Associates Limited in June 2016 (**the report**). That report is attached to my evidence as **Appendix 1**.

1.12 I have been asked by Ngāi Tahu to prepare evidence for this hearing on Plan Change 5 to the Canterbury Land and Water Regional Plan (**PC5**) about the report.

2. SCOPE OF EVIDENCE

2.1 My evidence addresses the following:

(a) an assessment of existing Good Management Practices and the likelihood that they can appropriately protect mahinga kai;

(b) reasons why I conclude that the GMPs may protect mahinga kai; and

(c) examples of good "on the ground" initiatives.

2.2 In the first part of my evidence relating to Good Management Practice, my evidence addresses matters that I have included in the *Water Quality, GMPs and Mahinga Kai* report. I am not sure if Environment Canterbury took account of the report when developing policies and methods for PC5, but in my opinion it has direct relevance to the subject matter of PC5.

3. INVOLVEMENT IN PLAN CHANGE 5 PREPARATION

3.1 I have not been directly involved in the preparation or drafting of PC5. My rūnanga has a number of relationships with farming groups and works collaboratively in the Waitaki and our takiwā. This has been the focus of my attention, not actively participating in PC5. However, my company was asked by Environment Canterbury to undertake a specific project looking at mahinga kai and Good Management Practices (**GMPs**).

4. THE WATER QUALITY, GMPs AND MAHINGA KAI REPORT

4.1 The purpose of the GMP project was:

(a) to provide Ngāi Tahu with some confidence that mahinga kai values are being protected in Farm Environment Plans (**FEPs**);

(b) to build a common understanding of mahinga kai values within the farming community and industry;

(c) to provide practical and implementable tools the farming community, consultants and auditors can use to:

(i) identify and understand mahinga kai on a farm;

(ii) understand what needs to be done once something of mahinga kai value is identified and what practices should be undertaken to ensure risks on those values are managed; and

(iii) understand what needs to be done if something of value has been impacted as a result of poor farming practices to ensure risks on those values are managed;

(d) to provide advice on:

(i) the consenting process, i.e. what should be addressed as part of a consent application and form part of the FEP when risks on cultural values have been identified;

(ii) what things farmers would need to seek advice upon and who could provide that advice; and

(e) to provide advice on:

(i) how effects on cultural values, and in particular mahinga kai, are best addressed under the current framework; and

(ii) what further changes could be undertaken to assist with implementation.

4.2 When I use "we" or "our" in my evidence, I am referring to Tipa and Associates, and my work colleagues who assisted in the project and preparation of the report.

4.3 We were told by Environment Canterbury that the GMPs we were to focus on within our assessment were the GMPs within the Matrix of Good Management from Environment Canterbury, the GMPs from Dairy New Zealand and those from New Zealand Beef and Lamb. We also chose to add into our assessment some of the GMPs from Irrigation New Zealand and the Fertiliser Association of New Zealand.

4.4 Because the first part of the project was educational, we started with some conceptual diagrams to show how mahinga kai is affected by agricultural activities. Because mahinga kai is such a broad encompassing cultural belief and practice, we chose to show the impact of the attributes of mahinga kai.

4.5 The attributes of mahinga kai we identified were:

A. <u>Ecological integrity of aquatic habitats</u>

- *Oxygen – fish get oxygen from water*
- *Food – for plants, birds and fish and all parts of the food chain*
- *Habitat – riparian, channel structure, patterns and quantity of sediments, contaminants, interactions between fish and invertebrates, competition with predators (fish, birds, plants, invertebrates etc.). Flows create conditions for growth, keep water tables high, supplies nutrients etc. Variation establishes site specific conditions e.g. high flows move seeds etc. Flows work channels, banks, alter soil moisture etc.*
- *Temperature of water*
- *Cover in aquatic ecosystems – protects species from predators, high temperatures, high turbulence. Flows provide protection especially for riverbed bird species, clear weeds etc.*
- *Turbidity – linked to oxygen concentrations. Suspended matter affects growth rates, movements etc., affects streambed*
- *Riparian vegetation - provides woody debris to rivers, intercept sediments and nutrients etc. Vegetation lessen velocities and helps*

reduce flood peaks by facilitating infiltration to groundwater into the ground during high flows and releasing back to the channel as flows subside

- *Movement corridors – free movement for life cycle stages or to move to better habitats*
- *Water quality*

B. Abundance and good health of cultural materials and kai (iconic to place)

C. Gathering

- *Ability to gather*
- *Desirability of gathering*
- *Legal permission to gather*

D. Access

- *Physical access to sites*
- *Legal permission to access*

E. Historic and significant sites

- *Recognising relationship of whānau with specific sites (based on whakapapa)*
- *Historic associations*
- *Knowledge of sites retained and transferred*

F. Traditional techniques/sites known, practiced and knowledge transferred

- *Able to use*

G. Spiritual connections and respect for the waterway and the koiora it sustains

H. Pursue whānau/ marae/ hapū/ iwi aspirations to use resources and sites.

4.6 This approach of working with attributes of value has been used previously, for example in the Waikato catchment. Attributes of a cultural value and belief of practice have been used as the foundation of

environmental report cards, and restoration plans. The intention was to also show something tangible for farmers and industry to implement.[1]

4.7 At Environment Canterbury's direction, the first part of the project was a desktop exercise.

4.8 With respect to Ngāi Tahu interests in farming practices, the approach that we adopted was to list specific areas of interest, or concern to Ngāi Tahu. These can be found in iwi management plans, Cultural Impact Assessments and Ngāi Tahu's expectations of Ngāi Tahu farms. We then assessed whether there was a GMP related to that interest or concern.

4.9 **Table 1** below is a summary of the assessment as to whether or not the GMPs are likely to protect mahinga kai. This is taken from page 5 of the report.

Table 1: Summary of Assessment: Are GMPs Sufficient to Protect Mahinga Kai?

Will Irrigation Management protect mahinga kai ?	
Farm design stage	Possibly
Water application	Possibly
Monitoring	Yes
Staff trained to use irrigation system	Possibly
Will Nutrient Management protect mahinga kai?	
Sources identified	Yes
Nutrient use	Possibly
Winter grazing	Yes
On farm rubbish disposal	Possibly
Will effluent management protect mahinga kai?	
Effluent system (Farm design as well)	Possibly
Effluent application	Yes
Staff	Yes
Will soil management protect mahinga kai?	

[1] Rutherford, K. Williamson, B. (eds) Compiled by: NIWA, Tipa & Associates, Diffuse Sources Ltd, AgResearch, Nimmo-Bell & Co Ltd, and Beca Group , *The Waikato River – Current Condition and a Framework for Restoration*, NIWA Client Report: HAM2010-009 January 2010 NIWA Project: MFE10201

Farm design / infrastructure	Yes
Soil issues	Possibly
Erosion issues	Yes
Will **Riparian and Waterway management protect mahinga kai ?**	
Farm design	Possibly
Stock exclusion	Possibly
Farm containments reduction	Possibly
Biodiversity / Taonga	Possibly
Is there a Good Management Philosophy to protect mahinga kai ?	
Continuous improvement	No

4.10 In the report we then identified a number of gaps in the current GMPs. These are set out in the more detailed Table 2 in the report at pages 6-9. We discussed these with whānau at a hui before recommending some additions. The additions included:

(a) additions to existing GMPs; and

(b) the addition of new GMPs.

4.11 I want to focus on the areas where whānau wanted to see new GMPs developed. These are set out in Table 2 below, which is taken from pages 10-12 of the report:

Table 2: Summary of Assessment: Are GMPs sufficient to protect Mahinga Kai?

Farm layout, farm infrastructure
Farm infrastructure placement needs to consider water management, including impacts on mahinga kai. For example, the GMP could include: • Placement of farm lanes in relation to waterways; • Location of waterway crossing; • Placement of troughs; • Use of culverts.
Biosecurity Management
Biosecurity protocols shown on visible sign on entrance to property: • Issues listed; • Protocols listed; • Contact details are taken; and • Visitors and staff coming from overseas (and outside district) have clothing and gear checked.
Suitable wash-down area on farm for machinery and equipment
Staff, farm contractors and consultants informed of biosecurity protocols
Machinery and equipment cleaned before property and when leaving it if necessary
Feed brought in is certified weed and pest free
New stock are inspected and isolated in specific paddock for a recommended period of time to check for any unwanted pests
Staff are trained to identify pests or weeds
On farm containment / extermination plan in place for unwanted pests and weeds: • No natives are considered a pest or weed species and should be left alone
Good Management Philosophy – Continuous improvement
Farm manager / owner / staff member regular training or increasing of knowledge: • Training on new farm practises; • Investigating new technology; • Attending farming conferences, community meetings or events like workshops; and • Records of attendance or knowledge learnt.

Farm manager / owner / staff member has actively sought information or involvement of tangata whenua on farm related activities. Example includes access for gathering, restoration etc. • Consultation early is required; • Has worked with or meet with Maori to discuss environmental issues; and • Records of Runanga involvement.
Farm manager / owner / staff participation in any environmental farming awards: • Amount of times participated; and • Awards won.
Research and development: • On farm research; and • Off farm research (Surveys, interviews).
Community outreach: • Farmer is involved in local committees (e.g. Zone committees), community restoration groups (e.g. Landcare), resource management groups (e.g. irrigation company, irrigation committees); • Farmer involved in local charities or groups which promote or assist in improving the environment; and • Farmer involved with training or providing employment opportunities for locals.
Optimum cow feed (amount) or type of feed to minimise N loss from cows: • High production worth cows; and • Low N feed / crops.
Sufficient cow condition and suitable track/ land design to maintain cow health: • Healthy cows and not lame cows are more active. Therefore will distribute N in larger area
Water Management
Restoration
Restoration of waterway to increase biodiversity and taonga species: • Baseline study; and • Species focused restoration
Access
Access to waterways provided on farm:

• Permission required; • Tracks available
Wetlands[2]
Historical wetlands on farm have been protected and / or restored: • Wetlands have been identified and protected; and • Active restoration of wetland or restoration plan in place
Wetlands created on farm which provide habitat for taonga species: • Wetlands are designed with to create taonga species habitat
Mahinga kai is provided by wetlands: • Access to mahinga kai provided; and • Mahinga kai is gathered
Chemicals / fuel
Fuel storage, use and disposal meets HZNO regulatory framework
Fertiliser storage / handing
Fertiliser storage / handling / use complies with the Code of Practise for Nutrient Management (Fertiliser Association of New Zealand)
Biodiversity / Taonga species Management
Land or water on farm (or adjacent) protects taonga species and biodiversity: • QE II covenant; • Maitaitai; and • Taiapure
Taonga species research and/or restoration carried out on farm: • Fish stocktake; and • Species translocation
Ecological survey carried out on farm to identify biodiversity and taonga species present: • Baseline survey; and • Restoration driven by ecological survey

4.12 It is difficult to say definitively if the GMPs will maintain, restore or protect mahinga kai. They may do. Conversely they may not. We identified in the report a number of key factors that will determine whether the GMPs protect mahinga kai, specifically:

2 Please note the Beef and Lamb submission refers to legally protected wetlands. However, there are many wetlands that may not fit within this definition. Ngāi Tahu is seeking protection of wetlands regardless of the legal status of their protection.

(a) implementation;
(b) timing;
(c) prioritisation;
(d) integration; and
(e) proactively planning for mahinga kai.

4.13 **Implementation** - Whānau need to be assured that farmers are in fact doing what they are supposed to be doing. This means there needs to be evidence and an "audit trail". Sufficient records need to be kept and be available. Whānau want to know if farmers are using guidelines, factsheets and other information to proactively care for the environment or whether the focus is on their farm plan production. Ideally there will be evidence that data and information is informing farmers to help them make the right decisions.

4.14 Inevitably, whānau want to see that initiatives are being implemented. This means that biodiversity initiatives, riparian enhancements, and waterway management initiatives need to be prioritised and started. Visible action on the ground is the best evidence of implementation.

4.15 **Timing -** Timing is closely linked to implementation. Actions in any plan need to have timeframes alongside them and evidence available to confirm timeframes are being met. For example:

(a) set a target for how many kilometres of riverbank are to be planted and by when;
(b) set a target for fencing of all critical source areas; and
(c) sets dates for transitioning to more precise technology.

4.16 **Integration –** In the report we chose to use the attributes of mahinga kai to help assess if and how GMPs could protect mahinga kai. However, a farmer cannot choose to protect just one attribute (e.g. temperature). In order for mahinga kai to be maintained, enhanced and protected <u>all attributes</u> (especially the bio-physical attributes) need to be maintained, enhanced and protected. If all the bio-physical attributes are protected then the cultural values they underpin are also likely to be maintained, enhanced and protected.

4.17 **Prioritisation -** As there are many financial fluctuations in the agricultural sector, it is imperative that environmental initiatives are not deferred. Protection of mahinga kai requires implementation of initiatives as soon as practicable. While whānau are likely to accept that initiatives are staged, they are not likely to wait 10 years for the planting to start.

4.18 **Proactively planning for mahinga kai -** Finally, GMPs are designed to:

(a) control the activities that cause an impact e.g. nutrient management; and

(b) mitigate the activities that cause a decline e.g. riparian planting.

4.19 Whānau noted that this is markedly different to North America where there are Best Management Practices (**BMPs**) that are specific to proactive action, such as biodiversity management. They also focus upon biodiversity protection and enhancement rather than just mitigating the impacts on biodiversity. This gives an indication of how a GMP specific to mahinga kai could be structured.

4.20 Ngāi Tahu believe that there are different components of the Farm Management Plan (**FMP**) and FEPs, and their focus (and level of proactivity) can change as follows:

(a) the FMP can include the GMPs to mitigate the effects of farming; and

(b) the FEP within the FMP can describe how it will proactively protect biodiversity, wetlands, riparian margins etc.

4.21 Clearly the existing GMPs will contribute to an environmental outcome but that does not necessarily mean that a mahinga kai outcome will be realised. Farmers and auditors need to understand what is needed for a mahinga kai outcome.

4.22 Fencing and planting may meet a GMP, but may fail to meet the needs of mahinga kai. Ideally the farmer will consider native species mix, planting density etc. In other words, the GMP is not just to plant the riparian margin, it is to ensure that the riparian margin is fit for purpose – fit for mahinga kai or the gathering of cultural materials.

4.23 Biodiversity is also a focus of a number of GMPs. While many indigenous species are a taonga species,[3] again planting with the purpose of a mahinga kai outcome in mind may shape some choices. Mahinga kai needs to be a part of all decisions relating to biodiversity.

4.24 Being able to provide a simple table / diagram / photos that confirm that mahinga kai interests have been factored into their plan (or are being implemented) would be the ideal.

5. PRACTICAL IMPLEMENTATION OF ON-FARM INITIATIVES

5.1 From my own experiences, I am aware of practical examples where rūnanga have worked directly with farmers:

(a) to restore wetlands, including prioritising the restoration of taonga species;
(b) to protect rock art on farms - multiple farmers in South Canterbury and North Otago are working with the Ngāi Tahu Rock Art Trust;
(c) to gain access to sites to replant native species, to undertake surveys of taonga species, and to undertake relocation of species;
(d) to enable access for kai gathering or the gathering of cultural materials;
(e) to accompany auditors on their inspection of farms;[4]
(f) to develop restoration plans to be part of a FEP;
(g) to comment on the templates of farm plans that an irrigation company intended to use; and
(h) to invite whānau to farming forums.

5.2 Such initiatives are positively received by Ngāi Tahu whānui who want to acknowledge publicly the innovation and collaboration that is evolving.

5.3 These positive initiatives clearly demonstrate that recognition of cultural interests need not be seen as a threat, and need not be at the expense of farming activities.

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3 See Schedule 97 of the Ngāi Tahu Claims Settlement Act 1998.

4 This is not participating as an auditor.

5.4 However, there are also examples that I am aware of where "restoration" has adversely impacted mahinga kai:

(a) an enhancement has prioritised aesthetics and not functionality e.g. species are planted that are not indigenous species, or cultural materials used by whānau. Willows and poplars are still being used in some areas for erosion control and these are not indigenous species;

(b) planting a species as riparian protection that may serve that purpose but ultimately results in a waterway being unfit for gathering. For example *mimulus* (Monkey Musk) is a herbaceous wildflower that grows along the banks of streams and seeps in Western North America. Both annual and perennial forms occur throughout the species' range. Monkey Musk was recommended as riparian cover and was planted alongside waterways. This species however spreads and covers the riverbed covering pools and holes making it dangerous to gather. Also, unless it is flowering, some mistake it for watercress and consume it;

(c) culverts are placed to keep cows out of waterways (which is positive) but there is no consideration of fish passage which could be relatively low cost;

(d) poor maintenance of plantings, or planting the wrong species, leads to limited outcomes; and

(e) restoration does not take account of mahinga kai in a waterway.

5.5 If there was statutory provision requiring a FEP to take account of mahinga kai, there would be an opportunity to avoid these mistakes.

6. NGĀI TAHU RELIEF

6.1 My understanding of the preferences and relief, obtained through my working relationship with Ngāi Tahu whānau, is that they do not want to stop good farmers carrying out best practice, especially those who work with Ngāi Tahu on a range of initiatives. As noted in paragraph 5.1 above some landowners are voluntarily engaging with Ngāi Tahu when developing farm plans.

6.2 Ngāi Tahu want to continue to gather and use resources. There are multiple mechanisms that have been negotiated over the years to give effect to this goal. For example, there are provisions in the Ngāi Tahu Claims Settlement Act 1998. There are kaitiakitanga targets in the Canterbury Water Management Strategy.

6.3 However, my concern is that some of these mechanisms will be devalued by inadequate farm environment planning. Ngāi Tahu know that landowners are a key component in ensuring that waterways (and resources) are fit for use, and are not adversely impacted by their land use. There are limited mechanisms that enable Ngāi Tahu to directly influence landowner decisions, at an individual farm scale. The mechanism that is now available to give Ngāi Tahu confidence that landowners are mitigating the effects of their operations of water quality is the mechanism of farm plan preparation, implementation, audit and enforcement.

6.4 The relief sought only relates to the first part of that mechanism; the preparation of farm plans.

6.5 The report concluded that it is possible that FEPs will result in outcomes that benefit mahinga kai. In my view, the risk is that these environmental benefits will be ad-hoc, incremental, and incidental.

6.6 There could be further mahinga kai losses. Ngāi Tahu has already experienced multiple mahinga kai losses.[5] It cannot risk losing more. On- farm initiatives may be in locations that are totally divorced from the location of mahinga kai.

6.7 However, more likely in my opinion, is that GMPs will address only one of the attributes of mahinga kai, rather than proactively working to enhance multiple attributes. For example, planting around a waterbody may beautify it, and may provide shade and regulate temperature, but it may not provide habitat and food for taonga species valued as a mahinga kai.

6.8 The relief sought by Ngāi Tahu is to provide more certainty to the outcomes that can be expected. Paragraph 6.1 above demonstrates that

5 Mahinga kai was one of the pillars of the Ngāi Tahu claim to the Waitangi Tribunal.

some landowners are already identifying ways to work collaboratively with Ngāi Tahu at the local level. However, this behaviour is not "business as usual" or normal behaviour.

6.9 The relief sought by Ngāi Tahu is to formalise this through a statutory mechanism rather than relying on the goodwill of a landowner or the outcomes from incidental enhancements.

6.10 The approach for the Waitaki (Part B of PC5), with regard to the inclusion of mahinga kai in FEPs, would be appropriate for inclusion as a region wide approach to how mahinga kai is addressed in FEPs. FEPs must be prepared in accordance with Schedule 7 of the Canterbury Land and Water Regional Plan. Part B of PC5 currently provides, that the following be added to Schedule 7, but only for within the Waitaki Sub-region:

> *Management Area: Mahinga kai*
> *Objective: To protect mahinga kai values*
> *Targets:*
> *1. Mahinga kai values on the property are recognised by achieving other objectives and targets in the Farm Environment Plan, and in addition by:*
> *(a) maintaining existing indigenous vegetation in accordance with relevant regional council and district council vegetation clearance rules or any granted resource consent;*
> *(b) identifying opportunities to undertake additional plantings of indigenous vegetation, and carrying out and managing any additional plantings in accordance with regional council guidelines for riparian planting;*
> *(c) undertaking farming activities in a manner that minimises adverse effects on existing indigenous vegetation and on any additional planting of indigenous riparian vegetation; and*
> *(d) managing pest plants in accordance with any regional council rules.*

6.11 I would like to suggest the following amendment to the provision in Part B, and I note that I consider this should apply region wide (as sought in Ngāi

Tahu's submission on Part A), rather than being focused on the Waitaki sub-region.

> *Management Area: Mahinga kai*
> *Objective: To protect mahinga kai values*
> *Targets:*
> *1. The effects of Mahinga kai values on the property are ~~recognised~~ **managed** by achieving other objectives and targets in the Farm Environment Plan, and in addition by:*
> *(a) maintaining existing indigenous vegetation in accordance with relevant regional council and district council vegetation clearance rules or any granted resource consent;*
> *(b) identifying opportunities to undertake additional plantings of indigenous vegetation, and carrying out and managing any additional plantings in accordance with regional council guidelines for riparian planting;*
> *(c) undertaking farming activities in a manner that minimises adverse effects **on waterways, riparian areas,** and existing indigenous vegetation and on any additional planting of indigenous riparian vegetation; and*
> *(d) managing pest plants in accordance with any regional council rules.*
> ***(e) Implementing any measures identified by and agreed with Ngāi Tahu.***

6.12 I have changed the wording in point 1 above because, as I explain the sections 5 and 6 of my evidence above, farmers may manage adverse effects on mahinga kai by implementing GMPs. However, it is unlikely that the farmer will be able to "recognise" the effects without the assistance of Ngāi Tahu.

6.13 1(c) above needs to explicitly refer to the effects on waterways and riparian areas.

6.14 The addition of 1(e) above recognises that the farmer can work with Ngāi Tahu to identify and agree targeted mahinga kai enhancements. I also

accept that this is included in the plan as a target and is not part of the objective. Requiring that both parties need to "agree" on the initiatives gives a level of confidence to the landowner that this clause envisages a relationship evolving over time, rather than the initiative being dictated to the landowner.

Gail Tewaru Tipa
22 July 2016

APPENDIX 1

Water Quality, GMPs and Mahinga Kai

Prepared by Tipa and Associates Limited, June 2016

WATER QUALITY, GMPs & MAHINGA KAI




Prepared by

Tipa & Associates Ltd

June 2016

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The landscape of Canterbury is dotted with sites utilised by Ngai Tahu. Sadly many places across Canterbury have been physically destroyed, or damaged by development, or are at risk from development. Today, Ngai Tahu remains committed to restoring valued sites, and reconnecting associations with these sites, including the reinstatement of patterns of resource use. Landowners are the fundamental component of any region wide initiatives to restore water quality, and mahinga kai.

In this summary we start with two tables. The first table is a summary of the assessment as to whether or not the GMPs are likely to protect mahinga kai. This high level table is then followed by a more detailed table that summarises gaps in the existing GMPs.

Table 1: Summary of Assessment: Are GMPs sufficient to protect Mahinga Kai?

Irrigation Management	
Farm design stage	Possibly
Water application	Possibly
Monitoring	Yes
Staff trained to use irrigation system	Possibly
Nutrient Management	
Sources identified	Yes
Nutrient use	Possibly
Winter grazing	Yes
On farm rubbish disposal	Possibly
Effluent management	
Effluent system (Farm design as well)	Possibly
Effluent application	Yes
Staff	Yes
Soil Management	
Farm design / infrastructure	Yes
Soil issues	Possibly
Erosion issues	Yes
Riparian and Waterway management	
Farm design	Possibly
Stock exclusion	Possibly
Farm containments reduction	Possibly
Biodiversity / Taonga	Possibly
Good Management Philosophy	
Continuous improvement	No

In the table below we provide a brief summary of the gaps in the current GMPs.

Table 2: Summary of gaps in GMPs

Irrigation Management	
Farm design stage	
High slope risk if >20 degrees. Evaluated and checked if irrigation appropriate or if too much risk.	No specific GMP relating to terrain or geographic considerations in designing the irrigation system. General statements are made but no reference to slope.
Irrigation system placement and design takes into consideration environmental risk on farm	Focus is upon management of irrigation system to improve efficiencies and reduce the risk of impacts on environment. There is limited consideration of the environment in terms of waterways etc. with the focus on soils and climate.
Backflow preventer if fertiliser, effluent or chemical applied using irrigation system	No specific GMP
Monitoring	
Soil moisture monitoring	No specific detail on the required minimum standard for measuring soil moisture. The minimum standard should be the use of a soil moisture probe in correct spots on farm to assist in decision making.
Rainfall monitoring (Rainfall records and weather forecasts used)	No specific details on how records will be keep and the amount of detail required. There is a need for a standard of record keeping.
Irrigation application records keep and evidence of their use in irrigation application decision making	There are limited details in the GMPs relating to record keeping. These are critical in good farm management decision making and auditing. Records need to meet a high standard as a farmer needs to show how they use this information when making farm management decisions.
Staff trained to use irrigation system	
Staff using irrigation system are sufficiently trained	No specific mention of records of training or experience.
A staff member has relevant INZ irrigation training	No specific GMP relating to INZ training although this maybe included within the GMP above.
Water application	
Avoid and mitigate on farm leakages	No specific GMPs relating to farm incident reporting or record keeping in relation to this.
Nutrient Management	
Sources identified	
Nutrient budget (yearly) in place which has used soil tests	No detail on how the soil tests will be carried out on farm.
Nutrient use	
No nitrogen is applied on farm or farmer has/ is reducing nitrogen usage on farm	These GMPs refer to reducing or keeping N application under a specific rate. A more specific GMP is required to identify farmers whom are making the significant effort of reducing overall N usage (or eliminating N usage on farm)
Fertiliser applied by Spreadmark standards or using an certified individual with calibrated, maintained equipment	No specific GMP

GPS used for all nutrient application	The use of GPS technology is included but without mention of any checks to see if the data produced is being used. If the data is not being used or checked then the total value of technology and data is not fully utilised.
All records relating to nutrient application are keep up to date	Maintaining accurate records is stressed rather than the use of this data in farm management. This underutilises the data and means compliance isn't being checked.
Winter grazing	
Management techniques or measures taken to mitigate sediment or nutrient runoff	No GMPs in relation to stocking rates, crop selection (follow up crop) or selection of appropriate spot for winter grazing
On farm rubbish disposal	
All non-biodegradable rubbish is removed from farm to be disposed of in an sustainable manner	No mention of using skips or disposing of rubbish sustainably off farm. The focus is making sure farm dumps don't impact water or impact human / animal health. Also no mention of recycling of any rubbish including Ag recovery and Plasback
Chemical containers are disposed of correctly via an authorised / certified organisation or following correct guidelines	No mention within any of the GMP or correct disposal of chemical containers
Effluent management	
Effluent system (Farm design as well)	
Effluent system sufficient for the farms operation	The GMPs covers general rules relation to effluent management including sufficient storage and compliance. They don't specify a minimum amount of storage required and don't discuss terrain, soil or terrain considerations. Although these maybe captured within the general GMPs.
Effluent system designed so areas where its applied are as far away from critical source areas as possible (waterways, sensitive soils, tracks etc.)	None - No specific GMPs relating to the consideration of critical source areas or areas of environmental risk when designing the effluent system or placing the effluent infrastructure.
Effluent system is compliant with council regulations and meets industry standards	INZ standards are not mentioned but effluent design code of practise is included as a GMP. These maybe similar. Although there is no mention of certification or auditing by an independent individual or organisation.
Effluent application	
Effluent application map created and used when applying effluent	No details on what the effluent management plan covers and how actively it has to be used.
Effluent is applied to the maximum area of the farm to reduce leaching risk or is taken off farm if required	This GMP implies the farmer will apply effluent to the maximum area to maximum the use of the nutrients within the effluent. There is no GMP relating to maximising effluent application area to reduce the risk of N leaching. Although this may be covered by the Effluent application plan.
Effluent is spread away from the following area	Within the Dairy NZ Effluent application plan they refer to having 20m buffers between waterways and areas where effluent is applied. This is less than 50m or 150m or having effluent being applied as far as possible away from areas of risk i.e. waterways.
GPS technology or application technology (VRI, Trackmap) used when applying effluent	When irrigation infrastructure is used to apply effluent this may be covered within those GMPs. Effluent management plan or application plan may cover these aspects.

Staff	
Incidents relating to effluent storage or application are addressed as soon as possible and fixed to prevent occurring again. This can include breakages (may need replacement or upgrade) or weather / human events.	Each farms effluent management plan may cover this GMPS in varying detail. Although the detail or how well this system is carried out is dependent on each specific farm. This GMP may be covered within irrigation management – water application. A discharge consent may cover some of these GMPs.
Soil Management	
Soil issues	
Soil compaction checked and identified on farm. Areas of highest risk of compaction checked first (fodder paddocks, cropped areas)	No GMP associated with reducing irrigation, effluent or fertiliser application completely. Most GMPs (including Irrigation management and effluent management) focus on changing or modifying farming practises which may include reduce or cutting application if there is an environmental risk.
Soil compaction maps created for staff and contractor use	No mention of staff training or map creation. Soil compaction issues maybe within a general farm map or within irrigation or effluent management plans / maps.
Riparian and Waterway management	
Farm design	
Areas of potential cultural significance or high biodiversity identified and integrated into farm design	No specific GMP
Fish passage maintained or protected	There are some GMPs relating to protecting fish passage but no reference to excluding fish from entering water infrastructure which may have a negative impact on them.
Waterways, wet areas and areas of environmental risk are considered when designing a farm conversion or expansion	Some GMPs address this issue but the entire farm design should take into consideration all the environmental risks when converting or a major upgrade on farm. Evidence of making these design considerations is proof the farmer is fully considering environmental risks. Farm design is fundamental in addressing environmental risks.
Stock exclusion	
All stock are excluded from all waterways, wetlands or wet areas all the time	More specific GMPs needed on types of fencing with stress upon permanent fencing and buffers between fencing and area of environmental risk i.e. waterways.
Farm containments reduction	
Riparian buffer with native vegetation planted on farm	No specific GMP relating to the minimum size for buffer strips. The focus is upon mitigating run off from farm operation.
Riparian planting plan designed or planned to be developed within one year	Riparian planting programme may include the targets listed but again its dependant on each individual farmer. Preparing a riparian planting plan shouldn't be the only objective.
Biodiversity / Taonga	
Habitat for taonga species protected on farm	No specific GMPs relating to cultural values although there may be some overlap within other GMP in other sections.
Weed or pest control on farm to assist in increasing native biodiversity	No specific GMP relating to weed or pest control on farm but assumed
Staff training or certification in use of chemicals on farm which could have an impact on environment.	No specific GMP which is of concern as this have the potential to have direct impact on native vegetation and native fish specific is proper training or guidelines are not in place.

Good Management Philosophy	
Continuous improvement	
Farm manager / owner / staff member regular training or increasing of knowledge.	No specific GMP
Farm manager / owner / staff member has actively sort information or involvement of tangata whenua on farm related activities. Example includes access for gathering, restoration etc.	No specific GMP
Farm manager / owner / staff participation in any environmental farming awards	No specific GMP
Research and development	No specific GMP
Optimum cow feed (amount) or type of feed to minimise N loss from cows	No specific GMP
Community outreach	No specific GMP
Sufficient cow condition and suitable track design to maintain cow health	No specific GMP

In this report we have therefore recommended some additions:

- Some are additions to existing GMPs; and
- Some are new GMPs.

Recommended additions to existing GMPs

Addition to Irrigation Management
Farm design
High slope risk if >20 degrees. Evaluated and checked if irrigation appropriate or if it represents too much risk.
Backflow preventer if fertiliser or effluent or chemical applied using irrigation system
Addition to Nutrient Management
Nutrient use
Fertiliser not applied within 10 metres of a waterway
Fertiliser applied by Spreadmark standards or using an certified individual with calibrated, maintained equipment • Spreadmark certified; • Equipment meets standards and has maintenance records (can deliver right amounts / rates); • Individual has more than 5 years' experience in applying nitrogen and can demonstrate knowledge of standards; • Individual knows all the risk areas on farm (give farm map with areas on it); • Individual knows the nutrient budget and can certify the correct amount / rate will / is applied on farm.
Addition to Effluent Management
Effluent system
Effluent system designed so areas where its applied are as far away from critical source areas as possible (waterways, sensitive soils, tracks etc.)

Addition to Riparian Management
Farm design
Areas of potential cultural significance or high biodiversity identified and integrated into farm design • Plan developed to minimise impact or enhance this areas on farm
Staff training or certification in use of chemical on farm which could have an impact on environment (some covered in nutrient management) • Staff have maps or knowledge of what species to spray and what not to spray or areas; • Have been trained with equipment and chemical.

Recommended new GMPs to be developed

Farm layout, farm infrastructure
Farm infrastructure placement needs to consider water management, including impacts on mahinga kai. For example the GMP could include: • Placement of farm lanes in relation to waterways; • Location of waterway crossing; • Placement of troughs; • Use of culverts.
Biosecurity Management
Biosecurity protocols shown on visible sign on entrance to property • Issues listed; • Protocols listed; • Contact details are taken; and • Visitors and staff coming from overseas (and outside district) have clothing and gear checked.
Suitable wash-down area on farm for machinery and equipment
Staff, farm contractors and consultants informed of biosecurity protocols
Machinery and equipment cleaned before property and when leaving it if necessary
Feed brought in is certified weed and pest free
New stock are inspected and isolated in specific paddock for a recommended period of time to check for any unwanted pests
Staff are trained to identify pests or weeds
On farm containment / extermination plan in place for unwanted pests and weeds • No natives are considered an pest or weed species and should be left alone
Good Management Philosophy – Continous improvement
Farm manager / owner / staff member regular training or increasing of knowledge • Training on new farm practises; • Investigating new technology; • Attending farming conferences, community meetings or events like workshops; and • Records of attendance or knowledge learnt.
Farm manager / owner / staff member has actively sort information or involvement of tangata whenua on farm related activities. Example includes access for gathering, restoration etc. • Consultation early is required; • Has worked with or meet with Maori to discuss environmental issues; and • Records of Runanga involvement.

Farm manager / owner / staff participation in any environmental farming awards • Amount of times participated; and • Awards won.
Research and development: • On farm research; and • Off farm research (Surveys, interviews).
Community outreach: • Farmer is involved in local committees (e.g. Zone committees), community restoration groups (e.g. Landcare), resource management groups (e.g. irrigation company, irrigation committees); • Farmer involved in local charities or groups which promote or assist in improving the environment; and • Farmer involved with training or providing employment opportunities for locals.
Optimum cow feed (amount) or type of feed to minimise N loss from cows: • High production worth cows; and • Low N feed / crops.
Sufficient cow condition and suitable track/ land design to maintain cow health: • Healthy cows and not lame cows are more active. Therefore will distribute N in larger area
Water Management
Restoration
Restoration of waterway to increase biodiversity and taonga species • Baseline study; and • Species focused restoration
Access
Access to waterways provided on farm • Permission required; • Tracks available
Wetlands[1]
Historical wetlands on farm have been protected and / or restored: • Wetlands have been identified and protected; and • Active restoration of wetland or restoration plan in place
Wetlands created on farm which provide habitat for taonga species • Wetlands are designed with to create taonga species habitat
Mahinga kai is provided by wetlands: • Access to mahinga kai provided; and • Mahinga kai is gathered
Chemicals / fuel
Fuel storage, use and disposal meets HZNO regulatory framework
Fertiliser storage / handing
Fertiliser storage / handling / use complies with the Code of Practise for Nutrient Management (Fertiliser Association of New Zealand)
Biodiversity / Taonga species Management
Land or water on farm (or adjacent) protects taonga species and biodiversity • QE II covenant; • Maitaitai; and • Taiapure

[1] Please note the Beef and Lamb refer to legally protected wetlands. However, there are many wetlands that may not fit within this definition. Ngai Tahu is seeking protection of wetlands regardless of the legal status of their protection.

Taonga species research and/or restoration carried out on farm • Fish stocktake; and • Species translocation
Ecological survey carried out on farm to identify biodiversity and taonga species present • Baseline survey; and • Restoration driven by ecological survey

Key factors underpinning protection of mahinga kai

It is difficult to say definitively if the GMPs will maintain, restore or protect mahinga kai. They may do. Conversely they may not. The key to be the GMPs protecting mahinga kai is implementation, timing, prioritisation, communication, planning for mahinga kai, limits, and integration.

Implementation

Whanau need to be assured that farmers are in fact doing what they are supposed to be doing. This means there needs to be evidence and an "audit trail". Records need to be kept and be available. Whanau want to know if farmers using guidelines, factsheets and other information to proactively care for the environment or is the focus on their farm plan production. Ideally there will be evidence that data and information is informing on farm decisions.

Inevitably, whanau want to see that initiatives are being implemented. This means that biodiversity initiatives, riparian enhancements, waterway management initiatives need to be prioritised and started. Visible action on the ground is the best evidence of implementation.

Timing

Timing is closely linked to implementation. Actions in any plan need to have timeframes alongside them and evidence available to confirm timeframes are being met. For example:

- Set a target for how many km of riverbank are to be planted by when.
- Set a target for fencing of all critical source areas.
- Sets dates for transitioning to more precise technology.

Integration

We have chosen to use the attributes of mahinga kai to help assess if and how GMPs could protect mahinga kai. However a farmer cannot choose to protect one attribute (e.g. temperature). In order for mahinga kai to be maintained, enhanced and protected **all attributes** especially the bio-physical attributes need to be maintained, enhanced and protected. If all the bio-physical attributes are protected then the cultural values they underpin are also likely to be maintained, enhanced and protected.

Prioritisation

As there are many financial fluctuations in the agricultural sector, it is imperative that environmental initiatives are not deferred. Protection of mahinga kai requires implementation of initiatives as soon as practicable. While whanau are likely to accept that initiatives be staged, they are not likely to wait 10 years for the planting to start.

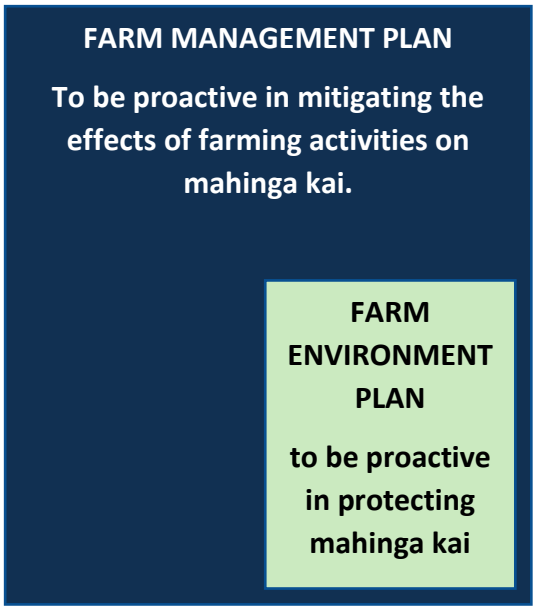
Proactively planning for mahinga kai

Finally, it is necessary to summarise an issue we raise in section 3.2. GMPs are designed to

- to control the activities that cause an impact e.g. nutrient management.
- to mitigate the activities that cause a decline e.g. riparian planting.

We note this is markedly different to North America where there are also BMPs that are specific to proactive action, such as wetland management, or biodiversity management. The biodiversity GMPs give an indication of how a GMP specific to mahinga kai could have been structured. Also Ngai Tahu believe that there are different components of the FMP and their focus (and tenor) can change:

- The FMP can include the GMPS to mitigate the effects of farming; and
- The FEMP within the FMP can describe how it will proactively protect biodiversity, wetlands, riparian margins etc.



Clearly the existing GMPs will contribute to an environmental outcome but that does not necessarily mean that a mahinga kai outcome is to be realised. Farmers and auditors need to understand what is needed for mahinga kai outcome.

- Fencing and planting may meet a GMP. But it may fail to meet the needs of mahinga kai. Ideally the farmer will consider native species mix, planting density etc. In other words, the GMP is not to plant the riparian margin, it is to ensure that the riparian margin is fit for purpose – fit for mahinga kai.
- Biodiversity is also a focus of a number of GMPs. While many indigenous species are a taonga, again planting with a purpose in mind (mahinga kai) may shape some choices. Mahinga kai needs to be a part of all decisions relating to biodiversity.

Being able to provide a simple table / diagram / photos that confirms that mahinga kai interests have been factored into their plan (or are being implemented) would be the ideal.

Limits

Limits need to be limits and not targets. There needs to be a clear plan showing that limits are to be met or, (even better), that implementation of the GMPs will in fact enable the farmer to perform better than the ECan limits.

1.0 INTRODUCING THE PROJECT

1.1 Introduction

The landscape of Canterbury is dotted with sites utilised by Ngai Tahu. These places did not function in isolation from one another, but were part of a wider cultural setting. Settlement in the nineteenth century impacted these valued landscapes. Many places across Canterbury have been physically destroyed, or damaged by development, or are at imminent risk from development. Today, Ngai Tahu remains committed to restoring valued sites, and reconnecting associations with these sites, including the reinstatement of patterns of resource use.

Of concern to Ngai Tahu is the ongoing loss of use of lands in the face of economic development, which could lead to the loss of knowledge about the wider associations between sites surrounding and supporting resource use. When compounded with other factors they represent the possible loss of a mahinga kai based culture. What also needs to be stressed is the fact that when individual Ngai Tahu are operating within a rights based system, uses cannot easily be translocated from one area to another because their site has been damaged or destroyed. This means restorative actions cannot focus on a particular site, and instead need to be applied region wide. Landowners are the fundamental component of any region wide initiatives to restore water quality, and mahinga kai.

Water is highly valued by the regional community for a variety of economic, environmental, cultural and social reasons. Within the Canterbury region there are competing demands between the use of for water for extraction and the use of water for maintenance or improvement of instream values. Water allocation decision making is therefore an area attracting intense interest and often criticism. On-going land use change enabled by irrigation development is another area of debate. At the same time Ngai Tahu is advocating for greater recognition of Tangata whenua values, protection of biodiversity values, protection of water quality and associated in-stream values. There are widely held concerns within Ngai Tahu communities with respect to the decline in the quality of lowland streams.

1.2 The purpose of the project

The objective of this project is to undertake a gap analysis of industry Good Management Practices (GMPs) to:

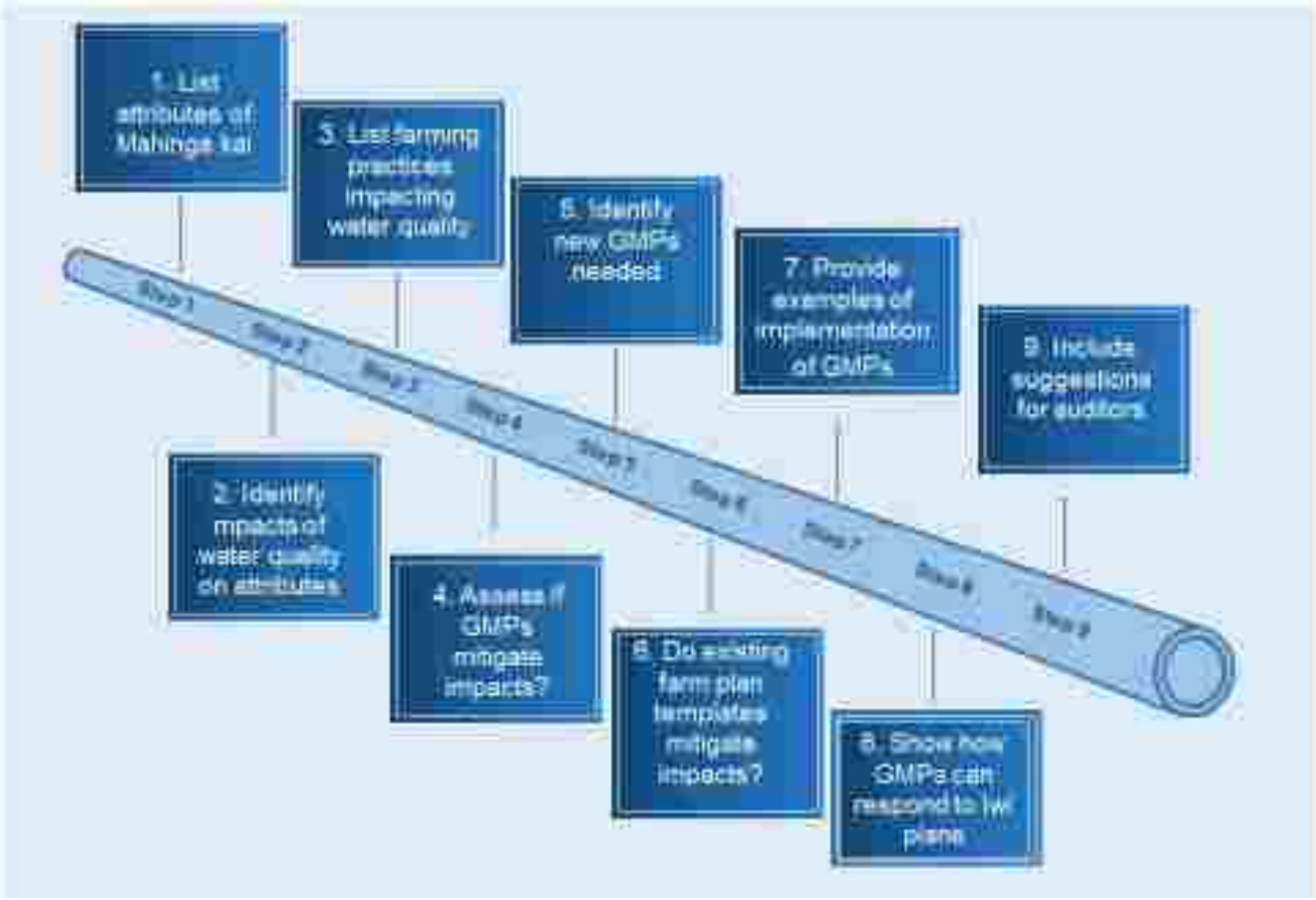
1. Assess whether the current industry GMPs will effectively deliver mahinga kai outcomes; and
2. If gaps are identified, identify what practices could effectively deliver the mahinga kai outcomes.

This stage of the project was solely a desktop exercise that centres on a review of existing written documents including Cultural Impact Assessments, iwi management plans, submissions, minutes, and an assortment of papers and articles.

1.3 The process that we followed

There were 9 steps in the process that we followed. These are set out in Figure 1.

FIGURE 1: THE 9 STEP PROCESS THAT FOLLOWED.



When the draft report was prepared it was circulated to Ngai Tahu representatives on the Zone Committees. The contents of this paper were also discussed with some representatives of Ngai Tahu at a hui held at Te Whare o Te Waipounamu. A number of changes were made as a result of that hui.

Each of these steps in Figures 1 corresponds to a section of the plan. However, we start by providing:

- An overview of the Canterbury Water Management Strategy ; and
- An introduction to the cultural beliefs and values of Ngai Tahu whanau.

2.0. BACKGROUND

2.1 Understanding the Canterbury Water Management Strategy

The Canterbury Water Management Strategy (CWMS) was an initiative of the Canterbury Mayoral Forum to provide a strategic response to water management issues in the Canterbury region. It presents an analysis of the scientific data from technical reports and the advice and opinion from public consultation and makes extensive recommendations for changes regarding water management in the region.

The CWMS is the result of four Canterbury strategic water studies (CSWS). The CSWS provides an opportunity for integrated and strategic water management planning for the whole region. The following paragraphs provide a brief summation of key components of the strategy.

2.1.1 The Key Challenges affecting Water Management in Canterbury

The CWMS detailed the key challenges facing the Canterbury region – they are

1. Pressure on river systems
    - Run-of-river takes are near the limit of what can be safely abstracted while maintaining environmental flows.

2. Restrictions are already widely in use, with the greatest pressure on lowland streams.

3. Pressure on aquifer systems
    - There are now ten red zones in Canterbury, where water has been fully allocated, and four "yellow zones", where allocation exceeds 80% of the allocation limit.

4. Cumulative effects on ecosystems
    - In lowland and coastal areas, remaining indigenous vegetation tends to occur in small, scattered fragments.
    - Less than 10% of the region's previously extensive wetlands remain.
    - There is a general decline in freshwater biodiversity.
    - In parts of the hill and high country, accelerating land use change and intensification is threatening the important indigenous habitat that remains.

5. Cultural health of waterways
    - The cultural health of freshwater in Te Wai Pounamu is moderate to poor.

6. Water use efficiency
    - Some substantial efficiency gains can be made.

7. Climate change
    - Projections of climate change suggest the region will become drier and need more irrigation simply to maintain existing outputs from the land.

- Natural systems for delivering water will become less reliable and therefore less able to support current levels of output.

8. Water quality impairment issues
    - If there are to be substantial increases in land-uses associated with nitrogen leaching, then there must be a corresponding decrease in nutrient leaching from existing land.
    - Modelling suggests it will be possible to substantially increase agricultural output while maintaining groundwater quality within acceptable limits as long as land management practices and technologies that reduce nutrients and other contaminants are applied across the region.
    - To achieve this outcome will require existing users of water as well as new users to adopt the improved land management practices and technologies.

9. Infrastructure issues
    - New infrastructure needs to be introduced in conjunction with much more efficient use of water, both by existing users and new users. This will reduce the scale of new infrastructure that has to be built to manageable levels.
    - New ways must be found to harness the knowledge and experience of existing irrigators in conjunction with external world class engineering, financial and management resources to build the next generation of storage.

The CWMS also confirmed that regulatory action to deal with environmental problems needs to be complemented with incentive mechanisms that progressively drive efficiency in the use of water and responsible land management practices.

2.2. The Vision of the CWMS

The desired outcome of the strategy is:

To enable present and future generations to gain the greatest social, economic, recreational and cultural benefits from our water resources within an environmentally sustainable framework.

If the strategy is successfully implemented, the following features should be evident within 10 years:

- people will feel they are being treated fairly and involved in decision-making.
- allocation decisions will be resolved in most cases without resorting to the courts.
- there will be a high level of audited self-management, and compliance action will be targeted on a minority of non-complying water uses.
- ecosystems, habitats and landscapes will be protected and progressively restored, and indigenous biodiversity will show significant improvement.
- water quality will be protected and starting to return to within healthy limits for human health and ecosystems.
- opportunities to exercise kaitiakitanga and rangitiratanga will be operative, and increasing.
- opportunities for recreational activities will be returning and improving.
- water users will have access to reliable water, which will be used efficiently and productively.

- primary production and employment will be increasing, and the net value added by irrigation to the Canterbury economy and the national balance of payments will be increasing.
- opportunities for tourism activities based on and around water will be returning and improving, and the net value to Canterbury's economy from these activities will be increasing.
- efficiency in the use of energy will be improving.
- rural community viability will be improving and community cohesion will be maintained.
- understanding and empathy between rural and urban dwellers will be increasing.
- the water management system will be better able to adapt to climate change in the future.

2.3 Understanding the Cultural Context

Māori living within the catchments of Canterbury experience a range of aquatic conditions – including floods, freshes and periods when the river flow may be considered critically low, beautifully clean waters, discoloured reaches, and highly polluted waters that cause cultural distress.

Māori conceptualisations are holistic encompassing the health of the catchment – and cannot be limited to discrete sites within a catchment. It also confirms that Māori want to protect their opportunities to interact with sites in the future. Mahinga kai is one of the enduring activities that demonstrates an active relationship with aquatic environs.

2.2.1 Kaitiakitanga Targets in the CWMS

Included within the CWMs are a series of Kaitiakitanga targets. These are attached as Appendix 1.

2.2.2 Cultural beliefs, values and uses.

Before narrowing our focus to mahinga kai, the relationship between cultural concepts and aquatic conditions are discussed in Table 1.

Table 1: A Selection of Cultural Beliefs, Values, Practices, Uses, Features	
Whakapapa (genealogy). Whakapapa describes bonds, relationships, and connections. Water is the medium flowing through a catchment that makes connections.	**Whanaungatanga** (kinship, familial relationships). Whanaungatanga describes the principle of kinship, connectedness, and inter-dependence between all things within the natural world including people. The concepts of sustainable management and integrated management are consistent with whanaungatanga as they reflect and give life to the inter-relationship between all things.
Manaakitanga (show kindness and respect, care for).	**Mauri** (Essential life force or principle; a quality inherent in all things both animate and inanimate). Ngai Tahu believe that people, flora, fauna as well as natural phenomena such as forests, waters, mists, winds and rocks, possess a *mauri* or life force (Te Runanga o Ngai Tahu 2001)
Rangatiratanga (Chieftanship, decision-making rights) which in the case of freshwater means having the right to make decisions of use, development and protection of water resources within one's tribal area.	**Kotahitanga** (unity, working together as one)
Tapu (Sacred) – which includes wai tapu.	**Noa** (Free from tapu, ordinary). *Tapu* and *noa* represent a traditional management technique that accepts that certain types of interaction and use within the natural environment are necessary to ensure the wellbeing of whanau and hapu, yet protects the environment. Tapu and noa were used to protect the mauri of a resource and are described by Williams (2003, 80) as the "single most pervasive feature of traditional life".
Kaitiakitanga (The exercise of customary custodianship, in a manner that incorporates spiritual matters, by those who hold mana whenua status for particular area or resource). This includes ensuring the waters within one's tribal area are respected and cared for.	**Wai Maori** (fresh water)
Mauka (mountain) which are the source of many of our waterways.	**Mahinga kai** (places where foods are procured and or produced). "Kai awa" and "kai roto" refers to the foods and resources sourced from rivers and lakes respectively.
Hauora (health and wellbeing). Healthy waters and the ability to interact safely with waters of cultural significance is a contributor to wellbeing.	**Wahi Ingoa** (traditional placenames). Placenames are extremely valuable when landscapes and landforms have been modified as many of them tell of the history of the area and describe particular environmental (including water features)
Kainga (settlement, place of residence). Settlements were located where there was a potable water supply and resources to sustain the community.	**Ara tawhito** (ancient trails). Many of the trails were along the streams and rivers. Today's transportation routes follow many of these old trails.
Tauranga waka (canoe mooring / landing site)	**Pa** (fortification) . Like kainga, pa were located where there was a potable water supply and resources to sustain the community.
Recreation – waterways remain valued as sites for a range of activities, including recreational.	**Urupa** (burial place). Some urupa were located on the banks of rivers, on promontories overlooking waterways, or on islands in the waterways.

When Ngai Tahu engage in resource management activities they want to protect these beliefs, values, practices uses and features. Eventually, through the GMP project, ECan should be able to demonstrate how GMPs contribute to protecting cultural interests including those in Table 1.

2.2.2 Provisions specific to cultural interests in the Resource Management Act 1991

Two sections of the Resource Management Act 1991 are of particular relevance to the interests of Tangata whenua. Section 6 requires that anyone exercising functions and powers under the Resource Management Act 1991 recognise and provide for matters of national importance including "the relationship of Maori and their cultures and traditions with their ancestral lands, water, sites, *wahi tapu* and other *taonga*" (section 6(e)).

Arguably, section 6(e) represents one of the strongest drivers for the development of culturally responsive management that enable explicit recognition and provision for cultural values in statutory planning processes. As Roberts (2002, p 217) observes:

> *The inclusion of the wording "the relationship of Maori..." is significant. For the first time New Zealand's environmental laws requires consent authorities to consider not only the tangible aspects of Maori culture, for example an unidentified pa, maunga (mountain) or river, but also the local whanau, hapu or iwi relationship with sites.*

Pursuant to section 7(a) decision-makers are required to have particular regard to *kaitiakitanga*. The Act presently defines kaitiakitanga as:

> *The exercise of guardianship by the Tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources; and includes the ethic of stewardship based on the nature of the resource itself.*

Roberts (2002, 217) observes that the reference to tikanga Maori reinforces the need to consider Maori worldviews.

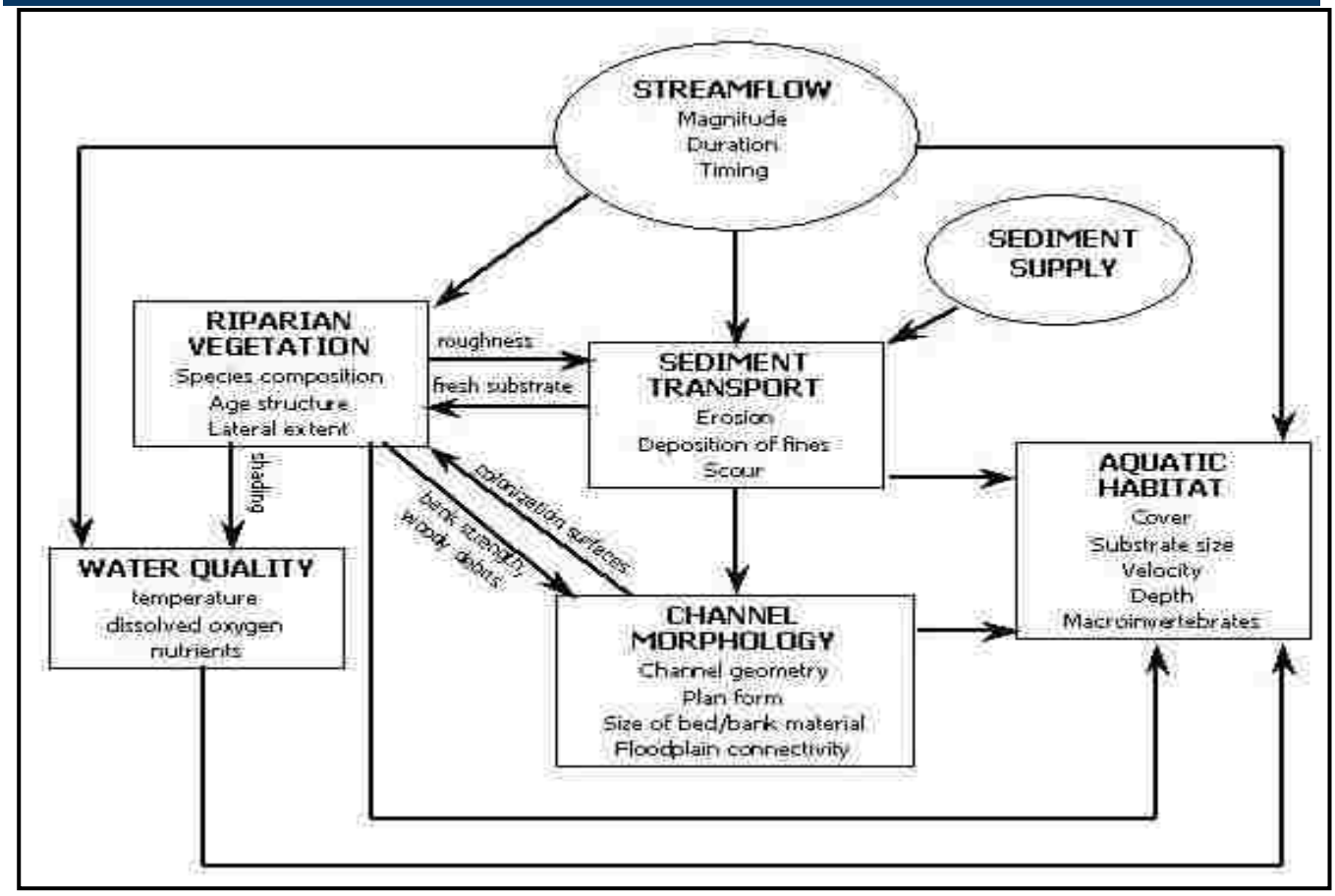
Section 8 of the Act requires that, anyone exercising functions and powers under the Resource Management Act 1991 'take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi)', albeit that this can be weighed against other factors in reaching a decision (Crengle 2002).

With reference to this project, the responsibilities of Tangata Tiaki are to protect the integrity of resources so that they are passed down in a healthy condition to future generations, thus ensuring the continuity of cultural practices such as mahinga kai. This requires Ecan, Maori and landowners to focus on long term environmental results, which are to include healthy ecosystems with robust mauri that are able to sustain cultural practices and uses. Working with resource users, including landowners, to mitigate any impacts on cultural uses and practices is fundamental to Ngai Tahu realising their goals of healthy ecosystems.

2.2.3 A healthy functioning waterway capable of sustaining cultural values, and uses

Having established that we need to provide for the relationship of Manawhenua with waterbodies within the region, it is necessary to consider how this relationship is impacted by the functions and processes essential to a "working river" that the CWMS purports to protect and possibly prioritise.

FIGURE 2: SCHEMATIC ILLUSTRATION OF MAJOR INTERACTIONS AMONG RIVERINE RESOURCES AND PROCESSES (STAMP, OLSEN, ALLRED 2008)

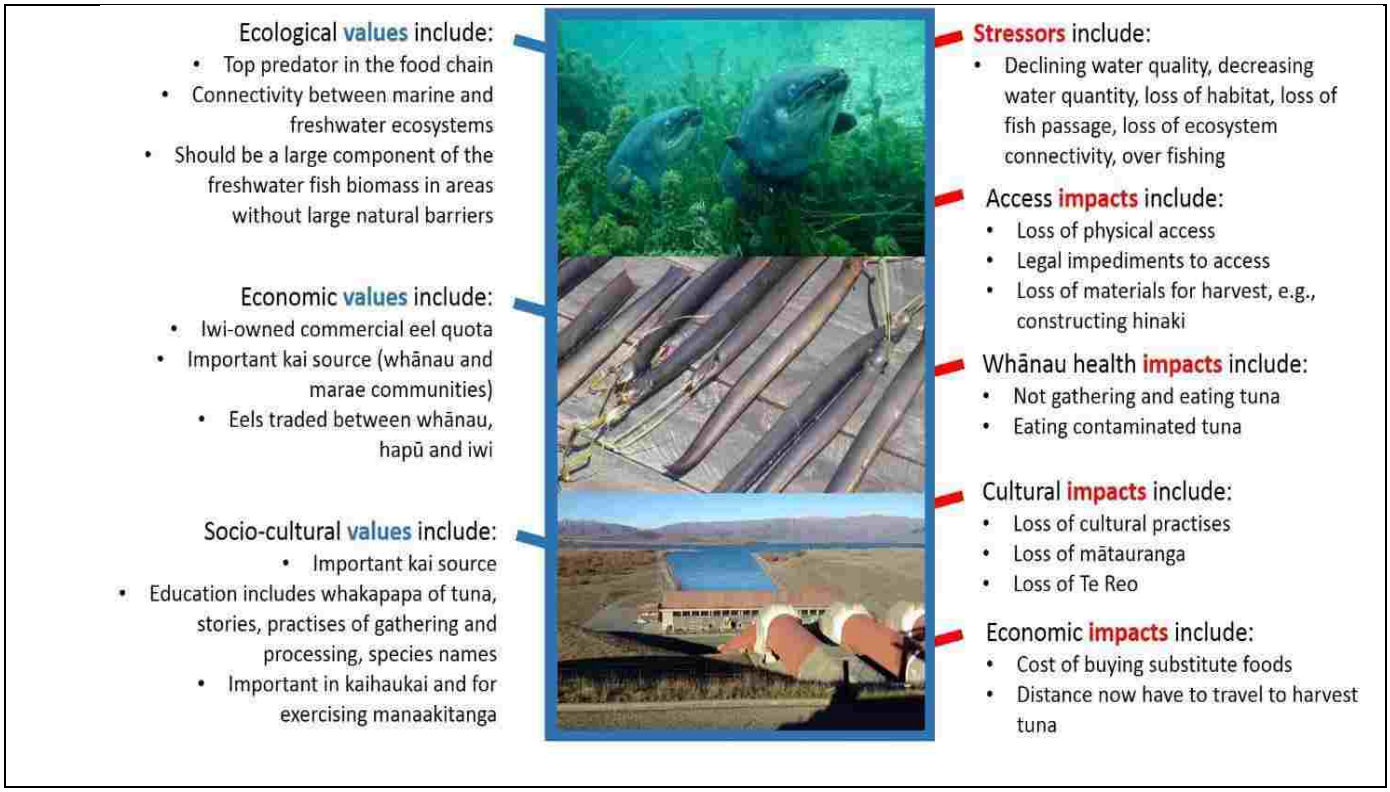


This approach - to consider the functions and processes of healthy river - could be seen to be continuing the bio-physical focus of freshwater management (Slootweg et al. 2001). However, it is consistent with the contention of Tangata whenua that the river ecosystem needs to be defined in a broad sense: the river ecosystem is seen as all components of the landscape that are directly linked to that river, including the source area, the channel from source to sea, riparian areas, the physical and chemical nature of water in the channel, associated groundwater, wetlands, floodplains, the estuary, and the near-shore marine ecosystem. It also enables decision-making to be based on a more profound understanding of the role the biophysical environment plays for Manawhenua and how each of the respective functions relate to the concerns of Tangata whenua.

2.2.4 Significance of mahinga kai

Mahinga kai is the ultimate indicator of the cultural health of an ecosystem (Goodall, 2003). Water quality and water quantity are essential to sustaining mahinga kai within the catchments of Canterbury. In many forums Ngai Tahu whanui have emphasised the need to protect mahinga kai. In Figure 3 we use eels to illustrate the range of cultural values associated with a species, and how this can be impacted.

FIGURE 3. THE VALUE AND SIGNIFICANCE OF TUNA (FRESHWATER EELS) AS A MAHINGA KAI AND TAONGA SPECIES. Photos: John Clayton, Erica Williams.



Figures 3 is specific to one species. However, in the many documents prepared by Ngai Tahu whanau they identify the species associated with specific catchments that remain a priority for management.

Species traditionally gathered from across South and Mid Canterbury[2].

SPECIES				
Eels	Smelt	Flounder	Potato	Turnip
Rats	Seals	Whitebait	Whale	Aruhe
Sea nuts	Kanakana	Patete	Kauru	Flax honey
Flax	Panako	Kumara	Shark	Groper
Shellfish	Paua	Sea urchins	Tutu	Kōkopu
Koareare	Weka	Kahawai	Cabbage	Kokopara
Kanaka	Pakihi	Minnows	Taramea	Birds
Mullet	Puha	Watercress		

Species traditionally gathered from Waihora[3]

2 This comes from analysis of the 1880 map and accompanying manuscript, commonly referred to as the "Taiaroa reports" by Ngai Tahu, represent a highly valued "cultural map" (Poole 2004). It was an initiative by kaumātua from neighbouring hapu and facilitated by H.K. Taiaroa, to map their collective territory, their mahinga kai interests and values associated with particular sites2.These records allow a more complete examination of the food gathering system within the Canterbury and Otago regions. Two thousand sites were listed.

[3] This information was extracted from the joint management that is in place for Te Waihora.

Kai whenua (from the land)	
Māori name	English name
aruhe/tauhinu	fern root*
harakeke	flax*
kākaho	reeds
kiore	rat #
kōwhitiwhiti	watercress (introduced)
kūmara	kumara
mānia	sedge*
panu	mud
pīngao	sand sedge*
pūhā	sour thistle
raupō	bulrush/raupo*
rongoā	medicinal plants
tī kōuka	cabbage tree*
tororaro	wiggy wig
wīwī/whīwhī/ wewe	rushes*
Ika (fish)	
aua	yellow-eyed mullet
īnanga, mata/ua	whitebait
kanakana/ piharau	lamprey
kōkopu	kōkopu
mohoao	black/common flounder
paraki	smelt
pātiki	3-corner flounder/ whitebelly
pātiki tōtara	yellow-belly flounder
tuna	eel
upokororo	grayling
kākahi	freshwater mussels
waikōura	freshwater crayfish
tuaki	cockles#
A number of other marine fish species also intermittently inhabit Te Waihora and are sourced as mahinga kai.	

Manu (birds)	
Māori name	English name
hua kakī ānau	black swan eggs©
hua manu	other bird eggs
kakī ānau	black swan©
karoro	black-backed gull*
kererū	wood pigeon*+
kawau	black+*, pied*, little shag*
kōtuku	white heron+*
kuruwhengi/ pateke	New Zealand shoveller©
matuku	Australasian bittern+
pūkura/pūkeko	pukeko*©
pāpango/ raipo	New Zealand scaup/ black teal+
pateke/ tarawhatu	brown teal+*
pārera /maunu	grey duck*©
pūtakitaki	paradise shelduck+©
kūaka	bar-tailed godwit+
ruru koukou	morepork+*
tarāpuka	Red-billed gull+
tete	grey teal©
whio	blue duck+

* Protected under the Wildlife Act 1953.
\# Customary fisheries 'Shellfish species' under the Ngāi Tahu Claims Settlement Act 1998.
\+ Taonga Species under the Ngāi Tahu Claims Settlement Act 1998.
© Game birds under the Wildlife Act 1953

2.2.5 Sustaining mahinga kai

Identifying how water quality impacts mahinga kai requires the identification of measures that are derived from specific, measurable attributes that can be studied and tracked over time. The measures need to reflect essential attributes or dynamics that can be tracked to identify changes, especially detrimental impacts. The tables that follow detail the essential attributes of mahinga kai.

TABLE 3: THE ATTRIBUTES OF MAHINGA KAI	
TAONGA	ATTRIBUTES

Taonga species – including • **mahinga kai** (places where foods are procured and or produced). "Kai awa" and "kai roto" refers to the foods and resources sourced from rivers and lakes respectively.	A. Ecological integrity of aquatic habitats • Oxygen – fish get from water • Food – for plants, birds and fish and all parts of the food chain • Habitat – riparian, channel structure, patterns and quantity of sediments, contaminants, interactions between fish and invertebrates, competition with predators (fish, birds, plants, invertebrates etc.). Flows create conditions for growth; keep water tables high; supplies nutrients etc.; variation establishes site specific conditions e.g. high flows move seeds etc. Flows work channels, banks, alter soil moisture etc. • Temperature of water • Cover in aquatic ecosystems – protects species from predators, high temperatures, high turbulence. Flows provide protection especially for riverbed bird species, clear weeds etc. • Turbidity – linked to oxygen concentrations. Suspended matter affects growth rates, movements etc., affects streambed • Riparian vegetation provides woody debris to rivers, intercept sediments & nutrients etc. Vegetation lessen velocities helps reduce flood peaks by facilitating infiltration to groundwater into the ground during high flows and releasing back to the channel as flows subside. • Movement corridors – free movement for life cycle stages or to move to better habitats. • Water quality
	B. Abundance and good health of cultural materials and kai (iconic to place)
	C. Gathering • Ability to gather • Desirability of gathering • Legal permission to gather
	D. Access • Physical access to sites • Legal permission to access
	E. Historic and significant sites • Recognising of relationship of whanau with specific sites (based on whakapapa) • Historic associations • Knowledge of sites retained and transferred
	F. Traditional techniques/sites known, practiced and knowledge transferred • Able to use
	G. Spiritual connections and respect for the waterway and the koiora it sustains
	H. Pursue whānau/ marae/ hapū/ iwi aspirations to use resources and sites

Although we have chosen to use attributes to structure our analysis, it must be remembered that protecting mahinga kai requires ALL attributes to be protected.

Because the focus is of this work is the impact of water quality on mahinga kai, we have also chosen to include some of the attributes of waters that need to be sustained.

TABLE 4: THE ATTRIBUTES OF WAI MAORI

TAONGA	ATTRIBUTES

Wai Maori, including	Condition of waterway and its surrounding lands nourished by waters
Repo raupo	Spiritual connection of Manawhenua
Puna	Cultural materials/riparian materials/kai available (including those iconic to place)
	Ecological integrity of waters
	River system connections (tributaries, hapua, springs, wetlands, riparian etc)

		
Drains	**Wetlands**	**Streams**
Whanau use drains which, as rivers have degraded, have become highly valued mahinga habitats.	**Swamps, wetlands, and seepages are important habitats that are to be managed as such.**	**Waterways need to be attractive and conducive to make whanau want to come and gather kai and cultural materials**

The central question for this report is whether GMPs are sufficient to protect the mahinga kai interests of Ngai Tahu.

While a considerable amount has been written about water quality impacts on mahinga kai we focus on the attributes of mahinga kai. We use attributes to bring a greater level of specificity to the discussion.

3.0 WATER QUALITY IMPACTS ON ATTRIBUTES OF MAHINGA KAI

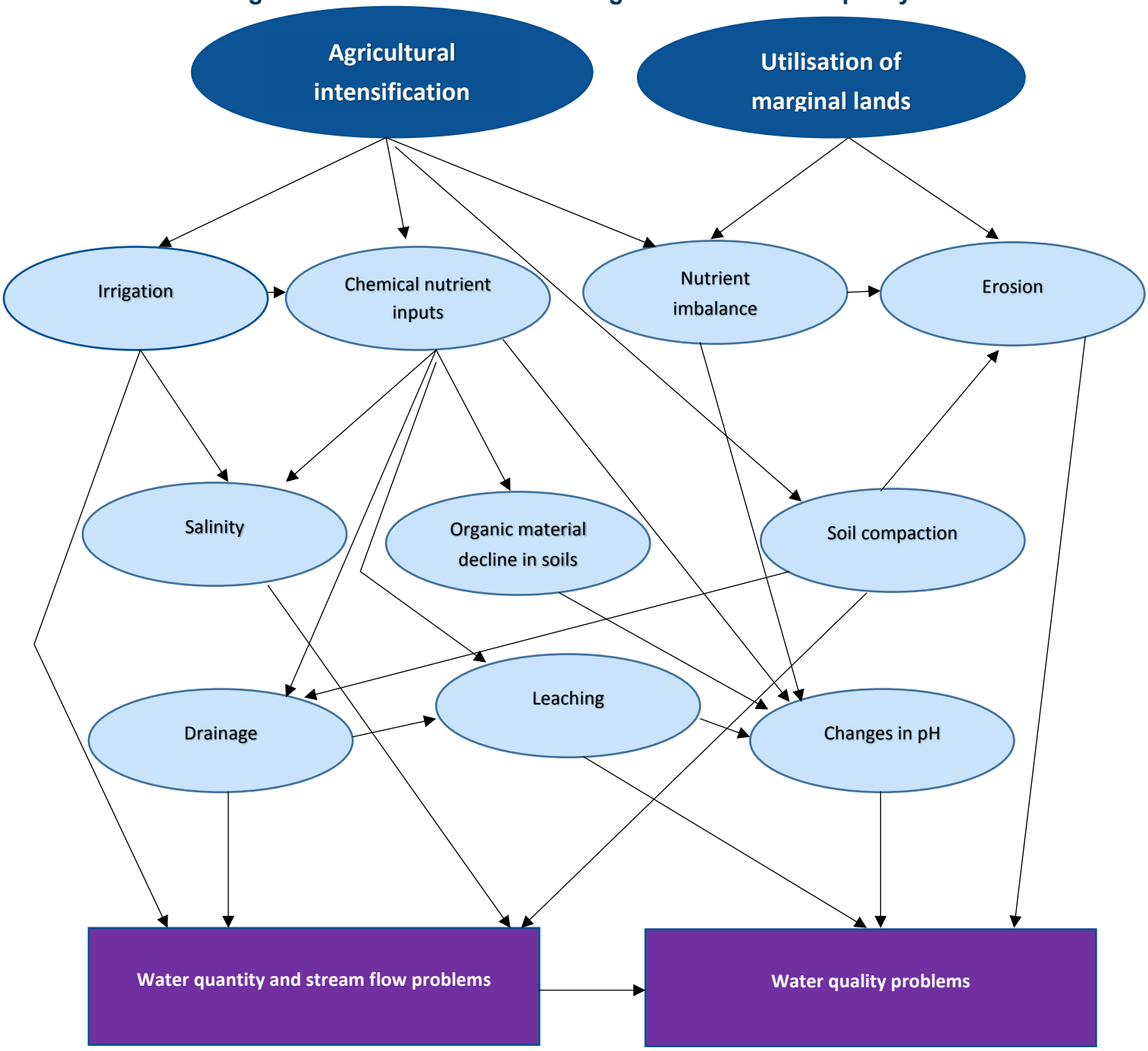
3.1 Overview of impacts of agriculture on mahinga kai

Water quality is vital for the success of agriculture, but in turn, good agriculture management practices are necessary to sustain ecosystem health and the multiple uses of waters. Sadly, agricultural practices have the potential to generate negative impacts on water quality. Improper agricultural methods may elevate concentrations of nutrients, faecal coliforms, and sediment loads. Increased nutrient loading can lead to eutrophication of water bodies which will damage aquatic ecosystems. Animal effluent may also introduce toxic faecal coliforms which threaten public health. Grazing and other agriculture practices may intensify erosion processes raising sediment input to nearby water sources. Increased sediment loads make drinking water treatment more difficult while also effecting fish and macroinvertebrates.

In this section we want to illustrate the link between agricultural practice, water quality and mahinga kai attributes. Communicating the state of attributes of mahinga kai (and other wahi taonga) often requires using a variety of data visualization strategies (e.g., maps, graphs, conceptual diagrams, photos). This project chose to focus on the attributes of mahinga kai (see section 2.2.5) as our starting point, and in this section use conceptual diagrams to show how the attributes of mahinga kai can be impacted by water quality.

We start however with a diagram that shows how agriculture can impact water quality.

Figure 4: Overview of effects of agriculture on water quality



Drainage	On farm chemicals
 Drains are to be included in FEPs as “waterways”.	 Whanau have questioned the ploughing of fields and application of fertilizer on days when there are strong winds.
Drains are to be included in FEPs as “waterways”. Erosion	Leaching
 Whanau are adamant – stock are to be fenced out of waterways.	 Dyes have been used to illustrate how contaminants can leach (move) down through the soils.
Soil compaction	
 Compacted soils limit the roots system of plants, which has an impact on the ability to plants to absorb nutrients from soils.	

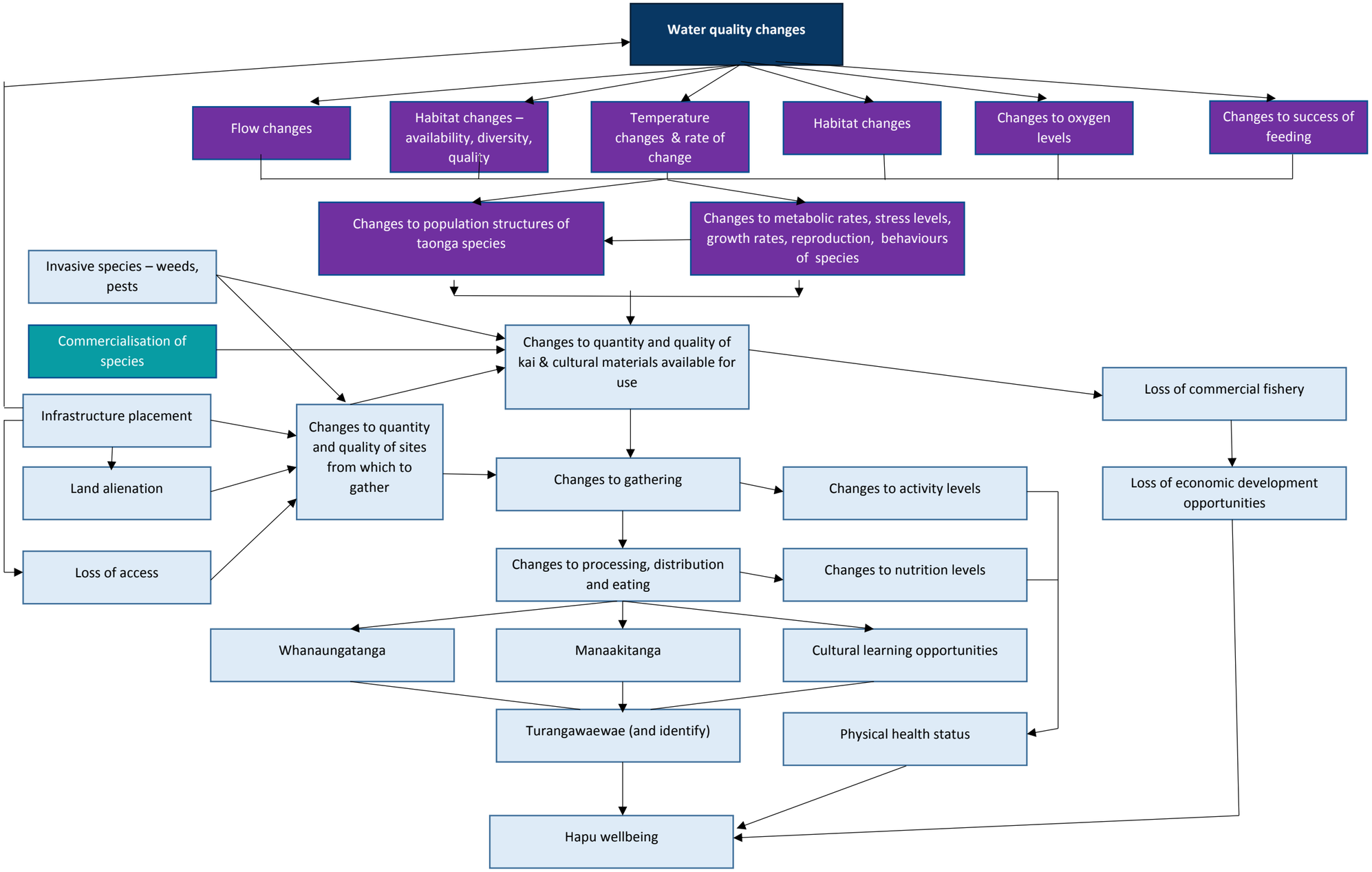
In Table 5 we expand on the potential impacts identified in Figure 4.

TABLE 5: SUMMARY OF POTENTIAL IMPACTS OF AGRICULTURE ON WATER QUALITY		
Issues	**Impacts**	**Impacts on water quality**
Use of nutrients and chemicals	• Human health ○ Pesticide and herbicide residues are human health issue • Metal toxicity and uptake by organisms • Bio-accumulation overtime • Excess ammonia is toxic to biota	• Can impact drinking water • Excess ammonia is toxic to fish and aquatic biota • Changes to pH impacts aquatic biota • Excess nutrients creates eutrophication and leads to oxygen depression and toxicity issues • Pesticide and herbicide residues are aquatic health issue • Metal toxicity and uptake by aquatic organisms
Changes organic matter	• Changes nutrient holding capacity • Changes water holding capacity	• Changes pH • Leads to flow alterations in streams • Changes patterns of erosion • Creates sediment issues
Drainage activities	• Increases risk of leaching nutrients • Reduces nutrient and manure retention	• Increases risk of eutrophication • Alters flows in streams
Activities changing sediment loadings	• Reduces productivity • Irritant to biota • Destroys habitat • Impacts ecological functioning •	• Reduces light and decreases productivity • Irritant to fish and biota • Destroys / changes habitat • Leads to oxygen problems • Impacts stream functioning • Absorbs organics & metals leads to toxicity and bio-accumulation • Smothers food & impacts feeding ability of species • Creates stress in species
Changes to microbes	Pathogens are human health issues	• Pathogens are aquatic health issues • Affects water based uses, including gathering of kai species and cultural materials • Promotes water borne diseases
Activities leading to soil compaction	• Increased surface run-off • Erosion and loss of organic material • Reduced aeration and productivity	• Increased suspended sediment • Changes to DO and light,

3.1 Linking impacts of declining water quality on the attributes of mahinga kai

To flesh out the linkages between changes in water quality and the impacts on the attributes of mahinga kai we have chosen to use a series of concept maps. We start with a concept map that ties together water quality impacts of agriculture, the attributes of mahinga kai, and some of the values of Ngai Tahu whanui.

Figure 5: Impacts of Water Quality on Mahinga kai



3.2 Key to the conceptual diagrams that follow

We have included a series of concept maps to make the linkage between agricultural practices, water quality and mahinga kai attributes

It is important to distinguish between the causes of water quality deterioration and effects.

- GMPs can be formulated to control the activities that cause a decline in the hope of avoiding an impact.
- GMPs can be formulated to mitigate the activities that cause a decline.

In the paragraphs that follow we expand on Figure 5 and examine:

- ***Causes*** of declining water quality:
  - Inputs specifically nutrients, herbicides, pesticides; and
  - Sediment.
- ***Effects*** of degraded water quality on attributes:
  - Habitat;
  - Flows;
  - Temperature; and
  - Oxygen.

We believe that concept maps will also aid discussions with whanau. We have used the following key when developing the diagrams.

	Activities and changes that may occur on farm
	Links to other concept maps in this section of the report
	Attributes of mahinga kai impacted
	Not directly related to farming activity

3.3 Activities that potentially cause a decline of water quality

Figure 6 Potential effects of sediment on water quality and a range of mahinga kai attributes

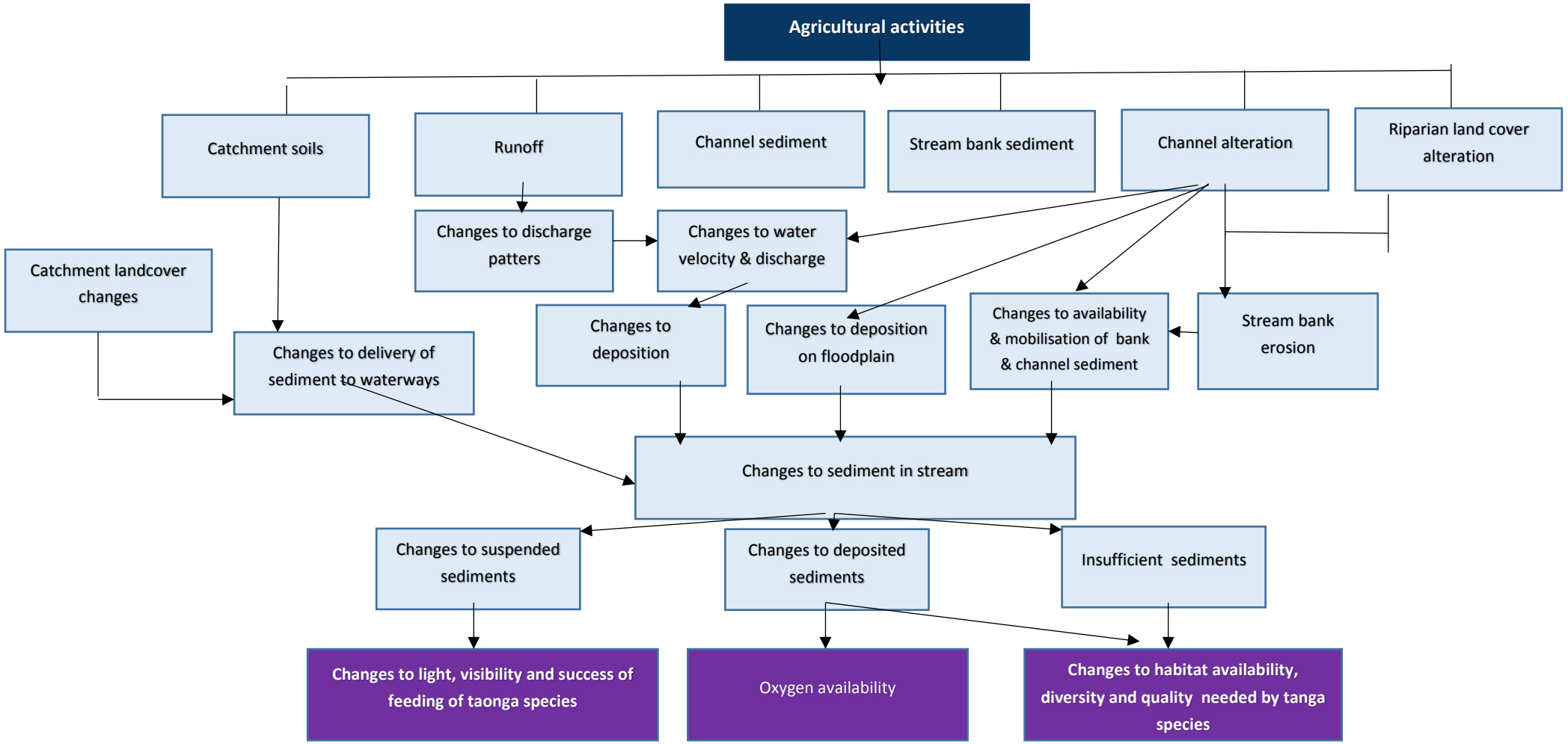
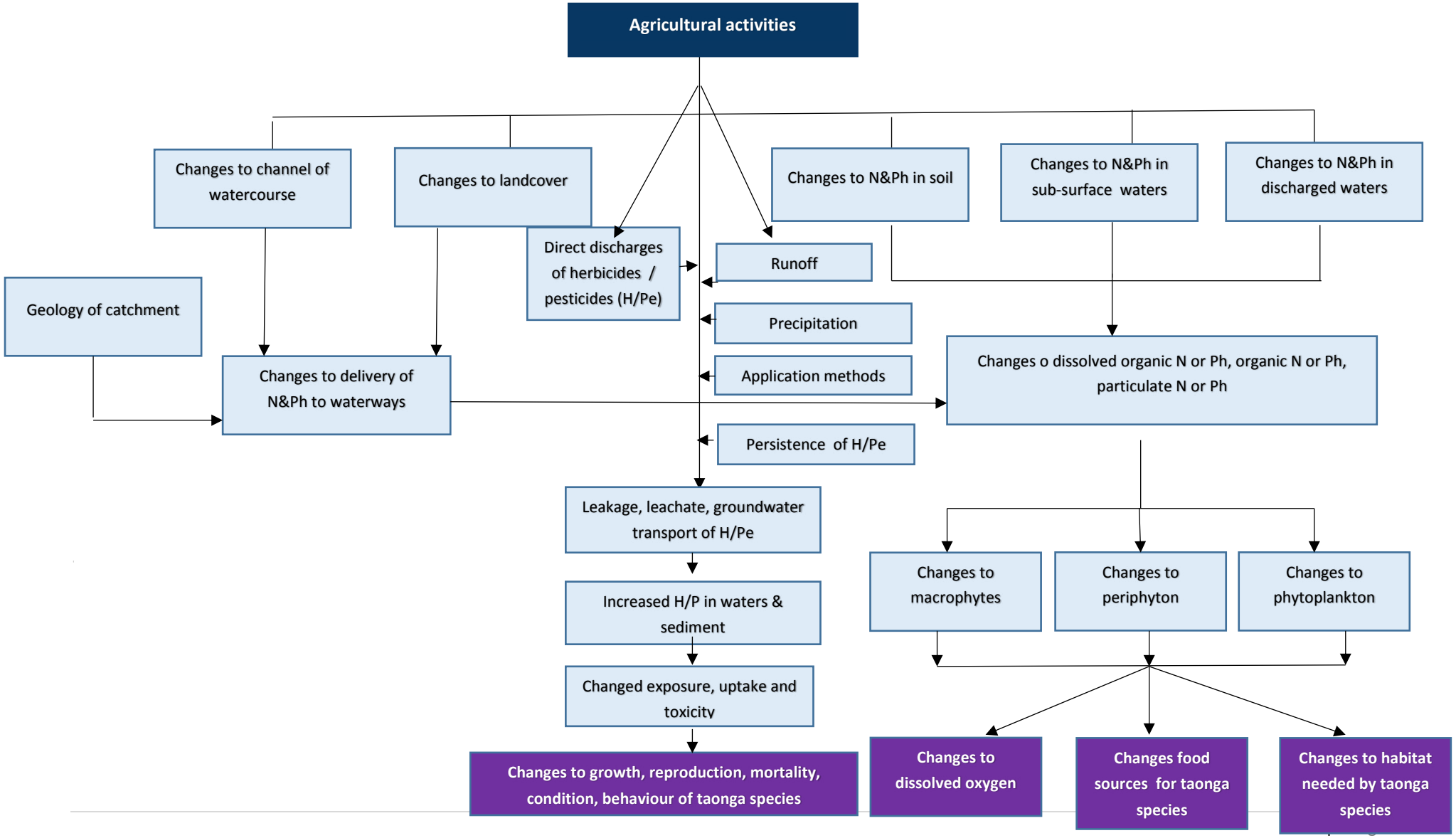


Figure 7 Potential effects of nutrients, herbicides and pesticides on water quality and a range of mahinga kai attributes



3.4 The potential effects of a decline of water quality on mahinga kai attributes

Figure 8 Effect of water quality changes on a mahinga kai attribute: oxygen

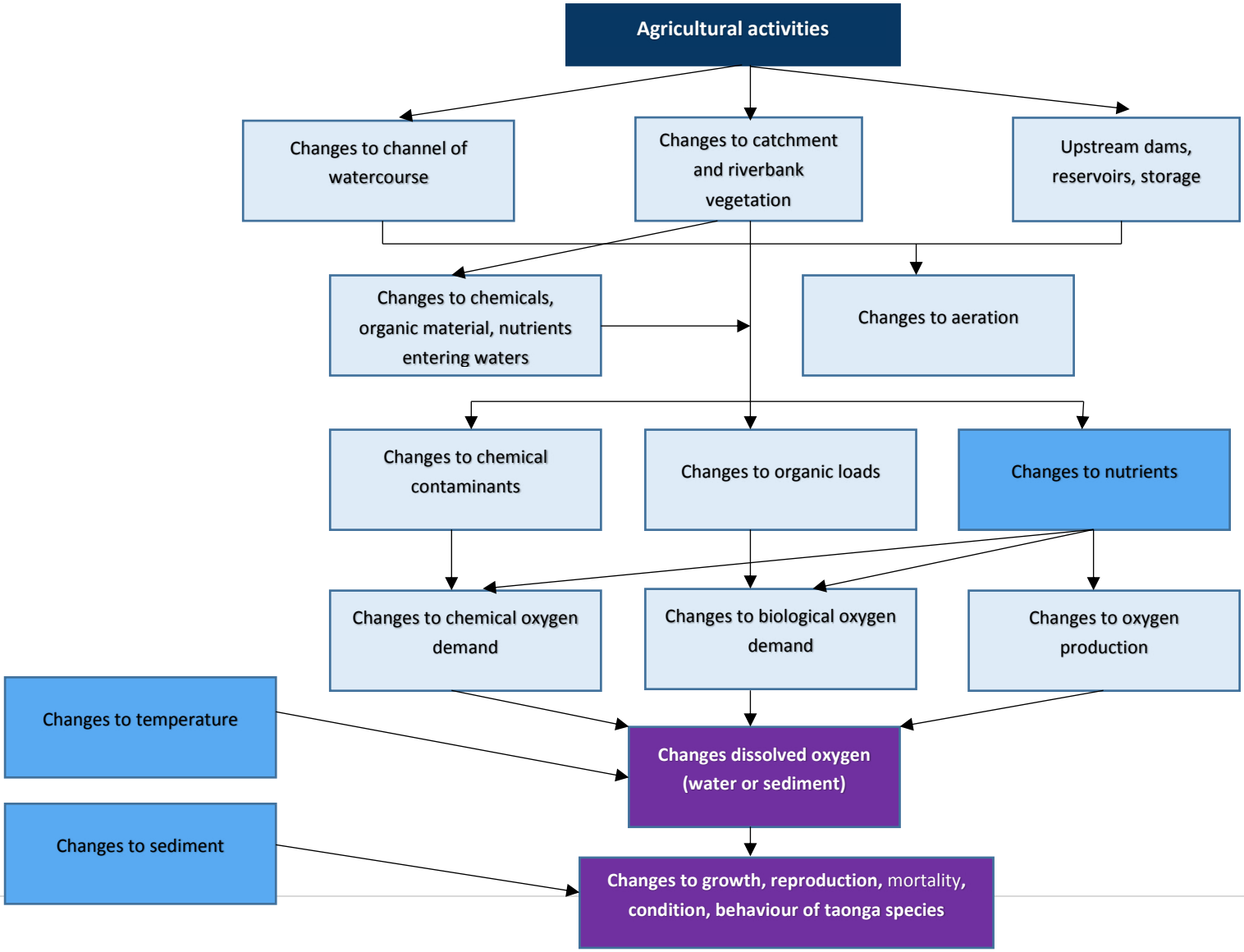


Figure 9 Potential effects of water quality changes on a mahinga kai attribute: water flows

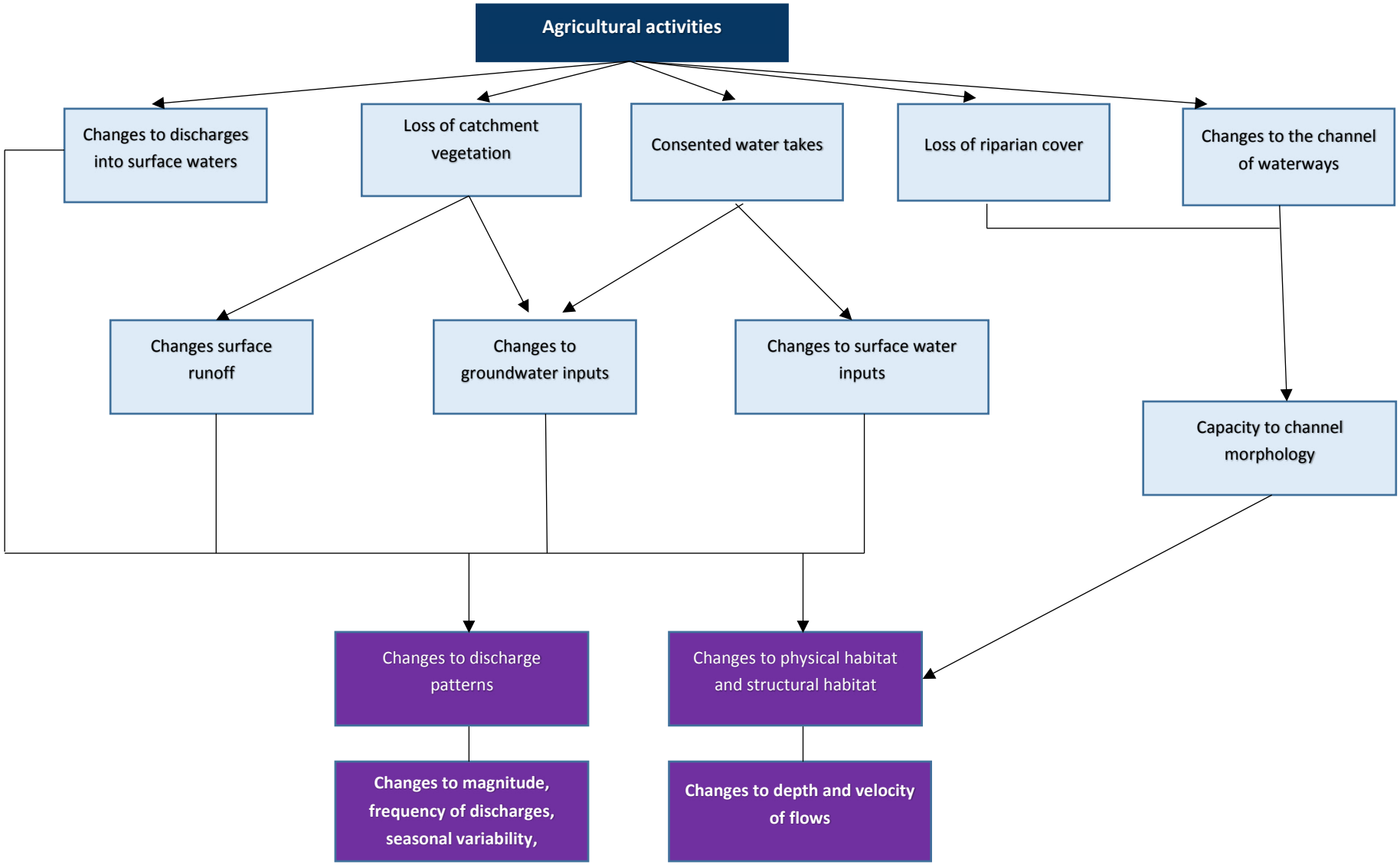


Figure 10 Potential effects of water quality changes on a mahinga kai attribute: temperature

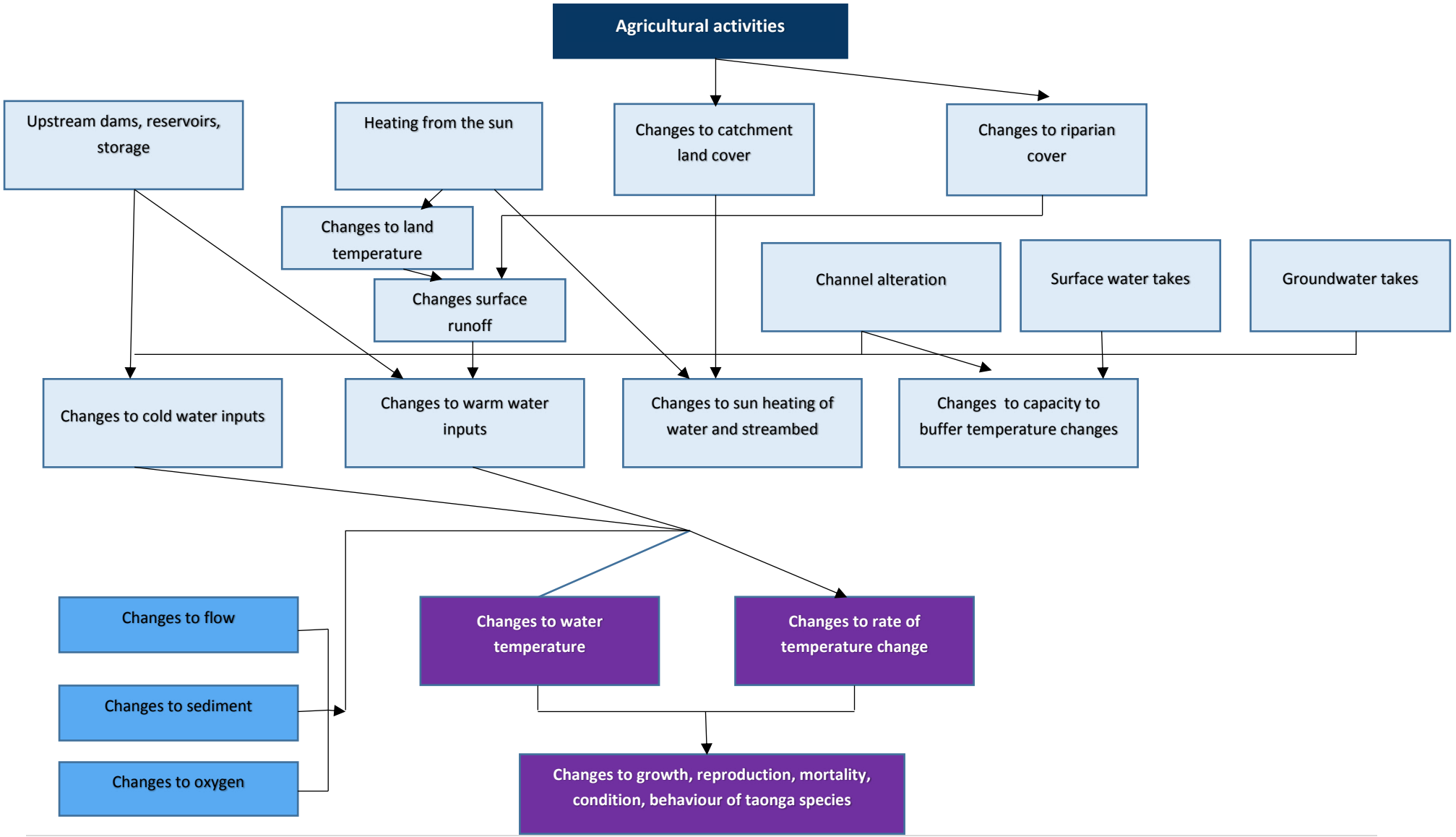
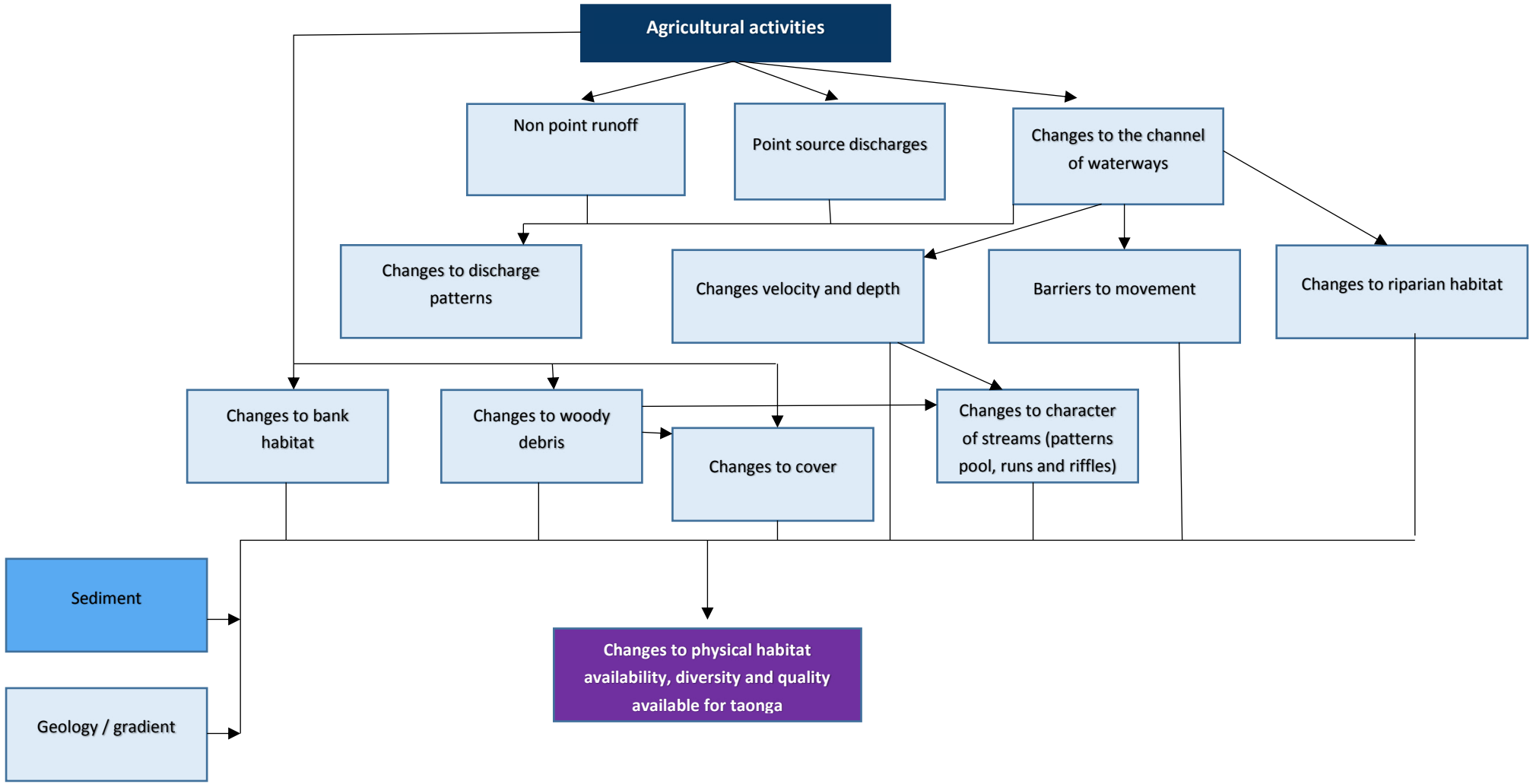


Figure 11 Potential effects of water quality changes on a mahinga kai attribute: habitat



4.0 EXTENT TO WHICH GMPS ADDRESS IMPACTS OF WATER QUALITY ON MAHINGA KAI

In this section we start with some of the expectations of whanau with respect to agriculture, and examine how interests are met by GMPs, and try to indicate how the attributes of mahinga kai benefit or are impacted by a GMP.

The analysis below is a result of:

- reviewing written material from Ngai Tahu, including statements that appear in Cultural Impact Assessments (CIA), Iwi plans, and minutes/ notes from iwi forums.
- the conceptual diagrams in section 3 detailing the effects of agricultural activities on the attributes of mahinga kai;
- 21 GMPs as shown in Appendix 2;
- Canterbury Farm Environment Beef and Lamb Guidelines; and
- Dairy NZ resources (Tech Notes, Farm Facts and Guides) all found on the Dairy NZ website.

Other valuable resources available on GMPs highlighted by whanau. These resources in many cases give more information of many of the GMPs. They include:

- Irrigation NZ website – Detailed information of many aspects of irrigation management
- The Fertiliser association of NZ – Information of spreadmark certification, Nutrient Management Adviser Certification Programme and Code of Practice for Nutrient Management.

This information was not used in this analysis but is a useful guide for whanau interested in finding out more about some of the areas mentioned below.

4.1 On farm activities, GMPs and the impact on Mahinga kai

General activities		
Cultural expectation	**GMPs**	**Mahinga kai attributes potentially impacted**
Overall farm design takes into consideration environmental considerations: • Farm lanes, crossing location • Farm infrastructure placement	• GMP1 (Identify the physical and biophysical characteristics of the farm system, assess the risk factors to water quality associated with the farm system, and manage appropriately) • GMP14 (Design, calibrated and operated irrigation system to minimise water	All

• Troughs	usage)	

Irrigation Management

Cultural expectation	GMPs	Mahinga kai attributes potentially impacted
Farm design stage		
Irrigation system (centre pivot, k-line, and spray) selected is the most appropriate for the land (soils, topography etc.) • Knowledge and expertise used to select system • Post installation checks of system	• GMP14 (System designed with site specific knowledge of soil, climate and crop needs) • Canterbury FEP B&L Guidelines "Irrigation– New Irrigation"(pg. 16) - System designed with site specific knowledge of soil, climate and crop needs • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 12) - New system design and installation • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 12) - Matching system capability to soil type and plant demand	• Food sources • Habitat • Temperature • Turbidity • Riparian vegetation
Irrigation system meets INZ standards • Audited regularly	• GMP14 (Design, calibrated and operated irrigation systems to minimise the amount of water needed to meet production objectives) • Canterbury FEP B&L Guidelines "Irrigation– New Irrigation"(pg. 16) - Independent evaluation of irrigation design undertaken before development • Canterbury FEP B&L Guidelines "Irrigation– New Irrigation"(pg. 16) - All new irrigation infrastructure is installed in accordance with Installation Code of Practice for Piped Irrigation Systems (Irrigation New Zealand, January 2012) • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 12) - New system design and installation	All (except access)
High slope risk if >20 degrees. Evaluated and checked if irrigation appropriate or if too much risk.	***None*** ***No specific GMP relating to terrain or geographic considerations in designing the irrigation system. General statements are made but no reference to slope.***	All (except access)
Operational guidelines, maintenance records and training records	• GMP2 (Maintain accurate and auditable records of annual farm inputs, outputs and management practises) • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 12) - Teaching good irrigation practices to farm staff	All (except access)

Tests of the irrigation system carried out before operation • System capacity • Application depth • Application intensity • Application Uniformity • Return interval	• GMP14 (Design, calibrated and operated irrigation systems to minimise the amount of water needed to meet production objectives) • Canterbury FEP B&L Guidelines "Irrigation– New Irrigation"(pg16) - Commissioning tests show that system performs to desired specifications for system capacity, application depth, intensity and uniformity and return interval • Canterbury FEP B&L Guidelines "Irrigation– New Irrigation"(pg16) - System meets flow meter, flow rate, volume and area irrigated requirements • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Annual audit of system completed to identify efficiency improvements • Canterbury FEP B&L Guidelines "Irrigation– New Irrigation"(pg16) - Post installation checks of application rate and distribution uniformity undertaken • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 12) - New system design and installation	All (except access)
Irrigation system placement and design takes into consideration environmental risk on farm • Proximity to waterways • Lane placements	• Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Application to non-target areas is minimised • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Annual audit of system completed to identify efficiency improvements • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Variable rate irrigation together with soil EM mapping used to maximise water use efficiency • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 11) - Protecting water quality ***Focus is upon management of irrigation system to improve efficiencies and reduce the risk of impacts on environment. There is limited consideration of the environment in terms of waterways etc. with the focus being on soils and climate.***	All (except access)

Backflow preventer if fertiliser, effluent or chemical applied using irrigation system	***None***	Habitat

Overall assessment – will GMPs for this farm activity protect mahinga kai values?	**What else is needed to change the assessment to YES?**
POSSIBLY	**If GMPs are sufficiently integrated into farm design before conversion, expansion or upgrade. Environmental risk needs to rated alongside irrigation efficiency**

Operational Stage		
Monitoring		
Soil moisture monitoring • Using an electronic soil moisture monitoring device (digging holes is not sufficient) • Records are keep • Regular monitoring at appropriate locations on farm • Equipment used for soil moisture monitoring has records of maintenance (to maintain it accuracy)	• GMP14 (Design, calibrated and operated irrigation systems to minimise the amount of water needed to meet production objectives) • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Daily checks for excessive runoff/ponding • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Soil moisture assessed—detail method and frequency • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Deficit irrigation used within soil moisture trigger points • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Rotation adjusted according to ET, soil moisture status and rainfall • Dairy NZ Sustainable Milk Plan "Irrigation and Water Management" (pg3) - To operate irrigation systems efficiently and ensuring that the actual use of water is monitored and efficient • Dairy NZ Guide to good irrigation – part 1: good irrigation practises on farm (pg. 12) – soil moisture status • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 9) – Soil moisture monitoring ***No specific detail on the required minimum standard for measuring soil moisture. The minimum standard should be the use of a soil moisture probe in correct spots on farm to assist in decision making.***	All (except access)

Rainfall monitoring (Rainfall records and weather forecasts used) • Records keep	• GMP14 (Design, calibrated and operated irrigation systems to minimise the amount of water needed to meet production objectives) • GMP2 (Maintain accurate records of annual inputs, outputs and management practises) • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Rainfall forecast and soil temperature monitored and used in decision making • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) -Rainfall, soil temperature and ET records used to schedule irrigation • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation" (pg16) - Decision rules used (i.e. no irrigation after 10mm rain etc • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation" (pg16) - Rotation adjusted according to ET, soil moisture status and rainfall • *C-GMP13 (Good to average records presented)* • Dairy NZ Guide to good irrigation – part 1: good irrigation practises on farm (pg. 12) – Weather forecast ***No specific details on how records will be keep and the amount of detail required. There is a need for an agreed standard of record keeping.***	All (except access)
Irrigation application records keep and evidence of their use in irrigation application decision making • Application areas • Application depths • Records of rainfall, soil moisture monitoring, soil temperature	• GMP2 (Maintain accurate and auditable records of annual farm inputs, outputs and management practises) • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Rainfall, soil temperature and ET records used to schedule irrigation • Dairy NZ Sustainable Milk Plan "Irrigation and Water Management" (pg3) - To operate irrigation systems efficiently and ensuring that the actual use of water is monitored and efficient • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 5) - Measuring and reporting annual water use • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 9) – Soil moisture monitoring • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 8) – More efficient water use on farm ***There are limited details in the GMPs relating to record keeping. These are critical in good farm management decision making and auditing. Records need to meet a high standard as a farmer needs to show how they use this information when making farm management decisions.***	-
Soil mapping (electronic) to assist in	• Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Variable rate	All (except access)

irrigation application • Holding capacity • Soil types	irrigation together with soil EM mapping used to maximise water use efficiency • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Soil and water - Soil and landscape classifications and risk profiles " (pg. 16) – Soil mapping	
Soil temperature monitoring	• Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) -Rainfall, soil temperature and ET records used to schedule irrigation • Dairy NZ Guide to good irrigation – part 1: good irrigation practises on farm (pg. 12) – Soil temperature	All (except access)

Overall assessment – will GMPs for this farm activity protect mahinga kai values	**What other GMPs are needed?**
YES	**Sufficient records are to be kept by farmer**

Water application		
Application to areas which are not farmed are eliminated • Tracks • Drains	• Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Variable rate irrigation together with soil EM mapping used to maximise water use efficiency • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Application to non-target areas is minimised	All (except access)
Landscape (hills, valley, slopes) are taken into consideration when irrigating	• Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Variable rate irrigation together with soil EM mapping used to maximise water use efficiency	All (except access)
Irrigation system maintenance program, records or a plan for the identification of issues and mitigation • Block nozzles, broken or split hoses, hydrants • After extreme weather events records of checks	• Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Daily checks for irrigation problems and problems fixed • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Application depth and uniformity checks pre-season, and through season • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Program to remedy problems in 5-yearly evaluation implemented • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 11) – How an evaluation can reduce water use and save costs • Dairy NZ Guide to good irrigation – part 1: good irrigation practises on farm (pg. 15-16) – Maintenance throughout the season	-

Soil moisture monitoring options – Guide to purchasing and locating soil moisture probes (Irrigation NZ)

Method	Instruments	Basic Principles	Advantages	Disadvantages
Soil Based Measurements				
Appearance & Feel	Hand and/or probe	Wetter soil is darker, physical properties change.	Simple - no special equipment.	Unreliable, poor accuracy and time consuming. Yield loss and water wastage likely.
Gravimetric Analysis (wet and dry weight)	Oven and accurate weighing equipment	Difference in weight of soil sample before and after drying show actual water content.	Direct measurement of soil water content. Very simple.	Require multiple samples, takes 24 hours to dry sample - plants may be stressed in mean time. Not real-time.
Soil Matric Potential (soil suction)	Tensiometers (Irrometer, Quickdraw)	Soil suction increases as it dries - tension measures how hard it is for plants to draw water.	Measures water tension directly. Close correlation to plant 'experience'. Can be automated.	Multiple sites, careful installation, frequent readings and maintenance.
Electrical Resistance (soil conductivity)	Gypsum Blocks (Watermark sensor)	Electrical conductivity increases with water content -drier soil has greater electrical resistance.	Indirect measure of soil water content. Easy automatically record / monitor. Same units as soil suction	Multiple sites, careful installation, calibration and frequent readings. Can be affected by soil texture.
Electromagnetic Capacitance	Time Domain Reflectometry - TDR (ECHO, Aquaflex, Diviner)	Water content controls the speed of an electromagnetic pulse sent through the soil.	Accurate, quick measurement of soil water content. Probes cheap, permanent, no servicing required.	Control unit very expensive. Multiple sites, probe/tube installation and interpretation.
Neutron Scattering	Neutron probe (Troxler)	Emitted neutrons slowed by hydrogen atoms in water molecules. Number slow neutrons = water volume.	Precise measurement of soil water content by percentage.	Very expensive, radioactive, multiple sites, tube installation, calibration and interpretation.
Plant Based Measurements				
Appearance	Eye	Plants start to wilt - subtle colour change.	Simple - no equipment needed	Yield lost before symptoms seen!
Leaf Temperature (Infra-red image)	Non-contacting thermometer	Transpiration reduces decreasing cooling and plant leaf tissue heats up.	Simple - relates to plant stress. Allows remote sensing	Techniques not well developed.
Leaf Water Potential	Pressure chamber	Measures plant hydration, a combined effect of aerial and soil environment.	Correlated to plant metabolic processes.	Large day/night variation, expensive, time consuming, difficult interpretation.
Atmospheric Measurements				
Pan Evaporation Rate	Evaporation pan	Water loss from a free water surface correlated to soil evaporation and plant water use.	Simple, cheap. One site can serve large area	Requires frequent service and data collection, careful siting, calibration for each crop and canopy size
Soil Water Balance Calculations (soil, climate and crop data)	Water balance models (manual calculations or sophisticated plant growth models)	Potential evapo-transpiration (from climate data) adjusted by crop coefficient (reflects crop/growth stage). Soil-water balance calculation updated on a daily basis.	Well developed, one calculation can serve a large area. Accurate for most crops over longer term. Good guide.	Requires considerable data and calculations, (manual calculation difficult for crop/growth stage. May not account for extreme conditions (strong, dry wind) in the short term.

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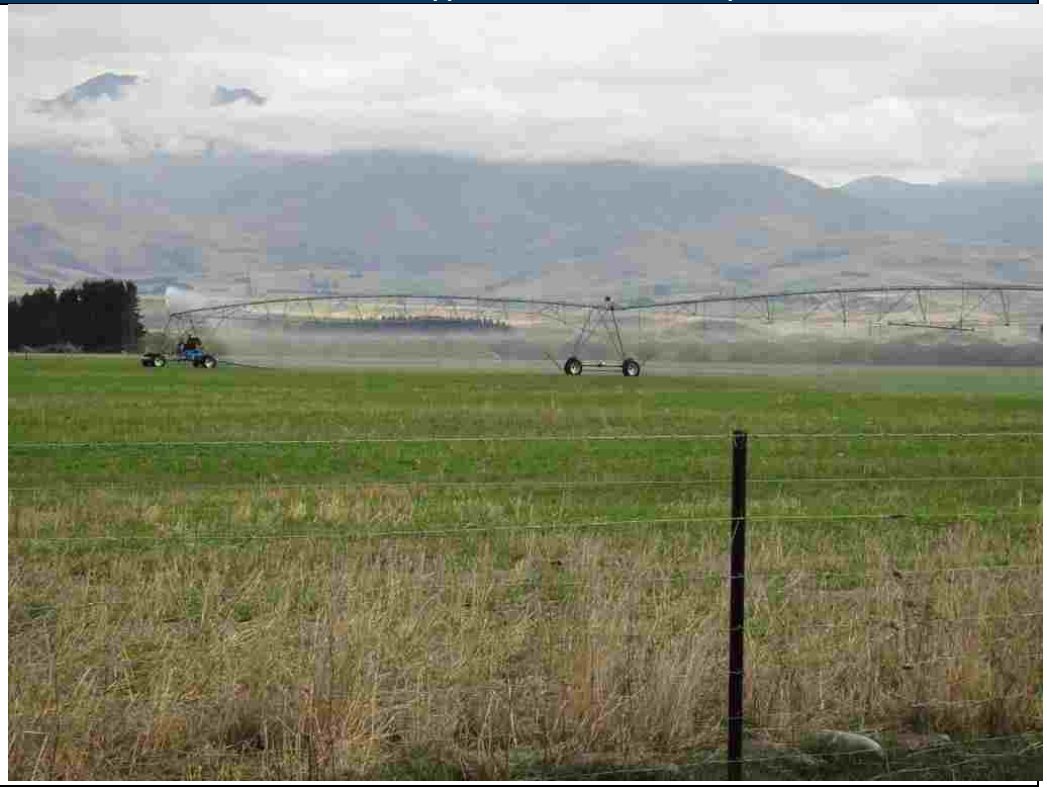
Entire irrigation system is checked annually by a qualitied person or maintenance carried out over the year. Any maintenance plan should focus on the most risky part of system first • Application depth, uniformity • Tires	• *C-GMP14 (Maintenance programme carried out and recorded)* • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Annual audit of system completed to identify efficiency improvements • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Program to remedy problems in 5-yearly evaluation implemented • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Annual water use checklist completed • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - System evaluation by certified evaluator 5-yearly • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Application depth and uniformity checks pre-season, and through season • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Audit upgrades identified in work plan with timelines for completion • Dairy NZ Guide to good irrigation – part 1: good irrigation practises on farm (pg. 15-16) – Maintenance throughout the season • Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 11) – How an evaluation can reduce water use and save costs	-
No ponding or runoff occurring on farm. • If so it is identified, recorded and mitigated as soon as possible • At risk areas (near drains, waterways) are monitored regularly or irrigation system is designed so runoff or ponding will not occur	• Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Daily check for excessive runoff/ponding • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Variable rate irrigation together with soil EM mapping used to maximise water use efficiency • Canterbury FEP B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - System closed down if runoff and/or ponding occurs • Dairy NZ Guide to good irrigation – part 1: good irrigation practises on farm (pg. 12) – Effluent	All (except access)
Spray line plan for irrigation systems which are moved (k-line, spray gun etc.) • A plan in place and record of compliance with plan. Staff have plan and are trained how to use equipment	• B&L Guidelines "Irrigation– Existing Irrigation"(pg16) - Spray line shifts made to suitable plan (e.g. GPS on bike; follow map)	All (except access)

Use of soil EM mapping and soil monitoring when using Variable rate irrigation or irrigation in general	• Canterbury FEP B&L Guidelines “Irrigation– Existing Irrigation”(pg16) - Variable rate irrigation together with soil EM mapping used to maximise water use efficiency • Canterbury FEP B&L Guidelines “Irrigation– Existing Irrigation”(pg16) -Rainfall, soil temperature and ET records used to schedule irrigation • Dairy NZ A farmer’s guide to managing farm dairy effluent - A good practice guide for land application systems “Soil and water - Soil and landscape classifications and risk profiles” (pg. 16) – Soil Mapping	All (except access)
Avoid and mitigate on farm leakages • Incident report and records of fixing	• GMP2 (Maintain accurate and auditable records of annual farm inputs, outputs and management practice) • Canterbury FEP B&L Guidelines “Irrigation– Existing Irrigation”(pg16) - Daily check for irrigation problems and problems fixed • Canterbury FEP B&L Guidelines “Irrigation– Existing Irrigation”(pg16) - Application depth and uniformity checks pre-season, and through season • Dairy NZ Guide to good irrigation – part 1: good irrigation practises on farm (pg. 5) – Maintain and manage the irrigation system to minimise wastage and leaks ***No specific GMPs relating to farm incident reporting or record keeping in relation to this.***	All (except access)

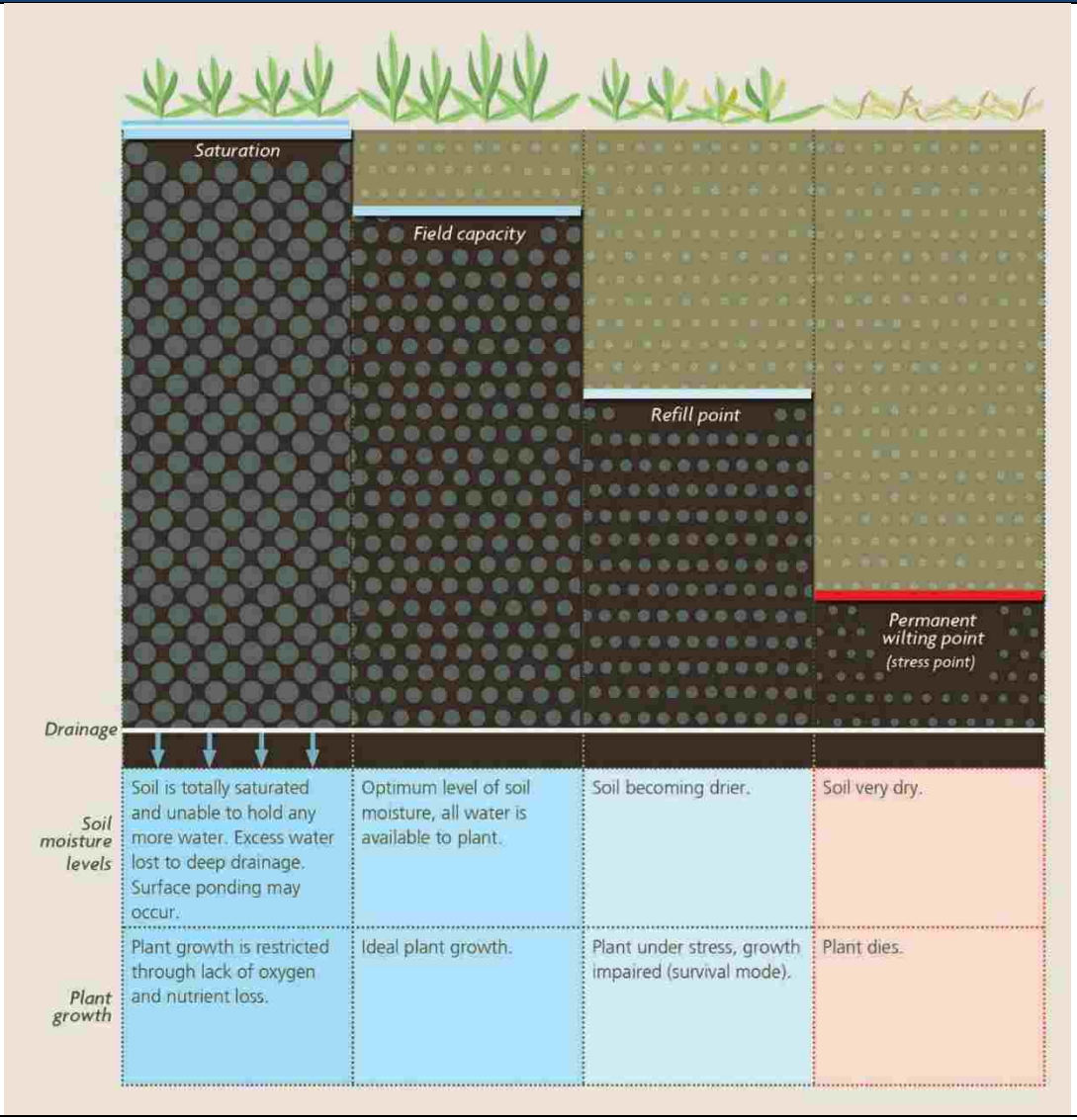
Overall assessment – will GMPs for this farm activity protect mahinga kai values?	**What else is needed to change the assessment to yes?**
POSSIBLY	To meet whanau expectations GMPs need to stress that detailed records which provide evidence of how a farmer is meeting a specific standard need to be kept.

Border dyke and flood irrigation (below) are unlikely to be supported by whanau.	Whanau have supported the use of central pivot
	

Staff trained to use irrigation system		
Staff using irrigation system are sufficiently trained • Records of training • Sufficient years using the system	Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 12) - Teaching good irrigation practices to farm staff ***No specific mention of records of training or experience.***	-
A staff member has relevant INZ irrigation training	Dairy NZ Guide to good irrigation – part 2: good irrigation practises for farm owners and managers (pg. 12) - Teaching good irrigation practices to farm staff ***No specific GMP relating to INZ training although this maybe included within the GMP above.***	-
Suitable information provided to all staff in irrigation management • All staff know of whom to contact if there are issues • All staff have some basic knowledge of system or know how to identify problems	Dairy NZ Guide to Good Irrigation – part 2: good irrigation practises for farm owners and managers (pg. 12) - Teaching good irrigation practices to farm staff	-

Overall assessment – will GMPs for this farm activity protect mahinga kai values	**What else is needed to change the assessment to yes.**
POSSIBLY	• To meet the whanau expectations evidence of staff training is required rather than just reference to staff training. • The degree of staff training and / or experience is likely to be required.

Soil moisture – Guide to good irrigation – part 1 (Dairy NZ website)



Nutrient Management		
Cultural expectation	**GMPs**	**Mahinga kai attributes potentially impacted**
Sources identified		
Nutrient budget (yearly) in place which has used soil tests • Meets Overseers standards • Carried out by certified person • Soil tests of the entire farm where nutrients applied (or soil types) • Nutrient budgets reviewed every year (pre and post to identify issues)	• Canterbury FEP B&L Guidelines "Nutrient Budgeting"(pg14) – Overseer nutrient budget prepared for farm and for each LMU/block • Canterbury FEP B&L Guidelines "Nutrient Budgeting"(pg14) – Nutrient budget reviewed annually and revised if necessary • Canterbury FEP B&L Guidelines "Nutrient Budgeting"(pg14) – Nutrient budget used in assessment of options for minimising nutrient loss and maximising nutrient use efficiency • Canterbury FEP B&L Guidelines "Nutrient Budgeting"(pg14) – Use of technical advisor to determine nutrient management policies • Canterbury FEP B&L Guidelines "Nutrient Budgeting"(pg14) – Regular soil tests (specify frequency) undertaken as aid to determining P needs • Canterbury FEP B&L Guidelines "Nutrient Budgeting"(pg14) – Plant analysis undertaken as aid to fertiliser needs • Canterbury FEP B&L Guidelines "Nitrogen loss"(pg15) - Undertake a comprehensive nutrient analysis using Overseer Nutrient Budgets • Canterbury FEP B&L Guidelines "Phosphorus and sediment loss"(pg14) - Regular soil tests (specify frequency) undertaken as aid to determining P needs • Dairy NZ Reducing nitrogen loss – A guide to good management practices "Assessing farm performance – Access environment impact" (pg. 6) - the environmental impacts of any changes will also need to be assessed in OVERSEER® Nutrient Budgets ***No detail on how the soil tests will be carried out on farm.***	All (except movement corridors and access)
Within Nitrogen leaching limits set by ECAN or Irrigation company	• Canterbury FEP B&L Guidelines "Nitrogen loss"(pg15) - Nutrient allocation Zone N loss limits met (see ECan information sheet for local rules)	All (except movement corridors and access)
At risk areas for sediment loss (including phosphorus) are identified, mitigation in place or a plan is in place to eliminate risks • Riparian buffers • Address issues within 5 years • Phosphorus not applied or rock	• GMP1 (Identify the physical and biophysical characteristics of the farm system, assess the risk factors to water quality associated with the farm system, and manage appropriately) • GMP7 (Locate and manage farm tracks, gateways, water troughs, self-feeding areas, stock camps, wallows and other sources of run-off to minimise risks to water quality)	All (except movement corridors and access)

phosphate • Places where stock group up or travel regularly causing pugging issues	• GMP3 (Manage farming operations to minimise direct and indirect losses of sediment and nutrients to water, and maintain or enhance soil structure, where agronomically appropriate) • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) – Key sites for phosphorus and sediment losses identified • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - Consider strategic vegetated-buffer areas where runoff converges • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - Vegetated riparian buffer strips maintained around waterways (intensely farmed areas) • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - No direct application of P-fertiliser application into waterways • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - No super-phosphate application in high risk months (June-September) • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - Manage or retire bogs and swampy areas • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss (pg. 1) – What are critical source areas? • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Erosion Control – Actions to minimise or avoid erosion” (pg. 2) - Exclude stock from critical source areas. Vegetative cover acts as a buffer to slow and capture runoff. • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Erosion Control – Actions to minimise or avoid erosion” (pg. 2) - In severe cases, destocking and retirement of land, or land use change to plantation forestry or native trees, may be the best option. • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Erosion Control – Actions to minimise or avoid erosion” (pg. 2) - Select cropping paddocks carefully, limiting cropping on steep slopes and critical source areas. • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Erosion Control – Actions to minimise or avoid erosion” (pg. 2) - Fence and plant riparian areas such as drains, streams and wetlands to create a buffer to slow and capture runoff before it can enter waterways. • Dairy NZ Sustainable Milk Plan “Land & Soil Management” (pg7) - To maintain or improve the physical and biological condition of the soils in order to minimise the movement of sediment, phosphorus and other contaminants to waterways	

Overall assessment – will GMPs for this farm activity protect mahinga kai values	What else is needed to change the assessment to yes.
YES	Sufficient records are to be kept and used by farmers. There is evidence that records (information and data) are informing farm decisions.

Nutrient use		
No nitrogen is applied on farm or farmer has/ is reducing nitrogen usage on farm	• Dairy NZ Reducing nitrogen loss – A guide to good management practices "Good management practices for influencing N loss - Reducing total N fertiliser applied annually " (pg. 3) - Reducing annual N fertiliser use per ha potentially reduces a farm's N surplus and therefore N leaching • Canterbury FEP B&L Guidelines "Nitrogen loss"(pg14) - Avoid excessive N-fertiliser rates (>50 kg N/application or >150 kg N/ha/yr (on pasture; crops may be higher)) ***These GMPs refer to reducing or keeping N application under a specific rate. A more specific GMP is required to identify farmers whom are making the significant effort of reducing overall N usage (or eliminating N usage on farm)***	All
Equipment used for nutrient application is regularly maintained	• GMP12 (Ensure equipment for spreading fertilisers is well-maintained and calibrated) • Canterbury FEP B&L Guidelines "Phosphorus and sediment loss"(pg14) - Equipment used for fertiliser application is suitably calibrated • Canterbury FEP B&L Guidelines "Nitrogen loss"(pg15) - Equipment used for N application is suitably calibrated	All (except movement corridors and access)
Nitrogen applied at appropriate soil temperature for plant growth	• Dairy NZ Sustainable Milk Plan "Nutrient Management" (pg4) - To maximise nutrient use efficiency while minimising losses to water • Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - N applied when soil temperature above 6 degrees Celsius and rising • Dairy NZ Reducing nitrogen loss – A guide to good management practices "Good management practises for influencing N loss - Getting the best response to N fertiliser " (pg. 13) - Optimise response rates and pasture utilisation	All (except movement corridors and access)

Fertiliser not applied within 20 metres of a waterway	• Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - No direct application of P-fertiliser application into waterways	All (except and movement corridors, access)
Nutrients applied at correct rates (consistent with nutrient budget or soil requirements)	• GMP10 (Manage the amount and timing of fertiliser inputs, taking account of all sources of nutrients, to match plant requirements and minimise risk of losses) • GMP9 (Monitor soil phosphorus levels and maintain them at or below the agronomic optimum for the farm system) • Canterbury FEP B&L Guidelines “Nitrogen loss”(pg15) - Fertilizer application rates based on advisor's recommendations • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - Maximum fertiliser application rates set • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - Olsen-P maintained at optimum levels • Canterbury FEP B&L Guidelines “Nitrogen loss”(pg15) - No May, June, July applications of N fertilisers • Canterbury FEP B&L Guidelines “Nitrogen loss”(pg15) - Avoid excessive N-fertiliser rates (>50 kg N/application or >150 kg N/ha/yr (on pasture; crops may be higher)) • Canterbury FEP B&L Guidelines “Nitrogen loss” (pg15) - N fertiliser application. rates based on industry crop models e.g wheat calculator • Canterbury FEP B&L Guidelines “Nitrogen loss” (pg15) - Deep soil N tests used as basis of N applications to crops • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - Regular soil tests (specify frequency) undertaken as aid to determining P needs • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - Phosphate fertiliser application rates consistent with nutrient budget rates • Dairy NZ Sustainable Milk Plan “Nutrient Management” (pg4) - To maximise nutrient use efficiency while minimising losses to water • Dairy NZ Reducing nitrogen loss – A guide to good management practices “Good management practises for influencing N loss - Getting the best response to N fertiliser ” (pg. 13) - Optimise response rates and pasture utilisation • Dairy NZ Reducing nitrogen loss – A guide to good management practices “Good Management practises for influencing N Loss” (pg. 6) - Reducing total N fertiliser applied annually	All (except movement corridors and access)

Nitrogen applied when plant is of sufficient size for uptake	• Dairy NZ Sustainable Milk Plan "Nutrient Management" (pg4) - To maximise nutrient use efficiency while minimising losses to water • GMP10 (Manage the amount and timing of fertiliser inputs, taking account of all sources of nutrients, to match plant requirements and minimise risk of losses) • Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - N application rates set to match growth cycle of pasture or crop • Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - Pasture is at least 25mm high (1000kg DM/Ha) before nitrogen is applied • Dairy NZ Reducing nitrogen loss – A guide to good management practices "Good management practises for influencing N loss - Getting the best response to N fertiliser " (pg. 13) - Optimise response rates and pasture utilisation	All (except movement corridors and access)
Nitrogen not applied if soil compaction issues or soil moisture issues	• Dairy NZ Sustainable Milk Plan "Nutrient Management" (pg4) - To maximise nutrient use efficiency while minimising losses to water • GMP10 (Manage the amount and timing of fertiliser inputs, taking account of all sources of nutrients, to match plant requirements and minimise risk of losses) • Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - N is not applied to severely compacted soils • Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - N is not applied when soils are at field capacity as measured using soil moisture equipment • Dairy NZ Reducing nitrogen loss – A guide to good management practices "Good management practises for influencing N loss - Getting the best response to N fertiliser " (pg. 13) - Optimise response rates and pasture utilisation	All (except movement corridors and access)
Fertiliser applied when weather conditions are suitable	• Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - No N fertiliser applications when heavy rain is forecast • Dairy NZ Reducing nitrogen loss – A guide to good management practices "Good management practises for influencing N loss - Getting the best response to N fertiliser " (pg. 13) - Optimise response rates and pasture utilisation	All (except movement corridors and access)
GPS used for all nutrient application • Data supplied to farmer and certified to be correct • If GPS data shows an issue the farmer has discussed this with the individual applying nutrients (mitigated if possible) or got a new individual to apply N or P	• Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - GPS technology used for precise application of all N fertiliser spread ***The use of GPS technology is included but without mention of any checks to see if the data produced is being used. If the data is not being used or checked then the total value of technology and data is not fully utilised.***	All (except movement corridors and access)

Fertiliser applied by Spreadmark standards or using an certified individual with calibrated, maintained equipment • Spreadmark certified • Equipment meets standards and has maintenance records (can deliver right amounts / rates) • Individual has more than 5 years' experience in applying nitrogen and can demonstrate knowledge of standards • Individual knows all the risk areas on farm (give farm map with areas on it) • Individual knows the nutrient budget and can certify the correct amount / rate will / is applied on farm	***None***	All (except movement corridors and access)
All records relating to nutrient application are keep up to date • GPS data, application rate, individual whom applied nutrients and any issues raised • Records reviewed or checked regularly to identify if any issues • Records compared to nutrient budget, soil tests etc. • Checked to see if Spreadmark standards are being meet	• GMP2 (Maintain accurate and auditable records of annual farm inputs, outputs and management practises) ***Maintaining accurate records is stressed rather than the use of this data in farm management. This underutilises the data and means compliance isn't being checked.***	-

Overall assessment – will GMPs for this farm activity protect mahinga kai values	**What else is needed to change the assessment to yes.**
POSSIBLY	• Those applying fertiliser meet industry standards. • Sufficient records are being keep and used by farmer to inform future decisions

Winter grazing		
Suitable crop rotation and the maintaining of soil cover to mitigate potential nutrient losses • Crop rotation / paddock rotation can both reduce runoff and can "clean up" (if correct crop is used) some nutrients (N) within soil • Maize (or appropriate crop) used after winter grazing to mitigate nutrient losses	• Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - Crop rotation designed to utilise residual nitrogen in soil, e.g. cereals following fodder crops • Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - Cultivation practices and timing adjusted to minimise N losses • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss "Cultivation and re-grassing" (pg. 5) - Avoid cultivation during very dry periods and north-westerly winds as this increases the risk of soil loss through wind erosion • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss "Cultivation and re-grassing" (pg. 5) - Choose a tillage method that minimises soil loss from your paddocks – direct drilling or broadcasting is recommended • Dairy NZ Reducing nitrogen loss – A guide to good management practices "Good Management practises for influencing N Loss -Winter crop management" (pg. 14) - Mineral N leaching can be reduced by minimal or no tillage establishment methods • Dairy NZ Reducing nitrogen loss – A guide to good management practices "Good Management practises for influencing N Loss - Winter crop management" (pg. 14) - Urine N leaching can be reduced through paddock selection, forage crop selection, grazing timing and regime • Dairy NZ Reducing nitrogen loss – A guide to good management practices "Good Management practises for influencing N Loss - Winter crop management" (pg. 14) - Winter fallow leaching can be reduced though the use of a cover crop or cultivating as late as possible	All (except movement corridors and access)
Management techniques or measures taken to mitigate sediment or nutrient runoff • Winter grazing on parts of farm where no waterways or no chance or nutrient or sediment runoff • Riparian buffers of 20m (minimum) around water ways • Maize (or appropriate crop) used after winter grazing to mitigate nutrient losses • Stocking rate low within winter grazing paddock or cows stood off paddock for sufficient amount of time or when	• GMP20 (Select appropriate paddocks for intensive grazing, recognising and mitigating possible nutrient and sediment loss from critical source areas) • GMP21 (Manage grazing to minimise losses from critical source areas) • GMP4 (Manage periods of exposed soil between crops/pasture to reduce risk of erosion, overland flow and leaching) • GMP6 (Identify risk of overland flow of sediment and faecal bacteria on the property and implement measures to minimise transport of these to water bodies) • Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - Cultivation practices and timing adjusted to minimise N losses • Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - When feeding winter fodder crops, stock stood off block for at least four hours • Canterbury FEP B&L Guidelines "Phosphorus and sediment loss"(pg14) - Cattle	All (except movement corridors and access)

conditions poor (raining)	grazed on and off fodder block • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - Straw bales placed in low spots to adsorb runoff from fodder crop block • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - Strip next to riparian margins grazed last when break feeding winter feed crops • Canterbury FEP B&L Guidelines “Phosphorus and sediment loss”(pg14) - Ensure runoff from areas of high animal concentration (e.g. yards, frequently used tracks and stock camps) is discharged onto land rather than into waterways • Dairy NZ Reducing nitrogen loss – A guide to good management practices “Good Management practises for influencing N Loss - Grazing cows off in winter” (pg. 13) - Grazing cows off the farm during winter will reduce the N leached on the milking platform and can have positive physical effects on soils and pasture grown • Dairy NZ Reducing nitrogen loss – A guide to good management practices “Good Management practises for influencing N Loss -Using off paddock facilities” (pg. 14) - • Dairy NZ Reducing nitrogen loss – A guide to good management practices “Good Management practises for influencing N Loss -Using off paddock facilities” (pg. 14) - Off paddock facilities, such as feed pads and stand-off pads, can be used to reduce N loss by intercepting the N from dung and urine • Dairy NZ Reducing nitrogen loss – A guide to good management practices “Good Management practises for influencing N Loss -Using off paddock facilities” (pg. 14) - Restricting grazing to 8 hours a day over the autumn/winter period, without supplementary feeding, has been shown to have no impact on production, but has the potential to reduce N leaching by 15-20% • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Grazing crops” (pg. 6) – Place bales well away from waterways, fences or critical source areas to reduce effluent accumulation around these areas • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Grazing crops” (pg. 6) – Critical source area with buffer fence creating a grass filter which captures runoff • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Grazing crops” (pg. 6) - Avoid grazing critical source areas. If you have to, they should be the last areas to be grazed and only when the water level is low • Dairy NZ Land management on Canterbury dairy farms– Managing land to	

	reduce sediment and phosphorus loss “Grazing crops” (pg. 6) - Back-fence as much as possible to reduce pugging and compaction of the soil where pasture has been grazed. ***No GMPs in relation to stocking rates, crop selection (follow up crop) or selection of appropriate spot for winter grazing***	

Overall assessment – will GMPs for this farm activity protect mahinga kai values	**What else is needed to change the assessment to yes.**
YES	There needs to be sufficient evidence of compliance with the standard by the farmer

Some wintering systems – Stand off pad booklet (Dairy NZ website)

	Type of facility / Wintering system								
	Stand-off Pad	Wintering Pad	Feed pad	Loose housed barn – slatted floor	Loose housed barn – bedding material	Freestall Barn	Crop	Support Block	Grazier
Initial capital outlay	Mod	Mod	Mod	High	Very High	Very High	None	Very High	None
Maintenance cost	High	High	Low	Mod	High	Low	Low – re-grassing	Low	None
Operational cost	Low	Low	Mod	Mod	Mod	Mod	Low	Mod	Very High
Skill level to operate system effectively	Low	Low	Low	Mod	Mod - High	Mod - High	Mod	Mod	None
Time required per day	Mod	Mod	Mod	High	High	High	Mod	Low	None
Reliance on machinery	Low	Mod - High	High	High	High	High	Low - Mod	Low - Mod	None
N leaching loss	Low	Low	Low	Low	Low	Low	Very High	High	High
Effluent collection and storage	Collected and stored						Not collected and stored		
Reliance on stored feed	Low	High	Mod	High	High	High	Low	None	None

Key: Very High | High | Moderate | Low

On farm rubbish disposal		
Offal pits are clearly marked (signage), covered or fenced	• Canterbury FEP B&L Guidelines "Rubbish, offal and silage effluent management "(pg14) - Offal pits covered and or fenced—think of child safety and vermin	
All non-biodegradable rubbish is removed from farm to be disposed of in an sustainable manner • All rubbish which can be recycled is or an significant proportion is recycled (Ag recovery or Plasback) • Sufficient skips or disposal containers to cope with farm rubbish output	• Canterbury FEP B&L Guidelines "Rubbish, offal and silage effluent management "(pg14) - Farm rubbish dumps located in an area where there is no risk of contamination of groundwater • Dairy NZ Farmfact - Farm dumps and offal pits "Siting farm dumps" - Bottom of the dump site at least one metre above the maximum expected ground water table level • Dairy NZ Farmfact - Farm dumps and offal pits "Siting farm dumps" - At least 100 metres from a domestic bore or 200 metres if the farm dump is at an elevated location • Dairy NZ Farmfact - Farm dumps and offal pits "Siting farm dumps" - At least 50 metres from any farm dairy • Dairy NZ Farmfact - Disposal of agrichemicals, containers, drums and silage plastics "Recycling agrichemical containers" • Dairy NZ Farmfact - Disposal of agrichemicals, containers, drums and silage plastics "Recycling silage wrap and pit covers" ***No mention of using skips or disposing of rubbish sustainably off farm. The focus is making sure farm dumps don't impact water or impact human / animal health. Also no mention of recycling of any rubbish including Ag recovery and Plasback***	Habitat, food sources, gathering
Biodegradable rubbish is disposed of on farm in safe and sustainable manner	• Canterbury FEP B&L Guidelines "Rubbish, offal and silage effluent management "(pg14) - Farm rubbish dumps located in an area where there is no risk of contamination of groundwater • Canterbury FEP B&L Guidelines "Rubbish, offal and silage effluent management "(pg14) - Composting used for dead stock disposal • Dairy NZ Farmfact - Composting dead stock • Dairy NZ Sustainable Milk Plan "Storage Infrastructure & Waste Management" (pg8) - To manage the number and locations of offal and rubbish pits to minimise risks to health and water quality	Habitat, food sources, gathering
Offal pits are located in areas without groundwater issues or potential groundwater issues • Sawdust is used to assist in the breakdown of offal	• Canterbury FEP B&L Guidelines "Rubbish, offal and silage effluent management "(pg14) - Offal pits located in areas where there is no risk of contamination of groundwater • Dairy NZ Farmfact - Farm dumps and offal pits "Siting offal pits" - At least 100 metres from any surface waterway, open drain, wetland or neighbouring	Habitat, food sources, gathering

• No complains have been recorded by neighbours • Offal pits are filled to the correct height and are not overflowing • Offal pits are clearly marked and so staff can locate them	boundary • Dairy NZ Farmfact - Farm dumps and offal pits "Siting offal pits" - Well away from any other offal pit that has been used in the last five years • Dairy NZ Sustainable Milk Plan "Storage Infrastructure & Waste Management" (pg8) - To manage the number and locations of offal and rubbish pits to minimise risks to health and water quality	
Silage bales / silage pit is place within an area or a way to eliminate leaching or runoff • Silage is wrapped correctly • Silage pits are sealed	• GMP15 (Store, transported and distributed feed to minimise wastage, leachate and soil damage) • Canterbury FEP B&L Guidelines "Rubbish, offal and silage effluent management "(pg14) - Risks of leachate from silage pits identified and managed • Canterbury FEP B&L Guidelines "Rubbish, offal and silage effluent management "(pg14) - No runoff of leachate from silage pits to waterways including drains	Habitat, food sources, gathering
Chemical containers are disposed of correctly via an authorised / certified organisation or following correct guidelines • Containers are triple washed • Liquid from washed containers is disposed of in sustainable manner • Agrecovery an certified organisation	• Dairy NZ Farmfact - Disposal of agrichemicals, containers, drums and silage plastics "Recycling agrichemical containers" • Dairy NZ Farmfact - Disposal of agrichemicals, containers, drums and silage plastics "Recycling silage wrap and pit covers" • Dairy NZ Farmfact - Disposal of agrichemicals, containers, drums and silage plastics "Disposing of unwanted and expired chemicals" ***No mention within any of the GMP or correct disposal of chemical containers***	*Habitat, food sources, gathering*

Overall assessment – will GMPs for this farm activity protect mahinga kai values	**What else is needed to change the assessment to yes.**
POSSIBLY	On farm rubbish needs to disposed of sustainability (recycled where possible)

Effluent management		
Cultural expectation	**GMPs**	**Mahinga kai attributes potentially impacted**
Effluent system (Farm design as well)		
Effluent system sufficient for the farms operation • Terrain • Soil types • Has at least 30 days storage (more if needed) • Any other environmental issues / risk considerations	• GMP16 (Ensure the effluent system meets industry specific Code of Practice or equivalent standard) • GMP17 (Have sufficient, suitable storage available to enable farm effluent and waste water to be stored when soil conditions are unsuitable for application) • Dairy NZ Sustainable Milk Plan "Effluent Management" (pg5) - To manage the risk associated with the operation of effluent systems to ensure effluent systems are compliant 365 days of a year • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "System design - Planning the right system for your farm" (pg. 5) - DairyNZ recommends farmers use suitably qualified and accredited effluent system designers • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "System design - Planning the right system for your farm" (pg. 5) - The system must be capable of storing all effluent when conditions aren't suitable to irrigate, and then allow the option of getting effluent onto land and emptying the pond when conditions permit ***The GMPs covers general rules relation to effluent management including sufficient storage and compliance. They don't specify a minimum amount of storage required and don't discuss terrain, soil or terrain considerations. Although these maybe captured within the general GMPs.***	All except access

Effluent system designed so areas where its applied are as far away from critical source areas as possible (waterways, sensitive soils, tracks etc.)	***None - No specific GMPs relating to the consideration of critical source areas or areas of environmental risk when designing the effluent system or placing the effluent infrastructure.***	All except access
Effluent system is compliant with council regulations and meets industry standards • Effluent system installed by INZ (or appropriate organisation) or certified installer • Effluent system has been certified and audited	• GMP16 (Ensure the effluent system meets industry specific Code of Practice or equivalent standard) • Dairy NZ Sustainable Milk Plan "Effluent Management" (pg5) - To manage the risk associated with the operation of effluent systems to ensure effluent systems are compliant 365 days of a year • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "System design - Planning the right system for your farm" (pg. 5) - DairyNZ recommends farmers use suitably qualified and accredited effluent system designers ***INZ standards are not mentioned but effluent design code of practise is included as a GMP. These maybe similar. There is no mention of certification or auditing by an independent individual or organisation.***	All except access
Effluent system is checked / audited regularly to maintain its integrity • Check application depth, hoses, nozzles etc. • Annual audit minimum • Older systems may require more maintenance • Records keep of audit and maintenance records	• GMP18 (Ensure equipment for spreading effluent and other organic manures is well-maintained and calibrated) • GMP2 (Maintain accurate and auditable records of annual farm inputs, outputs and management practices) • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Operation – Tips for maintenance" (pg. 47-48) – Suggested tasks for travelling applicator maintenance (A list) • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Operation – Tips for maintenance" (pg. 49) - Suggested tasks for sprinkler applicator maintenance (A list) • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Operation – Tips for maintenance" (pg. 50) - Suggested tasks for storage maintenance (A list) • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Operation – Operating and maintaining an effluent system" (pg. 42) - Irrigator run sheets and calibration recording	All except access

Overall assessment – will GMPs for this farm activity protect mahinga kai values **POSSIBLY**	What else is needed to change the assessment to yes. All systems need to be certified and audited by an accredited organisation and focus is equally on nutrient use of effluent & environmental risk

Effluent application		
Effluent application map created and used when applying effluent • Map is readily available, easy to read and practical to use • Records of application (depth, areas etc.) • Maps lists recommended application depths, issues etc. • Clear no application areas are labelled on map	Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Soil and water " (pg. 16) - Effluent application plan ***No details on what the effluent management plan covers and how actively it has to be used.***	-
Effluent is tested regularly to determine nutrient level and application is modified to reflex test results • Nutrient budget may need to be reviewed	Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Land application - Nutrient management – know the nutrient loading from effluent application" (pg. 16) - Taking nutrient samples	All except access
Effluent is applied to the maximum area of the farm to reduce leaching risk or is taken off farm if required • Maximum amount of suitable area (non-sensitive soils, away from waterways)	• Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Land application - Nutrient management – know the nutrient loading from effluent application" (pg. 16) - Using a nutrient budget to size the effluent application area • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Soil and water " (pg. 16) - Effluent application plan ***This GMP implies the farmer will apply effluent to the maximum area to maximum the use of the nutrients within the effluent. There is no GMP relating to maximising effluent application area to reduce the risk of N leaching. Although this may be covered by the Effluent application plan.***	*All except access*

Measures taken to reduce the amount of effluent created on farm or effluent created is lower risk to environment • Effluent has lower concentrations of nutrients • More soil effluent or effluent which can be applied with lower risk to environment	• Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Minimising the volume of effluent to manage" (pg. 33) - Stormwater diversion • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Minimising the volume of effluent to manage" (pg. 33) - Stormwater diversion • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Minimising the volume of effluent to manage" (pg. 33) - Good stockmanship will help reduce the amount of effluent generated • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Minimising the volume of effluent to manage" (pg. 33) - consider using recycled water for flood wash systems for yard and pad wash-down • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Minimising the volume of effluent to manage" (pg. 33) - in high rainfall areas, consider covering and diverting the roof water from large feed and standoff pads to reduce the catchment area for the effluent system • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Minimising the volume of effluent to manage" (pg. 33) - look at ways to reduce the water usage on the milking platform • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Minimising the volume of effluent to manage" (pg. 33) - low water-use backing gate wash-down options • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Minimising the volume of effluent to manage" (pg. 33) - if you are standing your herd off, consider a system that requires less water for effluent collection	All except access

Effluent storage system is correctly installed and meets industry and council standards • Certified installer and audited	• GMP16 (Ensure the effluent system meets industry specific Code of Practice or equivalent standard) • GMP17 (Have sufficient, suitable storage available to enable farm effluent and waste water to be stored when soil conditions are unsuitable for application) • Dairy NZ Sustainable Milk Plan "Effluent Management" (pg5) - To manage the risk associated with the operation of effluent systems to ensure effluent systems are compliant 365 days of a year • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "System design - Planning the right system for your farm" (pg. 5) - DairyNZ recommends farmers use suitably qualified and accredited effluent system designers	All except access
Soil moisture, weather and soil type are key components in the decision making relating to effluent application • Monitoring data used (proof of use) • Records of application (areas etc.)	• GMP19 (Apply effluent to pasture and crops at depths, rates and times to match plant requirements and minimise risk to water bodies) • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Soil and water " (pg. 16) - Effluent application plan • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Solids and slurries " (pg. 16) - Farm Dairy Effluent (FDE) Spreading Calculator • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Land application" (pg. 23) - Matching effluent application to the soil water deficit • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Soil and water " (pg. 16) - Effluent application plan • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team" (pg. 49) - Farm team effluent management plans	All except access

Effluent storage of at least 30 days on farm or more depending on soils, weather, farm type etc. • Storage volume is greater than what is required • Records keep of pond status • Pond is emptied at correct times	• GMP17 (Have sufficient, suitable storage available to enable farm effluent and waste water to be stored when soil conditions are unsuitable for application) • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Collection and pond storage " (pg. 30) - The Dairy Effluent Storage Calculator • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Collection and pond storage " (pg. 31) - Effluent Storage: Working Volume Calculator • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Storage - Managing storage volumes " (pg. 32) - Seasonal targets (Spring, Summer, Autumn, Winter)	All except access
Any risks relating to effluent application are listed and mitigation in place • Every year system is checked and updated if needed to reduce risks • Records of identification of problems and plans to mitigate issues	• GMP18 (Ensure equipment for spreading effluent and other organic manures is well-maintained and calibrated) • GMP2 (Maintain accurate and auditable records of annual farm inputs, outputs and management practices) • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Soil and water " (pg. 16) - Effluent application plan • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team" (pg. 39) - Farm team effluent management plans	All except access
Effluent is spread away from the following area • 50m from waterways (non-sloped), roads, tracks • 150m from residential areas, public areas and areas of cultural significance	• Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Soil and water " (pg. 16) - Effluent application plan • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team" (pg. 39) - Farm team effluent management plans ***Within the Dairy NZ effluent application plan they refer to having 20m buffers between waterways and areas where effluent is applied. This is less than 50m or 150m or having effluent being applied as far as possible away from areas of risk i.e. waterways.***	All except access

GPS technology or application technology (VRI, Trackmap) used when applying effluent • Records keeps and overlaid against effluent map to ensure compliance • Any issues identified and address	• Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Soil and water " (pg. 16) - Effluent application plan • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team" (pg. 39) - Farm team effluent management plans • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "System design - Understanding the different components of an effluent system" (pg. 11) – Technology (variable rate irrigation on pivots, integrated telemetry and data logging systems for soil moisture deficit monitoring, software for planning, monitoring and recording effluent management) • Refer to Irrigation Management – Application if pivots are used for effluent application as well. ***When irrigation infrastructure is used to apply effluent this may be covered within those GMPs. Effluent management plan or application plan may cover these aspects.***	All except access

Overall assessment – will GMPs for this farm activity protect mahinga kai values	**What else is needed to change the assessment to yes.**
YES	Sufficient records are to be kept and there needs to be evidence that information is being used by the farmer in decision making

An example of an Effluent management plan (excluding map) – Dairy NZ effluent management plan (Dairy NZ website)

Effluent management plan

Farm name: _____ Date: _____

Maximum application depth: _____ mm Maximum application rate: _____ mm/hr

Maximum N loading: _____ kg N/ha

Do not apply effluent if soil moisture is: _____

Effluent duty person is _____	Who	Date done
Daily Tasks *e.g. Make sure irrigator is in the right place*		
Weekly Tasks *e.g. Empty effluent sump and stone trap*		
Monthly Tasks *e.g. Check nozzles are not blocked or damaged*		
Annual Tasks *e.g. Do application rate test*		

Attach consent here

Farm Policy

- Effluent system is checked at least daily
- No effluent puddles in any paddocks
- Problems with effluent: tell your manager
- Check and record effluent irrigation events
- Any leak or breakdown is dealt with IMMEDIATELY
- No effluent gets into waterways
- No effluent into or near soakholes or bores
- All staff given adequate training before using system

_____

_____

What to do if...

Too wet to irrigate	
Irrigator stalled / breakdown	
Pump failure	
Poor pressure at irrigator	
No storage / storage full	
No electricity	
Hydrant / pipe leaking	

Attach effluent area and risk map

Emergency contact numbers

Farm contact person:	**Pump breakdown and service:**
Effluent equipment:	**Effluent collection tanker:**
Electrical problems:	**DairyNZ - Effluent specialist:**
Milk company - Effluent specialist:	**Regional Council:**

dairynz.co.nz
0800 4 DairyNZ (0800 4 324 7969)

DairyNZ

Staff		
Staff are trained and/or have experience in using this type of effluent system • Knowledge of the farm and understand effluent management plan / maps	• Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team" (pg. 38) - Orientation and training • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Soil and water " (pg. 16) - Effluent application plan • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team" (pg. 39) - Farm team effluent management plans	-
Incidents relating to effluent storage or application are addressed as soon as possible and fixed to prevent occurring again. This can include breakages (may need replacement or upgrade) or weather / human events. • Incidents are addressed as soon as possible by qualified individual • Mitigation put in place if required if environmental damage • Incident recorded and measures put in so this doesn't occur or risk of occurring again is low.	• Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team" (pg. 39) - Farm team effluent management plans • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team - Safety around the effluent system" (pg. 39) - training for system-operators relating to safe operation and maintenance of the effluent system • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team - Safety around the effluent system" (pg. 39) - making sure staff and visitors are aware of hidden hazards, • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team - Safety around the effluent system" (pg. 39) - turn off and secure moving parts when shifting or checking irrigators, • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team - Safety around the effluent system" (pg. 39) - install barriers or fences around ponds, sumps, stone traps, sludge bunkers or weeping walls ***Each farms effluent management plan may cover this GMPS in varying detail. Although the detail or how well this system is carried out is dependent on each specific farm. This GMP may be covered within irrigation management – water application. A discharge consent may cover some of these GMPs.***	-

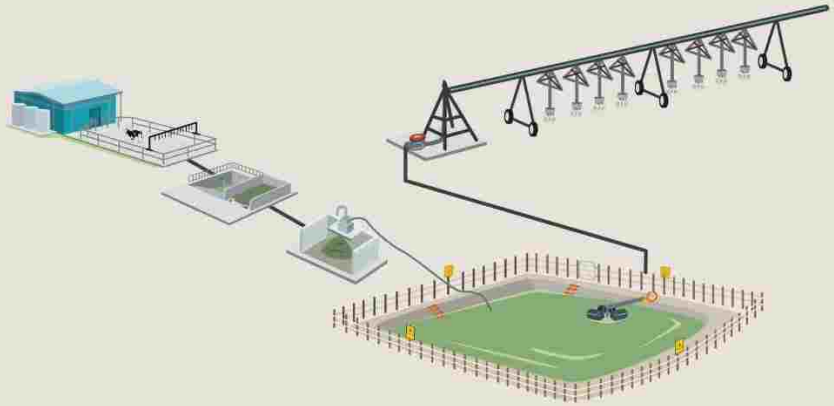
Overall assessment – will GMPs for this farm activity protect mahinga kai values **YES**	What else is needed to change the assessment to yes. Sufficient records are to be kept and there needs to be evidence that information is being used by the farmer in decision making

Ponding on farms is to be avoided	All cows are to be fenced out of waterways	The expectation is that effluent will not be applied in low, swampy wetted areas
		

Examples of an effluent systems - Farm dairy effluent systems planning (Dairy NZ website)

Pivot through the mainline – using mechanical separation

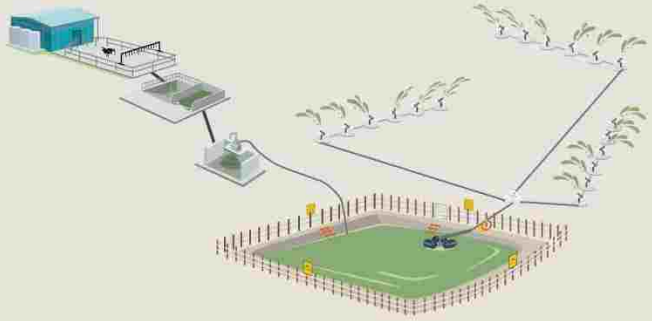
Using a pivot to irrigate is logically restricted to those already with pivots in place for water irrigation. The effluent flows through a stone trap to the mechanical separator. The liquid is then pumped to the storage facility and applied to the paddocks through the pivot mainline.



Best suited for	
Farms	Irrigation pivot already in place
Soils	All
Slope	Flat
Labour	Moderate labour input
Capital investment	Higher (storage additional)

Mulitple line low rate sprinkler – using mechanical seperation

This system has a storm water diversion at the yard. The effluent then flows through a stone trap to a mechanical separator where the solids are removed. The liquid is then pumped to storage and is irrigated to land via series of multiple irrigation lines simultaneously. Each line has a number of low rate applicators on it. Applicators distribute a large volume of effluent in a short period of time at a low application depth.



Best suited for	
Farms	All farms. Especially higher rainfall areas and farms that have limited opportunities to irrigate and empty ponds
Soils	All soil types. Especially suited to poorly /artificially drained high risk soils
Slope	All
Labour	Moderate labour input
Capital investment	Higher (storage additional)
Other	• Fast pond level reduction over large land area • Locations with few irrigation days available

Soil Management		
Cultural expectation	**GMPs**	**Mahinga kai attributes potentially impacted**
Farm design / infrastructure		
Riparian buffer strips to eliminate or dramatically reduce sediment entering ways	• GMP6 (Identify risk of overland flow of sediment and faecal bacteria on the property and implement measures to minimise transport of these to water bodies) • Canterbury FEP B&L Guidelines "Soil and Erosion management" (pg15) - Contour fencing • Canterbury FEP B&L Guidelines "Soil and Erosion management" (pg15) - Stabilisation planting such as flaxes, small trees, willows to prevent stream bank erosion • Canterbury FEP B&L Guidelines "Soil and Erosion management" (pg15) - Strategic tree planting to protect key infrastructure from erosion (fences, tracks, buildings, public roads) • Canterbury FEP B&L Guidelines "Soil and Erosion management" (pg15) - Afforestation of erosion prone areas • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss "Waterway management" (pg. 3) - Riparian plants filter sediment, phosphorus and bacteria in runoff, reducing the amount entering the water • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss "Erosion Control – Actions to minimise or avoid erosion" (pg. 2) - Fence and plant riparian areas such as drains, streams and wetlands to create a buffer to slow and capture runoff before it can enter waterways.	All except access

Placement of farm infrastructure e.g. tracks takes into consideration environmental risk including runoff • Farm tracks	• GMP1 (Identify the physical and biophysical characteristics of the farm system, assess the risk factors to water quality associated with the farm system, and manage appropriately) • GMP7 (Locate and manage farm tracks, gateways, water troughs, self-feeding areas, stock camps, wallows and other sources of run-off to minimise risks to water quality) • Canterbury FEP B&L Guidelines "Phosphorus and sediment loss" (pg15) - Ensure runoff from areas of high animal concentration (e.g. yards, frequently used tracks and stock camps) is discharged onto land rather than into waterways • Canterbury FEP B&L Guidelines "Phosphorus and sediment loss" (pg15) - Move troughs and gateways away from areas of high water flow • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss "Laneways" (pg. 6) - Well-constructed laneways with a gradual camber and cut-off drains that direct water to paddocks will be less likely to send sediment into waterways	All
Overall assessment – will GMPs for this farm activity protect mahinga kai values **YES**	**What else is needed to change the assessment to yes?** The score is likely to be "Yes" if enough of the GMPs are sufficiently integrated into farm design before conversion or expansion.	

Soil issues		
Soil compaction checked and identified on farm. Areas of highest risk of compaction checked first (fodder paddocks, cropped areas) • Irrigation, effluent and fertiliser stopped if an issue is identified. It is then only applied once compaction addressed or mitigated	• Canterbury FEP B&L Guidelines "Phosphorus and sediment loss" (pg15) - Regular checks for soil compaction undertaken for high risk soils ***No GMP associated with reducing irrigation, effluent or fertiliser application completely. Most GMPs (including Irrigation management and effluent management) focus on changing or modifying farming practises which may include reduce or cutting application if there is an environmental risk.***	All except movement corridors and access

Soil compaction maps created for staff and contractor use • Maps stored with other maps • Evidence of maps being used and issues on maps being addressed • Maps updated annually	• Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "Soil and water " (pg. 16) - Effluent application plan • Dairy NZ A farmer's guide to managing farm dairy effluent - A good practice guide for land application systems "The farm team" (pg. 39) - Farm team effluent management plans ***No mention of staff training or map creation. Soil compaction issues maybe within a general farm map or within irrigation or effluent management plans / maps.***	-
Soil compaction risks identified and mitigation put in place • Feed pads • Stock movement to limit compaction	• GMP5 (Retire all Land Use Capability Class 8 and either retire, or actively manage, all Class 7e to ensure intensive soil conservation measures and practices are in place) • Canterbury FEP B&L Guidelines "Phosphorus and sediment loss" (pg15) - Regular checks for soil compaction undertaken for high risk soils • Canterbury FEP B&L Guidelines "Phosphorus and sediment loss" (pg15) - Significant soil compaction managed through soil aeration • Canterbury FEP B&L Guidelines "Phosphorus and sediment loss" (pg15) - Differences in soil susceptibility to compaction recognised and managed to minimise damage • Canterbury FEP B&L Guidelines "Nitrogen loss" (pg15) - N is not applied to severely compacted soils • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) - Heavy machinery restricted to specified pathways	All except movement corridors and access
Overall assessment – will GMPs for this farm activity protect mahinga kai values **POSSIBLY**	**What else is needed to change the assessment to yes.** The GMPs need to focus more upon eliminating or reducing environmental risk	

Erosion issues		
Direct drilling or low tillage used on farm to reduce erosion or sedimentation issues • All crops and pasture renewal use these techniques • At risk areas (waterways, hills) care is taken when using these techniques	• Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Direct drilling or minimum tillage used in preference to conventional cultivation in high erosion risk situations • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss "Erosion control – Wind erosion" (pg. 3) - Use minimum tillage or no tillage cultivation practices to retain topsoil.	All except movement corridors and access
Measures taken to identify, reduce or mitigate erosion issues on farm • Containment structures for sediment • Erosion and sediment management plan	• GMP21 (Manage grazing to minimise losses from critical source areas) • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Move stock off wet soils in winter • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Use of containment structures for certain erosion types (e.g. debris dams) • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Strategic tree planting to protect key infrastructure from erosion (fences, tracks, buildings, public roads) • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Design or locate tracks, fences, etc. in a way that minimises the risk of erosion damage • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Engage a regional council advisor/officer or similar specialist for advice on erosion and soil management • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Stabilisation planting such as flaxes, small trees, willows to prevent stream bank erosion • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Reducing weight of stock on erodible country (e.g. replacing cattle with sheep or moving to a younger stock class) • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Regular checks for erosion from channelled runoff, (i.e. from wheel ruts, tracks etc.), and fast remedial action • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Deer mobs separated to reduce pacing and erosion on fence lines • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Fence lines/corners planted to reduce deer pacing behaviour and erosion • Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Areas of stream bank erosion are identified and controlled • Dairy NZ Land management on Canterbury dairy farms– Managing land to	All except movement corridors and access

	reduce sediment and phosphorus loss “Erosion control – Wind erosion” (pg. 3) – Do not over cultivate soils. This will leave them more vulnerable to wind erosion • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Erosion control – Sheet, rill and gully erosion” (pg. 3) - Use cut-offs on laneways to direct water into paddocks and prevent rills from occurring on steep sections of the laneway • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Erosion control – Sheet, rill and gully erosion” (pg. 3) - Select cropping paddocks carefully, limiting cropping on steep slopes and critical source areas • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Erosion control – Mass movement” (pg. 3) - Use lighter stock classes or lower stocking rates to reduce pressure on steeper land • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Erosion control – Mass movement” (pg. 3) - In severe cases, destocking and retirement of land, or land use change to plantation forestry or native trees, may be the best option	
Overall assessment – will GMPs for this farm activity protect mahinga kai values **YES**		**What else is needed to change the assessment to yes?** The farmer needs to implement the GMPs and have evidence of that.

Areas at risk of supplying sediment should be planted out - ideally with taonga plant species	The expectation is that exposed riverbanks will be replanted so that they do not contribute sediment	The placement of lanes and crossings away from waterways is important.
		

Riparian and Waterway management

Cultural expectation	GMPs	Mahinga kai attributes potentially impacted
Farm design		
Areas of potential cultural significance or high biodiversity identified and integrated into farm design • Plan developed to minimise impact or enhance this areas on farm	***None***	All except movement corridors and access

Riparian planting plan designed as part of farm conversion or expansion • Key component in farm conversion	• Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Enhancement programme in place for identified areas of indigenous biodiversity • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) - Riparian planting programme planned/implemented	-
Fish passage maintained or protected • Fish screen to stop native fish getting stuck within water infrastructure (if this will have negative impact upon them) • Sufficient continuous flow for range of native species	• DairyNZ Waterway technote – Crossings "Culverts - Good management practices for culverts" (pg. 12) – Set the floor of the culvert below the streambed level to avoid vertical drops at the downstream end. Do not create a waterfall as this increases the chance of erosion and restricts fish movement upstream • c Allow natural streambed material to settle on the culvert floor along its length so that it is easier for fish to swim through ***There are some GMPs relating to protecting fish passage but no reference to excluding fish from entering water infrastructure which may have a negative impact on them.***	All except movement corridors and access
Waterways, wet areas and areas of environmental risk are considered when designing a farm conversion or expansion • Lane placement • Riparian buffers and fencing • Water crossings	• GMP14 (Design, calibrated and operated irrigation systems to minimise the amount of water needed to meet production objectives) • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Culverts or bridges at stock crossings • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) - Runoff from stock tracks and races directed away from waterways or filtered through riparian buffers • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Legally protected wetlands on farm identified and protected • Dairy NZ Sustainable Milk Plan "Waterway & Biodiversity Management" (pg6) - o manage wetlands and water bodies so that stock are excluded as far as practicable from water, to avoid damage to the bed and margins of a water body, and to avoid the direct input of nutrients, sediment, and microbial pathogens • DairyNZ Waterway technote – Crossings "Good management practices for culverts" (pg. 5) – When choosing a culvert, bigger is generally better if you are concerned about blockages, erosion from over-topping or if high downstream water levels restrict water flow • DairyNZ Waterway technote – Crossings "Good management practices for culverts" (pg. 5) – Position the culvert so that the gradient and alignment are the same as the stream • DairyNZ Waterway technote – Crossings "Good management practices for culverts" (pg. 5) – Set the floor of the culvert below the streambed level to avoid	All except

	vertical drops at the downstream end. Do not create a waterfall as this increases the chance of erosion and restricts fish movement upstream • DairyNZ Waterway technote – Crossings “Good management practices for culverts” (pg. 5) – Allow natural streambed material to settle on the culvert floor along its length so that it is easier for fish to swim through. • DairyNZ Waterway technote – Crossings “Good management practices for culverts” (pg. 5) – Make sure the culvert is not altering the natural gradient and bed of the stream • DairyNZ Waterway technote – Crossings “Good management practices for culverts” (pg. 5) – Take care to minimise the amount of sediment entering the waterway when installing the culvert • DairyNZ Waterway technote – Crossings “Good management practices for culverts” (pg. 7) – Culvert sizing guidelines • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss “Laneways” (pg. 6) - Well-constructed laneways with a gradual camber and cut-off drains that direct water to paddocks will be less likely to send sediment into waterways • DairyNZ Waterway technote – Crossings “Bridges” (pg. 12) – Avoid locating your bridge on a bend in a waterway, as sediment will build up on the inside • DairyNZ Waterway technote – Crossings “Bridges” (pg. 12) – Construct raised lips on the deck and edges to prevent runoff entering the waterway • DairyNZ Waterway technote – Crossings “Bridges” (pg. 12) – Raising the bridge above its approaches will also help to reduce runoff from tracks and races from entering the waterway • DairyNZ Waterway technote – Crossings “Bridges” (pg. 12) – Channel runoff from the bridge into grassy areas or planted areas • DairyNZ Waterway technote – Crossings “Bridges” (pg. 12) - Construct your bridge high enough to avoid impeding high stream flows ***Some GMPs address this issue but the entire farm design should take into consideration all the environmental risks when converting or when there is a major upgrade on farm. Evidence of making these design considerations is proof the farmer is fully considering environmental risks. Farm design is fundamental in addressing environmental risks.***	

Overall assessment – will GMPs for this farm activity protect mahinga kai values **POSSIBLY**	What else is needed to change the assessment to yes? The farmer is to correctly identify waterways and areas which are wet for the majority of the year and implement relevant GMPs to an standard which meets whanau expectations.

Stock exclusion		
All stock are excluded from all waterways, wetlands or wet areas all the time • Sufficient fencing (regularly checked) • Hot wires are used only in areas where its temporary wet. If an area is regularly wet then fencing required. • If areas within paddocks regularly wet then re contour may be required or permanent fencing	• GMP8 (To the extent that is compatible with land form, stock class and intensity, Exclude stock from waterways) • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Stock excluded from all waterways and wetlands in accordance with ECan rules • DairyNZ Waterway technote – Fencing "Key messages/quick links - Under the Sustainable Dairying Water Accord " (pg. 2) – All stock must be excluded from any permanently flowing rivers, streams, drains and springs, more than a metre wide and 30cm deep by May 2017 • DairyNZ Waterway technote – Fencing "Planning - How to determine where your fence should go" (pg. 2) – Where you locate your fence will depend on how you intend on managing the zone. There are four major ways to manage your riparian zones (Fence/keep stock out of streams, Low planting – plant low growing sedge species and fence, Full planting - fence and plant, Fence stock out of seeps wetlands/swamps and spring the riparian margin) ***More specific GMPs needed on types of fencing with stress upon permanent fencing and buffers between fencing and area of environmental risk i.e. waterways.***	All except movement corridors and access
Stock water provided in every paddock • Stock don't need to access waterways • Trough placed in areas to minimise environmental risk	• Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Reticulate stock water • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Alternative sources of stock water in each paddock (e.g. troughs).	All except movement corridors and access

Overall assessment – will GMPs for this farm activity protect mahinga kai values **POSSIBLY**	What else is needed to change the assessment to yes. **The farmer is to identify waterways and areas which are wet for the majority of the year and exclude stock.**

Farm containments reduction		
Farm tracks, races and crossings are contoured so runoff doesn't enter waterways or wet areas • Runoff is intercepted by riparian buffers • Runoff is put back onto paddock then riparian buffer • Sediment is stopped from entering waterways	• Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Runoff from stock tracks and races directed away from waterways or filtered through riparian buffers • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Approaches to stock crossings are managed to avoid runoff to waterways • Dairy NZ Land management on Canterbury dairy farms– Managing land to reduce sediment and phosphorus loss "Laneways" (pg. 6) - Well-constructed laneways with a gradual camber and cut-off drains that direct water to paddocks will be less likely to send sediment into waterways • DairyNZ Waterway technote – Crossings "Bridges" (pg. 12) – Raising the bridge above its approaches will also help to reduce runoff from tracks and races from entering the waterway • DairyNZ Waterway technote – Crossings "Bridges" (pg. 12) – Channel runoff from the bridge into grassy areas or planted areas	All except movement corridors and access
Riparian buffer with native vegetation planted on farm • Iwi Plans set out what whanau believe should be a minimum buffer width (see Figure 12) • Sufficient native vegetation planted	• Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Riparian margins are of sufficient width to adequately filter run-off (1-10m) • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Riparian planting programme planned/implemented • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Riparian planting • DairyNZ technote – Draiins "Benefits of good drain practice" (pg. 2) - Enhancing water quality by reducing nutrient, sediment and bacterial concentrations • DairyNZ technote – Draiins "Benefits of good drain practice" (pg. 2) - Improving habitat for fish and insects by cooling water, enhancing flow and increased oxygenation ***No specific GMP relating to the minimum size for buffer strips. The focus is upon mitigating run off from farm operation.***	All except movement corridors and access

Riparian planting plan designed or planned to be developed within one year • Riparian planting plan prepared by certified / knowledgeable individual • Set timeframes for riparian planting plan • Targets for riparian planting plan carried out within a timeframe agreed with whanau	• Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Enhancement programme in place for identified areas of indigenous biodiversity • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Riparian planting • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Legally protected wetlands on farm identified and protected • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Riparian planting programme planned/implemented ***Riparian planting programme may include the targets listed but again its dependant on each individual farmer. Preparing a riparian planting plan shouldn't be the only objective.***	-
Overall assessment – will GMPs for this farm activity protect mahinga kai values **POSSIBLY**	**What else is needed to change the assessment to yes.** **The farmer is to identify waterways and areas which are wet for the majority of the year and exclude stock.**	

Contaminants entering waterbodies remain a concern to whanau. In Table 6 below we summarise the extent to which the GMPs, if fully implemented a likely to address the potential impact of these contaminants on waterways.

On farm sources of contaminants	Potential contaminants	Potential pathway to water source	GMPs mitigate potential impact	Recommended GMPs mitigate potential impact
Fuel storage	• Diesel, petrol • Used engine oil, lubricants • Breakdown products (e.g. benzene)	• Spills, leakages • Infiltration to ground water • Runoff of surface water	N	Y
Fertiliser and pesticide storage, use and handling	• Chemical products • Breakdown products	• Back siphoning in to the well or water supply • Spills, leakages • Infiltration, runoff	Y	N/A
Effluent storage (May or may not include shed waste water)	• Nitrates and other nutrients • Bacteria	• Storage overflow, spills • Runoff, infiltration	Y	N/A
Shed wastewater	• Phosphorus, nitrates • Shed clearing products including Chlorine • Bacteria • Degraded milk solids • Medicines i.e. Penicillin • Estogen	• Illegal connection to tile drainage • Runoff, infiltration	Y	N/A
Silage leachate	• Nitrates and other nutrients • Acids • Organic matter, bacteria	• Infiltration, runoff, spills	Y	N/A
Composting	• Pesticide products • Organic matter • Phosphorus, nitrates	• Runoff, infiltration	Y	N/A
Deadstock and other hazardous wastes	• Bacteria, disease organisms • Medicines • Disinfectants • Paints, cleaners, oils • Batteries • Any other non-bio degradable waste • Diseases i.e listeria, rotavirus	• Infiltration, runoff if improper disposal	Y	N/A

Biodiversity / Taonga		
Increasing or protecting habitat and biodiversity on farm for taonga species • Significant riparian planting	• Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Enhancement programme in place for identified areas of indigenous biodiversity • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Riparian planting • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Legally protected wetlands on farm identified and protected • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Riparian planting programme planned/implemented • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Vegetated riparian buffer strips around waterways.	All except movement corridors and access
Habitat for taonga species protected on farm	• Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Enhancement programme in place for identified areas of indigenous biodiversity • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Riparian planting • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Legally protected wetlands on farm identified and protected • Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Riparian planting programme planned/implemented ***No specific GMPs relating to cultural values. Although there may be some overlap with other GMP in other sections.***	All except movement corridors and access
Weed or pest control on farm to assist in increasing native biodiversity • Non-native control e.g. gorse • Fish barriers to exclude trout / non-native but allow native fish passage • Spraying wilding pines	• Canterbury FEP B&L Guidelines "Waterways and biodiversity" (pg16) – Weeds and pests within protected areas are managed • DairyNZ Waterway technote – Pest animals "Benefits of animal pest control - Benefits of pest animal control around waterways" (pg. 1) – Improve native biodiversity and habitat. • DairyNZ Waterway technote – Pest animals "Benefits of animal pest control - Benefits of pest animal control around waterways" (pg. 1) – Improve the chance of a successful riparian management project ***No specific GMP relating to weed or pest control on farm relating to native biodiversity. Some GMPs may contribute to protecting, increasing or reducing native biodiversity.***	
Staff training or certification in use of chemicals on farm	***None***	

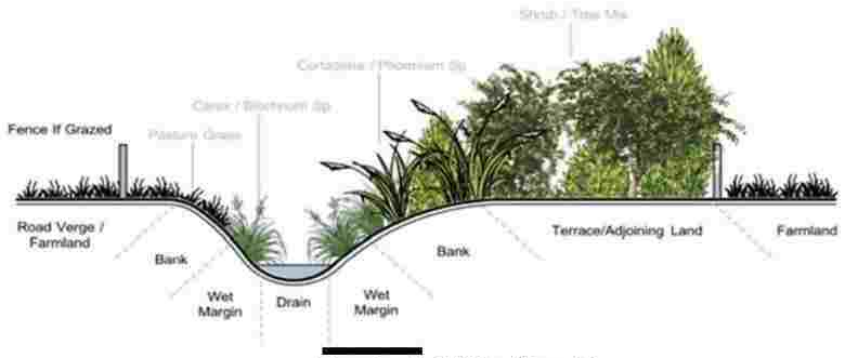
which could have an impact on environment • Staff have maps or knowledge of what species to spray and what not to spray or areas • Have been trained with equipment and chemical	***No specific GMP which is of concern as this has the potential to have direct impacts on native vegetation and native fish. Currently, sufficient training or guidelines GMPs are not in place.***	
Silt traps or dams used to reduce sediment from entering waterways	• Canterbury FEP B&L Guidelines "Soil and erosion management" (pg15) – Use of containment structures for certain erosion types (e.g. debris dams)	

Overall assessment – will GMPs for this farm activity protect mahinga kai values	**What else is needed to change the assessment to yes.**
POSSIBLY	The farmer is to identify waterways and areas which are wet for the majority of the year and exclude stock.

Figure 12 The differing purposes of riparian planting

Figure 12 shows how the purpose of riparian planting needs to be a factor when setting aside areas and planting out.

Whanau want to see aquatic habitats, protected but equally importantly want to see the provisions of iwi plans implemented. In the case of the Mahaanui Iwi Plan a riparian margin of at least 20metres is preferred.



Bank stability (5m +)

Sediment removal (10 to 30m)
Soil bound nutrient (10 to 30m)

Soluble nutirients (15 to 50m)
Aquatic habitat (15 to 30m)

Maahanui iwi managment plan 20m+

Wildlife habitat 10 to 300m

Good Management Philosophy – Continuous improvement		
Farm manager / owner / staff members regular training or actively increasing knowledge • Training on new farm practises • Investigating in new technology • Attending farming conferences, community meetings or events • Records of attendance or knowledge learnt	***None***	-
Farm manager / owner / staff members has actively sort information or involvement of tangata whenua on farm related activities. Example could be providing access for gathering, restoration etc. • Early and proactive consultation with tangata whenua • Has worked with or meet with Maori to discuss environmental issues	***None***	-

Records of Runanga involvement		
Farm manager / owner / staff participation in any environmental farming awards • Amount of times participated • Awards won	***None***	-
Research and development carried out on farm or participation • On farm research • Off farm research (Surveys, interviews)	***None***	-
Optimum cow feed (amount) or type of feed to minimise N loss from cows • High production worth cows • Low N feed / crops	***None***	-

Community outreach • Farmer is involved in local committees (e.g. Zone committees), community restoration groups (e.g. Landcare), resource management groups (e.g. irrigation company, irrigation committees) • Farmer involved in local charities or groups which promote or assist in improving the environment • Farmer involved with training or providing employment opportunities for locals	***None***	-
Sufficient cow condition and suitable track design to maintain cow health • Healthy cows are more active than lame cows. Therefore they will distribute N in larger area	***None***	-
Overall assessment – will GMPs for this farm activity protect mahinga kai values **NO**	**What else is needed to change the assessment to yes.** This is included in the recommended additions to GMP	

5.0 RECOMMENDED AREAS WHERE GMPS NEEDED TO ADDRESS IMPACTS OF WATER QUALITY ON MAHINGA KAI

The second task for this project was to identify where new GMPs were needed. We have separated our recommendations into two section:

1. We have recommended a number of management practices that could be added to existing GMPs in order to address mahinga kai needs.
2. We have also identified where we believe new GMPs need to be developed.

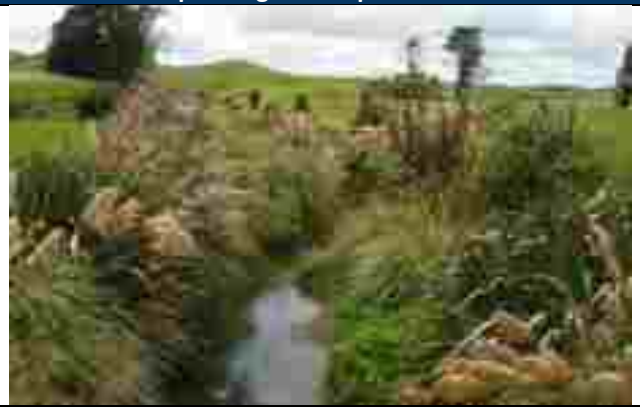
5.1 Recommended additions to existing GMPs

Irrigation Management
Farm design
High slope risk if >20 degrees. Evaluated and checked if irrigation appropriate or if too much risk.
Backflow preventer if fertiliser or effluent or chemical applied using irrigation system

Nutrient Management
Nutrient use
Fertiliser not applied within 10 metres of a waterway
Fertiliser applied by Spreadmark standards or using an certified individual with calibrated, maintained equipment • Spreadmark certified • Equipment meets standards and has maintenance records (can deliver right amounts / rates) • Individual has more than 5 years' experience in applying nitrogen and can demonstrate knowledge of standards • Individual knows all the risk areas on farm (give farm map with areas on it) • Individual knows the nutrient budget and can certify the correct amount / rate will / is applied on farm
Effluent Management
Effluent system
Effluent system designed so areas where its applied are as far away from critical source areas as possible (waterways, sensitive soils, tracks etc.)

Riparian Management
Farm design
Areas of potential cultural significance or high biodiversity identified and integrated into farm design • Plan developed to minimise impact or enhance this areas on farm
Staff training or certification in use of chemical on farm which could have an impact on environment (some covered in nutrient management) • Staff have maps or knowledge of what species to spray and what not to spray or areas • Have been trained with equipment and chemical

Culverts can prevent the movement of fish. Connections are vitally important to native fish species.	**Making the barrel diameter as large as you can and having the downstream culvert outlet sunken below the stream bed aids migration. If you can't sink the outlet then you should try and ensure there is at least one unbroken surface (that stays wet) leading up to the culvert outlet.**	**Ropes can also be used to enable native fish species to climb up to and through a pipe/culvert**
		

Fencing stock out of a waterway is insufficient mitigation. Riparian planting is one of the most visible demonstrations of a commitment to protect mahinga kai	A stream shaded by riparian vegetation and seeing habitats where native fish would live demonstrates that the planting is for aquatic habitat.	Having taonga plant species (that are used by whanau) within the riparian margin represents a commitment to mahinga kai
		

5.2 Recommended new management areas requiring new GMPs to be developed

Farm layout, farm infrastructure
Farm infrastructure placement needs to consider water management, including impacts on mahinga kai. For example the GMP could include: • Placement of farm lanes in relation to waterways • Location of waterway crossing • Placement of troughs • Use of culverts • Fuel storage

Biosecurity Management
Biosecurity protocols shown on visible sign on entrance to property • Issues listed • Protocols listed • Contact details are taken • Visitors and staff coming from overseas (and outside district) have clothing and gear checked
Suitable wash-down area on farm for machinery and equipment • Disposal of rubbish in suitable manner
Staff, farm contractors and consultants informed of biosecurity protocols and risks
Machinery and equipment cleaned before property and when leaving it if necessary
Seed / feed brought is weed / pest free
New stock are inspected and isolated in specific paddock for a recommended period of time to check for any unwanted pests
Staff are trained to identify pests or weeds • Information on current biosecurity risks given to staff or staff informed
On farm containment / extermination plan in place for unwanted pests and weeds • No natives are considered an pest or weed species and should be left alone

Water Management
Restoration
Restoration of waterway to increase biodiversity and taonga species • Baseline study • Species focused restoration
Access
Access to waterways provided on farm • Permission required • Tracks available

Wetlands
Natural wetlands on farm have been protected and / or restored • Wetlands have been identified • Active restoration of wetland or restoration plan in place
Wetlands created on farm which provide habitat for taonga species • Wetlands are designed with to create taonga species habitat
Mahinga kai is provided by wetlands • Access to mahinga kai provided • Mahinga kai is gathered
Chemicals / fuel
Fuel storage, use and disposal meets HZNO regulatory framework
Fertiliser storage / handing
Fertiliser storage / handling / use complies with the Code of Practise for Nutrient Management (Fertiliser Association of New Zealand)

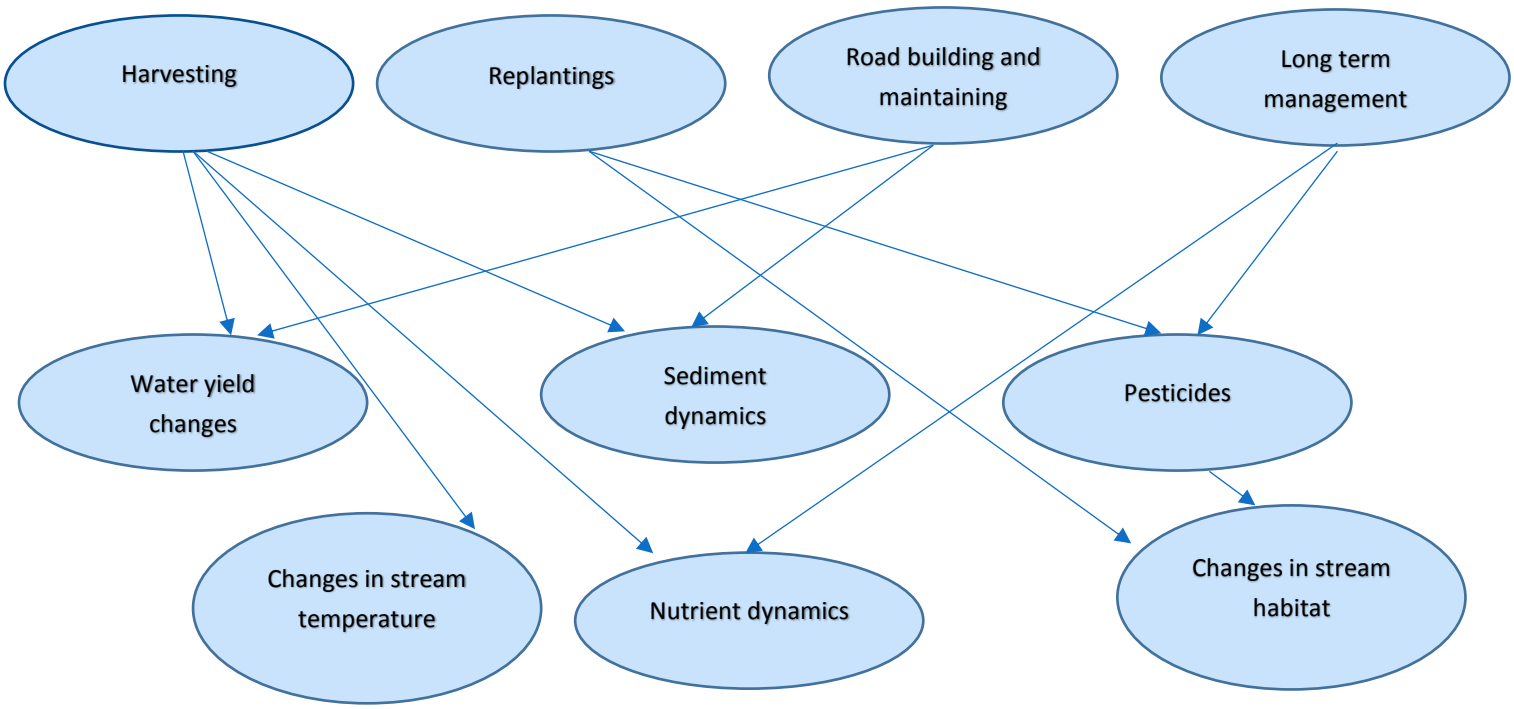
Biodiversity / Taonga species Management
Land or water on farm (or adjacent) protects taonga species and biodiversity • QE II covenant • Maitaitai • Taiapure
Taonga species research and/or restoration carried out on farm • Fish stocktake • Species translocation
Ecological survey carried out on farm to identify biodiversity and taonga species present • Baseline survey • Restoration driven by ecological survey

Good Management Philosophy - Continuous improvement
Farm manager / owner / staff member regular training or increasing of knowledge • Training on new farm practises • Investigating new technology • Attending farming conferences, community meetings or events like workshops • Records of attendance or knowledge learnt
Farm manager / owner / staff member has actively sort information or involvement of tangata whenua on farm related activities. Example includes access for gathering, restoration etc. • Consultation early is required • Has worked with or meet with Maori to discuss environmental issues • Records of Runanga involvement
Farm manager / owner / staff participation in any environmental farming awards • Amount of times participated • Awards won
Research and development • On farm research • Off farm research (Surveys, interviews)
Community outreach • Farmer is involved in local committees (e.g. Zone committees), community restoration groups (e.g. Landcare), resource management groups (e.g. irrigation company, irrigation committees) • Farmer involved in local charities or groups which promote or assist in improving the environment • Farmer involved with training or providing employment opportunities for locals
Optimum cow feed (amount) or type of feed to minimise N loss from cows • High production worth cows • Low N feed / crops
Sufficient cow condition and suitable track/ land design to maintain cow health • Healthy cows and not lame cows are more active. Therefore will distribute N in larger area

6.0 FARM FORESTRY

Although the focus is pastoral farming practices, there are a number of farms with forestry blocks. We have not identified GMPs in relation to farm forestry. However we illustrate in Figure 12 the potential effects of forestry on water quality and quantity.

Figure 13: Overview of effects of forest management on water quality



7.0 TAKING ACCOUNT OF IWI MANAGEMENT PLANS

Farm Environment Plans / Farm Management Plans are a mechanism that can be used to assess the extent to which the iwi management plans that are formulated are taken into account by both ECan and landowners. It is feasible to:

1. To carry out a cultural review the farm plan templates;
2. To provide recommendations to the agencies / organisations developing the templates and proposed amendments to the templates on behalf of the papatipu runanga; and
3. To analyse the farm management plan process and provide recommendations on how it can deliver cultural outcomes

In the paragraphs below we provide an example of how this could be undertaken.

Nutrient Management (This has been extracted from a FEP template)

Management objective: To maximise nutrient use efficiency while minimising nutrient losses to water				
Target 1: All sources and potential areas of loss of nutrients, sediment and effluent are clearly identified	*Target 2: Nitrogen loss target/s for property are met or exceeded.*	*Target 3: P and sediment losses to waterways minimised*	*Target 4: Demonstrated plans in place to minimise nutrient and sediment losses from winter grazing of forage crops*	*Target 5: All on-farm silage and offal pit & rubbish dump discharges are appropriately managed*

It is then possible to extract provisions from an iwi management plan that are (in this case) specific to nutrient management. The provisions from one iwi plan are shown below.

Manawhenua targets / objectives[4] as detailed in the Mahaanui Iwi Management Plan
Wai Maori
1. *WM6.8 - To continue to oppose the discharge of contaminants to water, and to land where contaminants may enter water.*
2. *WM6.12 - To address the decline in water quality in the takiwā by requiring, supporting and contributing to:*
(a) The development of catchment nutrient budgets (using the best available modelling software) as a tool to manage the cumulative effects of land use on water quality and create rules and incentives to improve on land and water management;
(b) The setting of effective limits for nitrogen, phosphorus, sediment and Escherichia coli in waterways and groundwater; and
(c) The setting of effective discharge limits for nutrients and sediment on site, whether 'at the farm gate', on an industrial site, or within a residential property development, as a tool to improve on on site management of nutrients and contaminants.
(d) ….

[4] Ngāi Tūāhuriri Rūnanga, Te Hapū o Ngāti Wheke (Rāpaki), Te Rūnanga o Koukourārata, Ōnuku Rūnanga, Wairewa Rūnanga, Te Taumutu Rūnanga. (2013). *Mahaanui Iwi Management plan*. ISBN: 978-0-473-23667-0. Retrieved May 2014 from http://mkt.co.nz/mahaanui-iwi-management-plan/Mahaanui-IMP-web.pdf

To assist Ecan, Ngai Tahu and the farmer, a summary table (such as that shown below) can be prevented along with recommendations for the landowner to consider implementing.

Nutrient management summary	
Manawhenua perspective	
An Ngāi Tahu perspective	
Recommendations from Ngāi Tahu – *1.* … *2.* .. *3.* … *4.* …	

Iwi management plans represent a significant investment of time and resources. A fundamental question for whanau is whether the provisions of plans are being taken account of. An analysis, along the lines that we suggest, serves twofold the purpose. It provides:

- Clarity of expectation for the farmer; and
- Evidence for Ngai Tahu that the provisions of plans are being implemented.

Undertaking this analysis is the final step in demonstrating responsiveness to whanau interests.

8.0 AUDITING OF FMP AND GMPS

Ngai Tahu whanau asked that a section be added to this report to discuss auditing of FMPs. To be confident in the application of GMPs and implementation of Farm Management (Environment) Plans, which are the common mechanism for organising GMPs into a framework useful for landowners, Ngai Tahu need to be able to participate in the auditing process. The degree of participation and at what level needs to be discussed so that the outcomes sought, and in many cases proposed in the GMP / FMP process, are delivered.

For Ngai Tahu the first step in participating within the auditing of GMPs and Farm Management Plans is being able to have a copy of all the current FMP templates which have been approved by ECAN. This is highlighted within Chapter 7.0 where the need for FMP templates to enable Iwi Management plan analysis is mentioned. In the context of auditing GMPs and FMPs Ngai Tahu need to know what specific GMPs are within each FMP as the Schedule 7 guidelines from ECAN (see Appendix 3) give general areas which need to be covered not specific GMPs.

As templates are provided to ECAN and reviewed by them, they should be publically available to assist not just Ngai Tahu having confidence in the process but the public as well. In some cases these FMP templates are readily available from industry websites.

8.1 NGAI TAHU PARTICIPATION IN AUDITS

With GMPs and FMPs becoming a significant part of resource management process in determining if a landowner in complying with various objectives or outcomes including those relating to mahinga kai. Ngai Tahu need to be able to participate in all levels of the process which includes audits of GMP implementation via FMPs.

Ngai Tahu need to see if the GMPs are being actually carried out on farm, how well they are being carried out, or how long some landowners will take to meet GMPs. Without participation in this process Ngai Tahu can't have confidence that the process will deliver the outcomes sought by Ngai Tahu.

The actual level and type of participation by Ngai Tahu will need to be discussed between ECAN and specific papatipu runanga. In many cases papatipu runanga are already involved in GMP and FMP process via external relationships (i.e. irrigation companies).

Some ways Ngai Tahu may choose to participate could include:

- A Papatipu runanga representative participates in the auditing of specific farms
    - This could be location based or issue based or a way for papatipu runanga members to familiarise themselves with the process
- A Papatipu runanga representative participates in the auditing of the auditors themselves
    - This needs to be discussed within ECAN and a process agreed.
- A Papatipu runanga representative participates in the training or workshops ECAN has for prospective auditors within Canterbury

8.2 AUDIT RESULTS PROVIDED TO NGAI TAHU

When audits are carried out of FMPs Ngai Tahu should receive the results of these audits provided to each papatipu runanga. They would like to review these audits and determine if they are meeting the requirements of papatipu runanga in regards to cultural outcomes, including mahinga kai.

The format of how these audit results could be reported to Ngai Tahu will need to be discussed with ECAN.

Some examples of what may be required by Ngai Tahu include:

- A synopsis of whether GMPs are being adopted on farms and an assessment of how well they are being adopted
    - Identification of the range of issues raised during the audits: both specific or general
- A summary of when GMPs will be fully adopted on farm.
- The audit results should also highlight any compliance issues.

Finally and most importantly from the perspective of Ngai Tahu, if an action plan is put in place to address issues raised during the audits, papatipu runanga must be updated on progress being made towards addressing these issues, with firm timeframes for when these issues will be fully resolved.

9.0 CONCLUSIONS

We have chosen to use the attributes of mahinga kai to help assess if and how GMPs could protect mahinga kai. However a farmer cannot choose to protect one attribute (e.g. temperature). In order for mahinga kai to be maintained, enhanced and protected **all attributes** especially the bio-physical attributes need to be maintained, enhanced and protected. If all the bio-physical attributes are protected then the cultural values they underpin are also likely to be maintained, enhanced and protected.

In this section we decided to return to the concept maps that we included in section 3. We have modified the colour coding however. In the concept maps that follow we have used the following key.

	Activities and changes that may be mitigated by existing GMPs if implemented fully by landowners.
	Activities and changes that may be mitigated by the newly recommended GMPs (see section 5) if implemented fully by landowners
	Activities and changes that may be mitigated by the combination of existing and newly recommended GMPs (see section 5) if implemented fully by landowners
	Activities that could be mitigated by provisions in regional plans.
	Mahinga kai attribute to be protected
	A related cause or impact
	Links to another conceptual map

We conclude with a table that summarises in the attributes we identify in Table 3 are likely to be protected.

Figure 13 GMPS likely to mitigate potential effects of sediment on water quality and a range of mahinga kai attributes

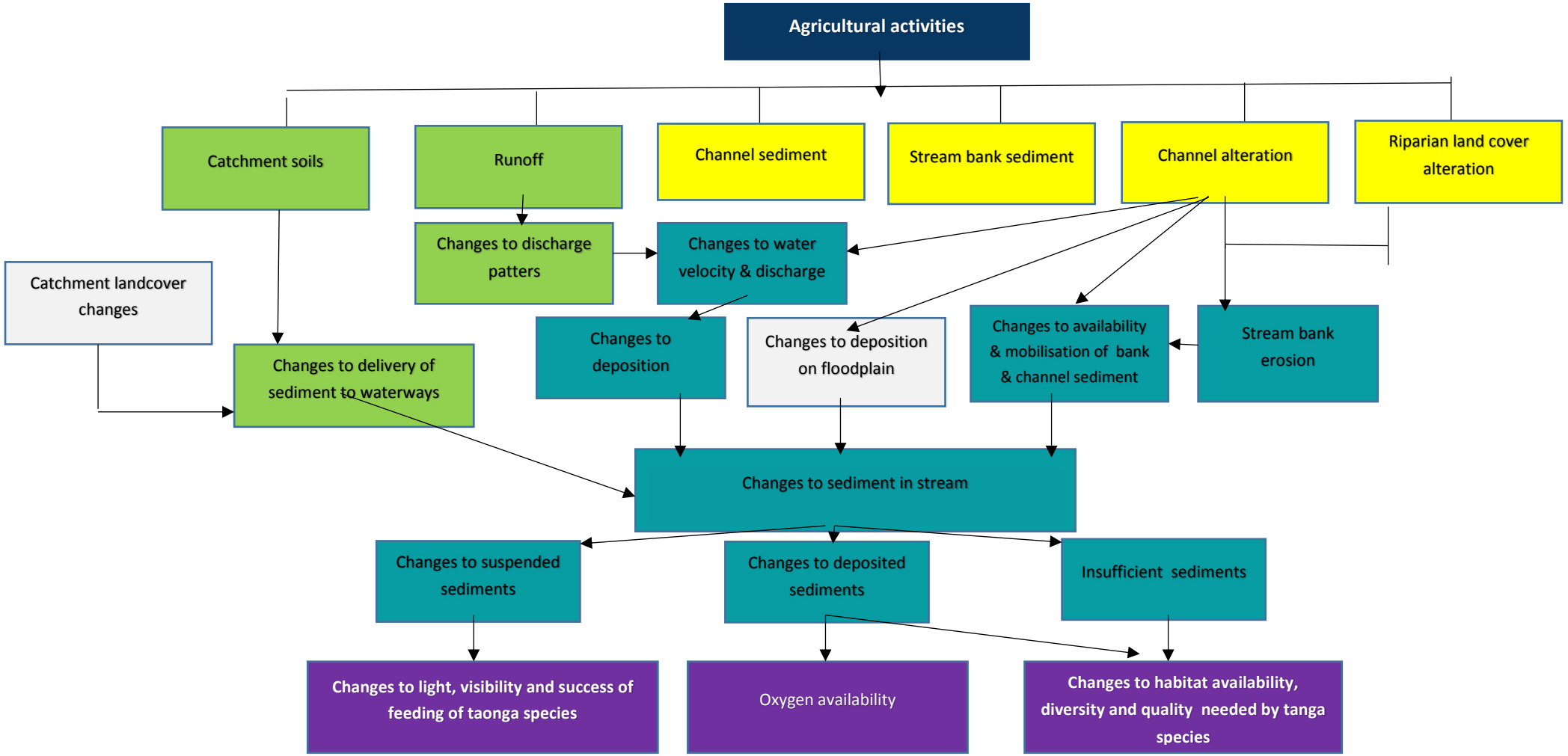


Figure 14 GMPS likely to mitigate potential effects of nutrients, herbicides and pesticides on water quality and mahinga kai attributes

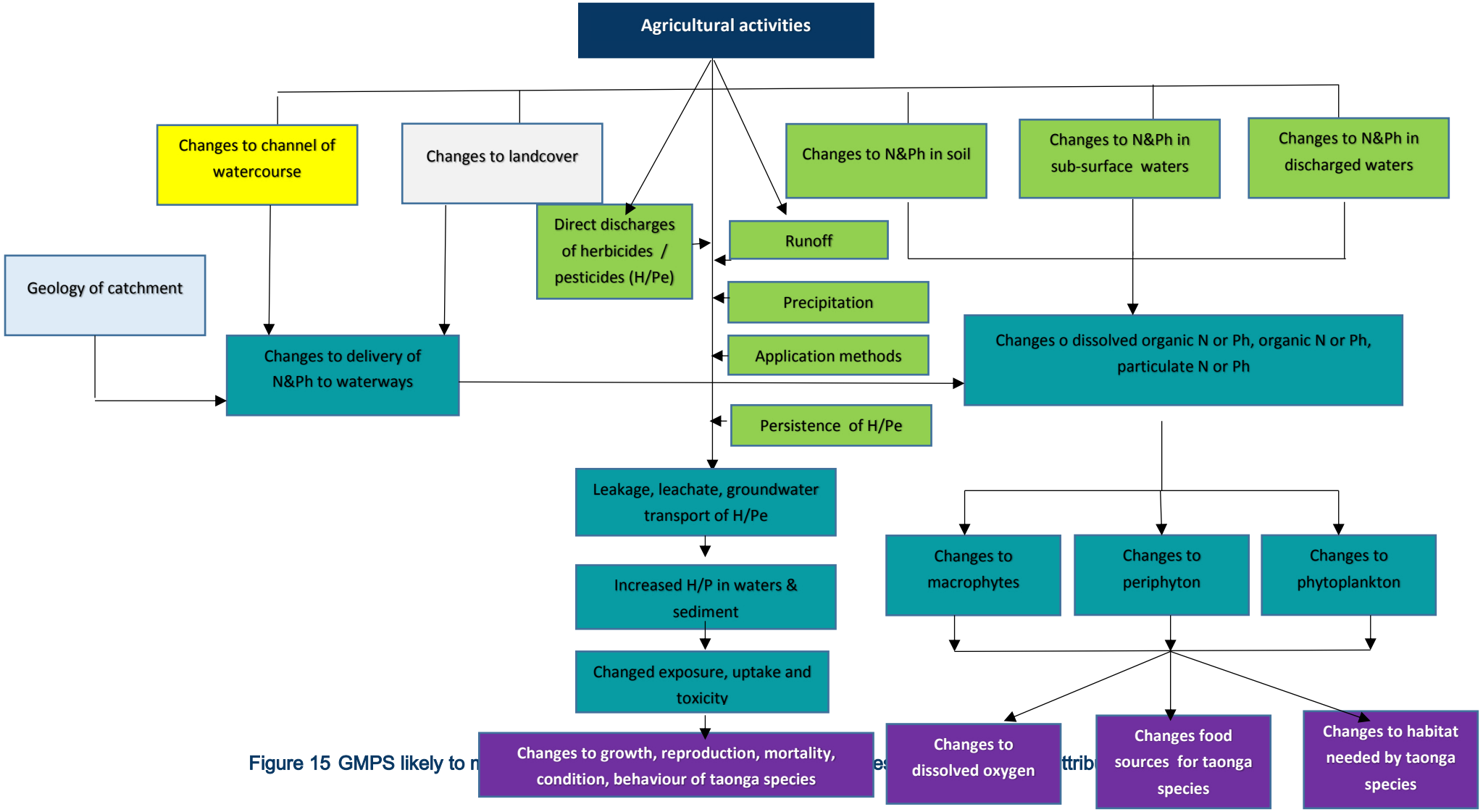


Figure 15 GMPS likely to m es ttrib

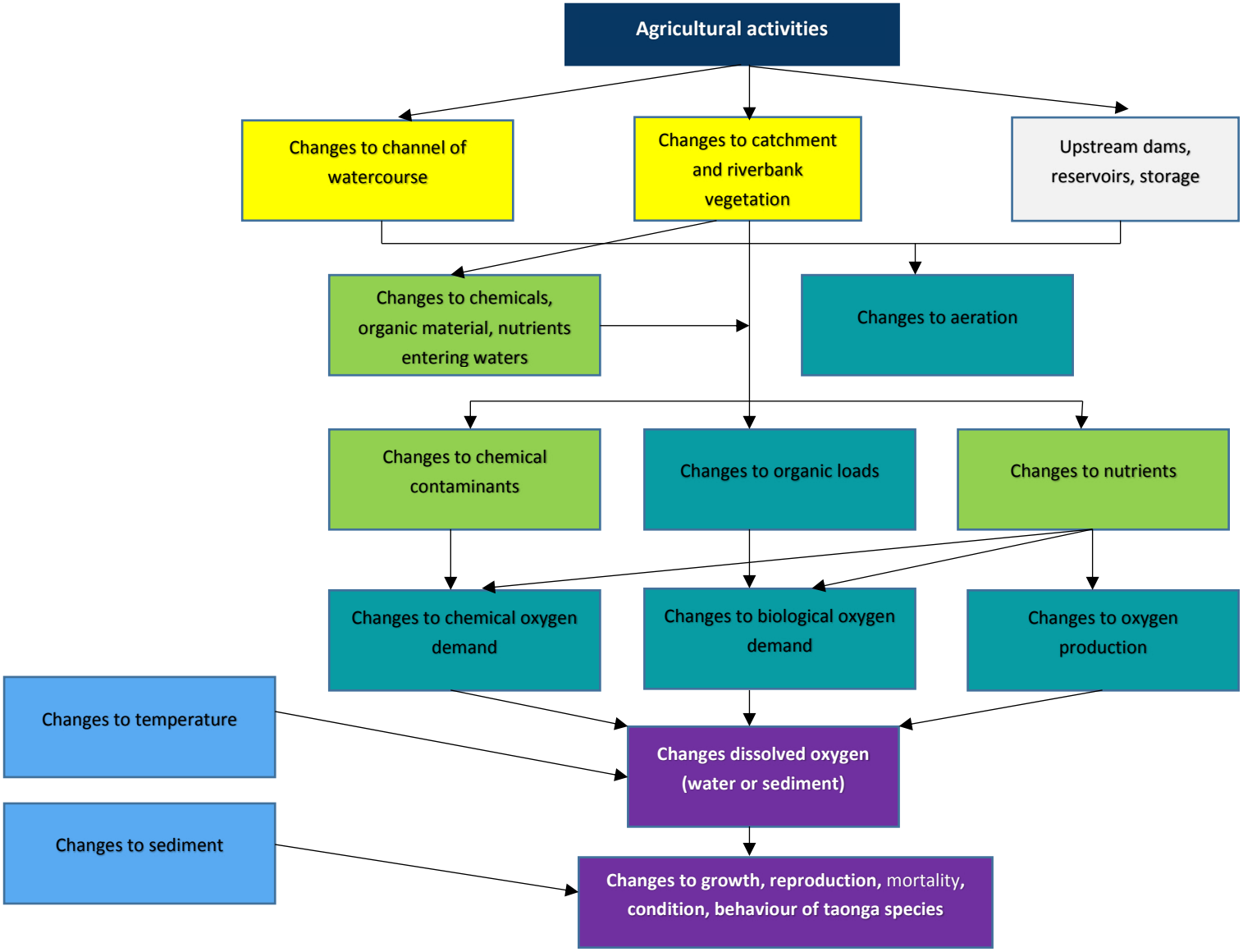

Agricultural activities
Changes to channel of watercourse
Changes to catchment and riverbank vegetation
Upstream dams, reservoirs, storage
Changes to chemicals, organic material, nutrients entering waters
Changes to aeration
Changes to chemical contaminants
Changes to organic loads
Changes to nutrients
Changes to chemical oxygen demand
Changes to biological oxygen demand
Changes to oxygen production
Changes to temperature
Changes to sediment
Changes dissolved oxygen (water or sediment)
Changes to growth, reproduction, mortality, condition, behaviour of taonga species

Figure 16 GMPS likely to mitigate potential effects of water quality changes on a mahinga kai attribute: water flows

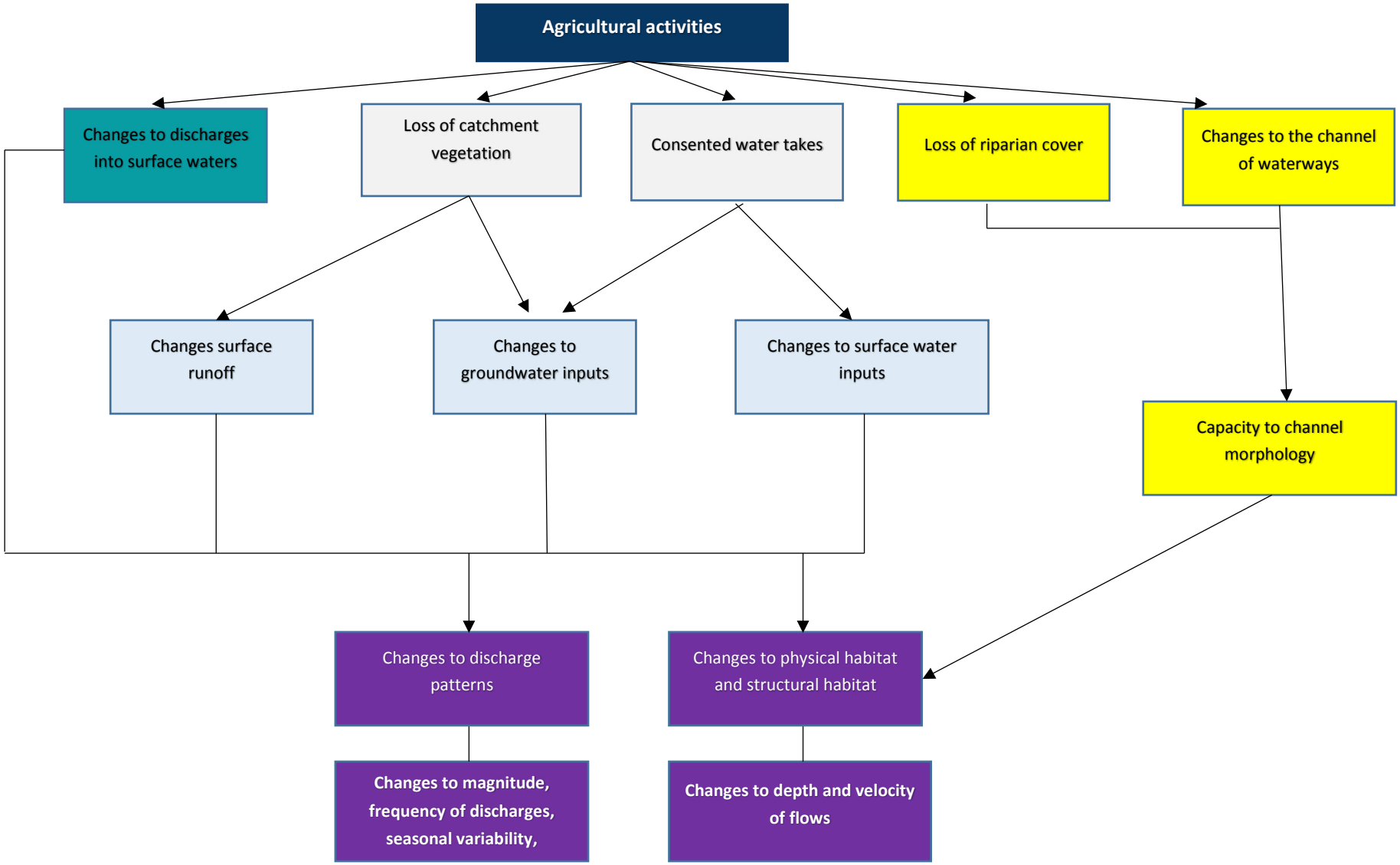


Figure 17 GMPS likely to mitigate potential effects of water quality changes on a mahinga kai attribute: temperature

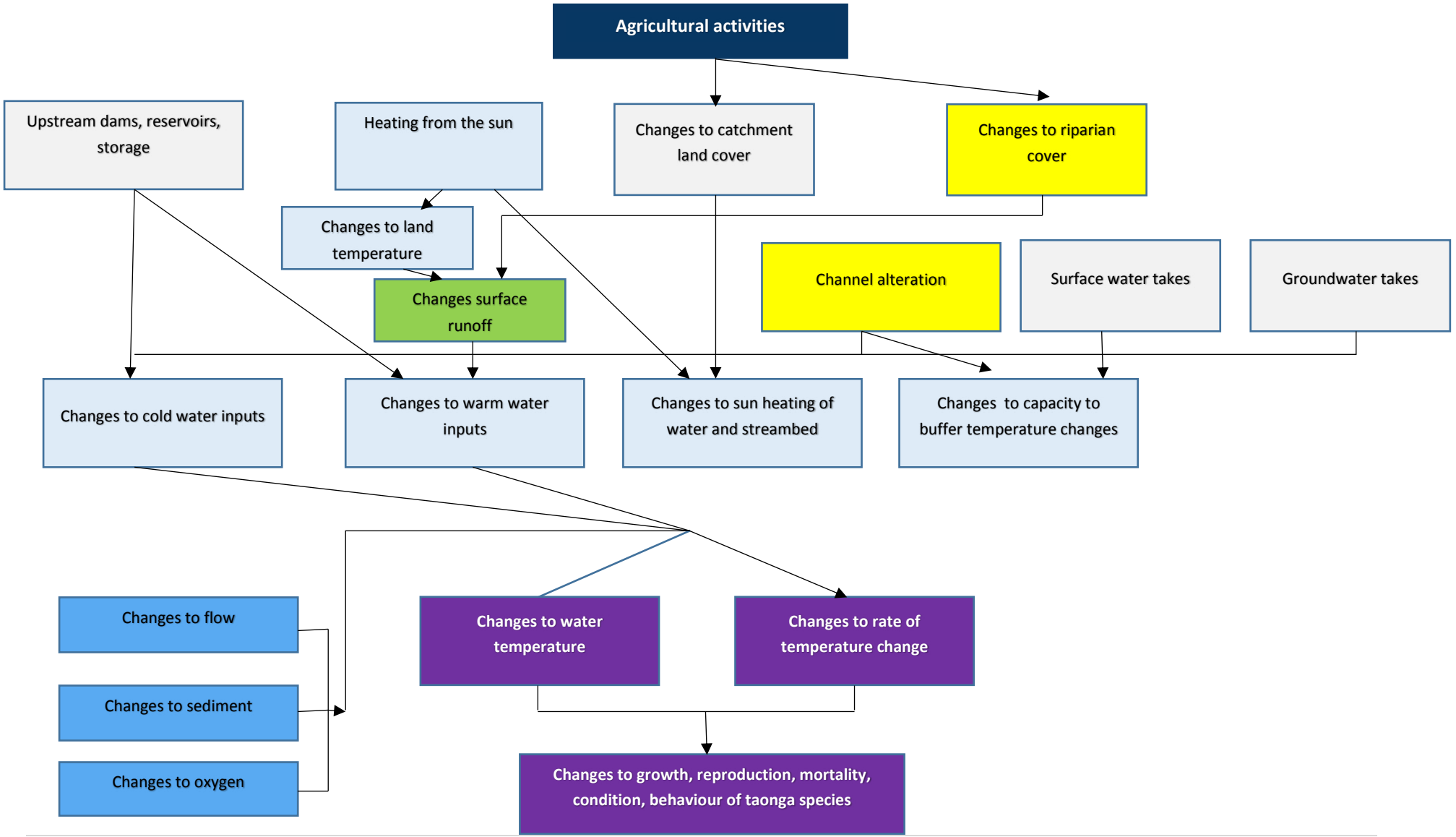
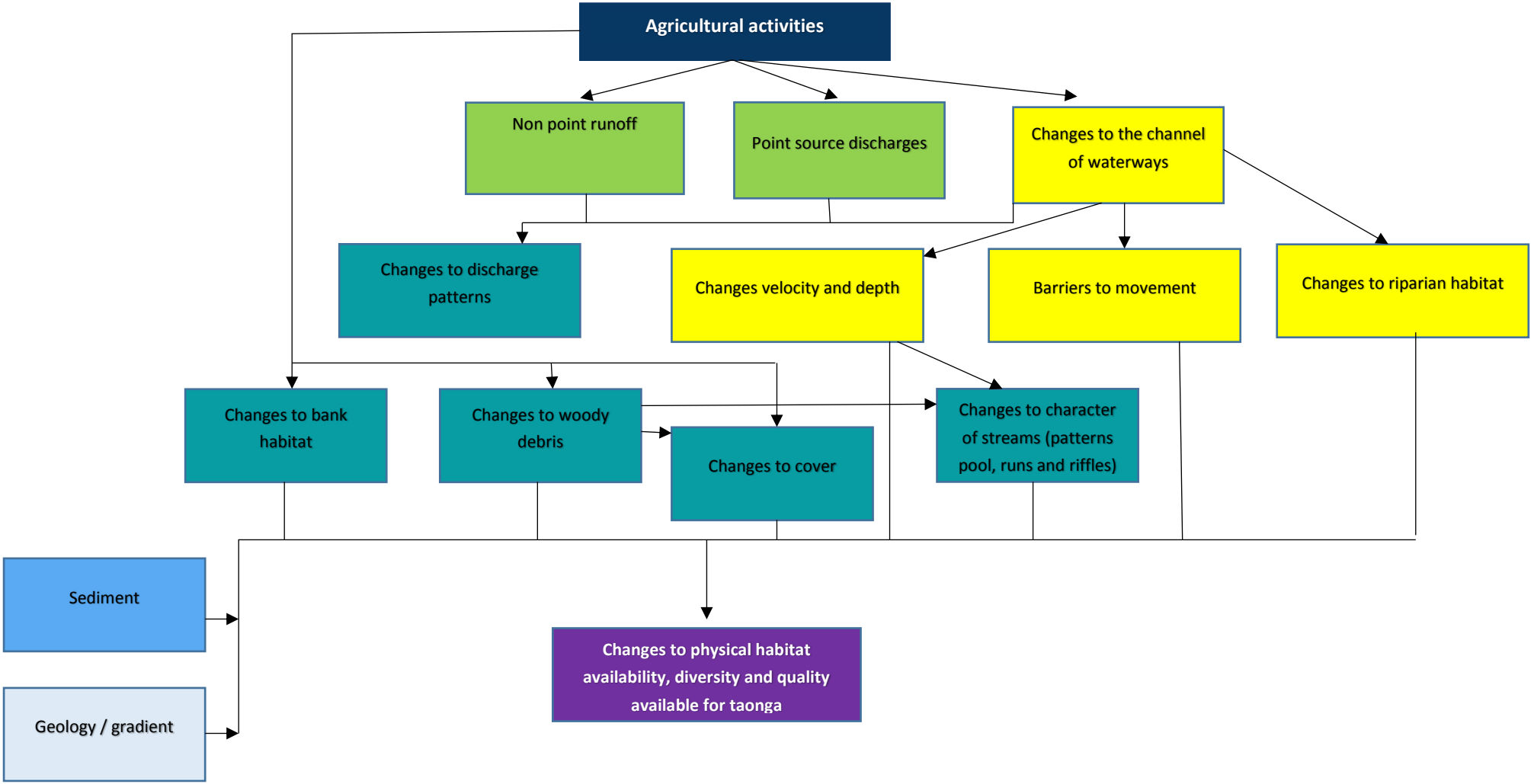


Figure 11 Potential effects of water quality changes on a mahinga kai attribute: habitat



THE ATTRIBUTES OF MAHINGA KAI		
ATTRIBUTES	**ADDRESSED BY EXISTING GMPs**	**ADDRESSED BY NEW GMPs**
A. Ecological integrity of aquatic habitats	Possibly – GMPs for irrigation, effluent, soils etc will contribute to mitigation of effects on ecological integrity.	This attribute would be further protected with GMPs specific to: riparian planting, biodiversity and biosecurity. Some farmers are willingly and proactively identifying restoration actions on farms. Some templates for FEP already have these sections within them.
B. Abundance and good health of cultural materials and kai (iconic to place)	Possibly – GMPs for irrigation, effluent, soils etc will contribute to mitigation of effects on species.	This attribute would be further protected with GMPs specific to: riparian planting, biodiversity and biosecurity.
C. Gathering	Possibly – GMPs for irrigation, effluent, soils etc will contribute to mitigation of effects	One of the most visible factors for whanau to observe is healthy riparian vegetation, with plantings of taonga species, sheltering a waterways that whanau know will sustain kai. This attribute would be further protected with a GMPs specific to riparian planting, biodiversity, biosecurity. .
D. Access	Possibly – GMPs for irrigation, effluent, soils etc will contribute to mitigation of effects	Some farmers have made waterways, known to sustain kai, accessible to whanau.
E. Historic and significant sites	Possibly – GMPs for irrigation, effluent, soils etc will contribute to mitigation of effects	Some farmers who know sites of cultural significance are located within adjacent to, or potentially impacted by their operations have initiated relationships with whanau and developed restoration plans. Having a mechanism to recognise and reward this would be advantageous
F. Traditional techniques/sites known, practiced and knowledge transferred	No	Not directly – but ecological healthy waterways with abundant kai and cultural materials will provide a setting whanau can use and traditional practiced can be applied.
G. Spiritual connections and respect for the waterway and the koiora it sustains	No	The GMPs including the new additions are proactive in seeking to protect biodiversity and biosecurity rather than simply mitigating effects of farming on water quality. Being proactive demonstrates respect for the waterway.
H. Pursue whānau/ marae/ hapū/ iwi aspirations to use resources and sites	No	No

At the start of section 3 we explained that it is possible to distinguish between the causes of water quality deterioration and effects.

- GMPs can be formulated to control the activities that cause a decline.
- GMPs can be formulated to mitigate the activities that cause a decline.

There are GMPs to address mitigate many of the adverse effects likely to impact mahinga kai. What is a glaring omission, however, is the inclusion of GMPs that proactively manage lands to achieve an environmental outcome. For example, best management practices internationally include BMPs for biodiversity, for aquatic habitats, for wetlands. We have therefore suggested some additional GMPs at the request of Ngai Tahu whanau.

10.0 EXTENT TO WHICH GMPS ADDRESS IMPACTS OF WATER QUALITY ON OTHER TAONGA

We believe that defining attributes of wahi taonga is the "link" mechanism that enables us to work with whanau to determine if GMPs do mitigate the effects of water quality on wahi taonga. It is also the mechanism, if accepted by ECan that we can expand upon and illustrate to:

1. Enhance cross communication between farmers and whanau with respect to mahinga kai outcomes; and
2. Provide guidance to auditors.

Examples of how we could implement points 1 and 2 have been provided to ECan but are separate to this document.

REFERENCES

Canterbury FEP B&L Guidelines – Retrieved from http://www.beeflambnz.com/Documents/Farm/Canterbury%20FEP%20guidelines.pdf

DairyNZ Sustainable Milk Plan – Retrieved from http://www.dairynz.co.nz/media/1136726/smp-tool-v6-water-mark.pdf

DairyNZ Good guide to irrigation – Part 1: good irrigation practices on-farm – Retrieved from http://www.dairynz.co.nz/media/757905/guide-to-good-irrigation-part-1.pdf

DairyNZ Good guide to irrigation – Part 2: good irrigation practices for farm owners and managers – Retrieved from http://www.dairynz.co.nz/media/757907/guide-to-good-irrigation-part-2.pdf

DairyNZ Land management on Canterbury dairy farms - Managing land to reduce sediment and phosphorus loss. Retrieved from http://www.dairynz.co.nz/media/2231977/land-management-canterbury.pdf

DairyNZ Reducing nitrogen loss: A guide to good management practices. Retrieved from http://www.dairynz.co.nz/media/1237817/reducing-nitrogen-loss.pdf

DairyNZ farmfact (5-37) - Composting dead stock. Retrieved from http://www.dairynz.co.nz/media/254313/5-37_Composting_dead_stock.pdf

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DairyNZ Waterway technote – Pest plants. Retrieved from http://www.dairynz.co.nz/media/2071979/pest-plants-waterway-technote.pdf

Appendix 1 – The Kaitiakitanga Targets from the CWMS

From 2010:

- Prevent further decline in the quality or quantity of water bodies used as a drinking water supply to marae and associated papakāinga
- Prevent further loss or degradation of Ngāi Tahu nominated wāhi taonga
- Increase understanding in each zone of the customary values and uses associated with specific waterbodies or parts of waterbodies
- Involve Papatipu Rūnanga in the Immediate Steps restoration programme and the setting of priorities
- Formally recognise Te Rūnanga o Ngāi Tahu Freshwater Policy and, in each zone, work towards resolving issues related to Ngāi Tahu policies on:
    - environmental flows that afford protection to instream values
    - direct discharge of point source contaminants to water
    - the unnatural mixing of water sourced from different waterbodies
    - addressing non-point source pollution through a range of measures including regulatory control

By 2015:

- Protocols for the recognition and exercise of mana, including kaitiakitanga within the Ngāi Tahu rohe, are implemented
- All degraded wāhi taonga and mahinga kai[5] waterways nominated by Ngāi Tahu have an active restoration programme in place that responds to cultural priorities
- A report on the health of all Ngāi Tahu nominated waterbodies using Ngāi Tahu Cultural Health Monitoring Tool
- Identified customary uses (current and potentially restored) for all waterways
- Iwi Management Plans in place for all zonal areas
- Institutional capability within local government to adequately recognise and provide for the principle of kaitiakitanga in water management
- A formal co-governance arrangement (developed in partnership by Ngāi Tahu, the Crown and Canterbury local government) for the active management of Te Waihora (Lake Ellesmere) and its catchment
- A programme for identifying cultural preferences for river and stream flow agreed in each zone
- A system for appointing Ngāi Tahu Tangata tiakiwai (water guardians) that have formal recognition and support from local government is established

[5] Mahinga kai - traditional food and other resources and the areas that they are sourced from

- Work and research has commenced on establishing a mahinga kai food gathering standard

By 2020:

- Increased the abundance of, access to and use of mahinga kai.
- Further co-governance arrangements (developed in partnership by Ngāi Tahu, the Crown and Canterbury local government) for the active management of a nominated waterbodies in North and South Canterbury
- Integrated Ki Uta Ki Tai[6] environmental management philosophies into zonal and regional management planning.
- All marae and associated papakāinga have access to high quality drinking water
- At least one Ngāi Tahu Tangata tiakiwai is appointed within each zone
- A mahinga kai food gathering standard is confirmed and implemented as a water quality monitoring tool

By 2040:

- Protection, in accordance with Ngāi Tahu values and practises, of waahi taonga and mahinga kai waterways
- Kaitiakitanga is a normalised and an integrated practise of water management.

Although there is a distinct set of targets in the CWMS specific to the interests of Tangata whenua it needs to be recorded that many of the other targets are relevant to Tangata whenua, for example:

- Tangata whenua are concerned about biodiversity
- Tangata whenua want to pursue economic development opportunities
- Tangata whenua may want to develop infrastructure
- Tangata whenua value the recreational values of rivers.

[6] A mountains to the sea approach to water management

Appendix 2 – List of GMPs

Matrix of Good Management (MGM) Good Management Practices (GMP) Tables

GMP Code	GMP Description
GMP1	Identify the physical and biophysical characteristics of the farm system, assess the risk factors to water quality associated with the farm system, and manage appropriately.
GMP2	Maintain accurate and auditable records of annual farm inputs, outputs and management practices.
GMP3	Manage farming operations to minimise direct and indirect losses of sediment and nutrients to water, and maintain or enhance soil structure, where agronomically appropriate.
GMP4	Manage periods of exposed soil between crops/pasture to reduce risk of erosion, overland flow and leaching.
GMP5	Retire all Land Use Capability Class 8 and either retire, or actively manage, all Class 7e to ensure intensive soil conservation measures and practices are in place.
GMP6	Identify risk of overland flow of sediment and faecal bacteria on the property and implement measures to minimise transport of these to water bodies.
GMP7	Locate and manage farm tracks, gateways, water troughs, self-feeding areas, stock camps, wallows and other sources of run-off to minimise risks to water quality.
GMP8	To the extent that is compatible with land form, stock class and intensity, Exclude stock from waterways.
GMP9	Monitor soil phosphorus levels and maintain them at or below the agronomic optimum for the farm system.
GMP10	Manage the amount and timing of fertiliser inputs, taking account of all sources of nutrients, to match plant requirements and minimise risk of losses.
GMP11	Store and load fertiliser to minimise risk of spillage, leaching and loss into water bodies.
GMP12	Ensure equipment for spreading fertilisers is well-maintained and calibrated.
GMP13	Manage the amount and timing of irrigation inputs to meet plant demands and minimise risk of leaching and runoff.
GMP14	Design, calibrated and operated irrigation systems to minimise the amount of water needed to meet production objectives.
GMP15	Store, transported and distributed feed to minimise wastage, leachate and soil damage.
GMP16	Ensure the effluent system meets industry specific Code of Practice or equivalent standard.
GMP17	Have sufficient, suitable storage available to enable farm effluent and waste water to be stored when soil conditions are unsuitable for application.
GMP18	Ensure equipment for spreading effluent and other organic manures is well-maintained and calibrated.
GMP19	Apply effluent to pasture and crops at depths, rates and times to match plant requirements and minimise risk to water bodies.
GMP20	Select appropriate paddocks for intensive grazing, recognising and mitigating possible nutrient and sediment loss from critical source areas.
GMP21	Manage grazing to minimise losses from critical source areas.

Appendix 3 – Canterbury Land and Water Regional Plan – Farm Environment Plan Factsheets

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Canterbury Land & Water Regional Plan

Information Sheet for Farmers - Farm Environment Plans

March 2016

What is a farm environment plan?

A farm environment plan (FEP) is a key environmental risk-management tool which helps farmers recognise on-farm environmental risks, and sets out a programme to manage those risks.

FEPs are unique to a property and reflect the local climate and soils, the type of farming operation, and the goals and aspirations of the land user.

The level of complexity of a FEP will largely depend on how much farm system change is under way or being considered.

FEPs and the Land & Water Regional Plan

FEPs are required under the Land & Water Regional Plan (LWRP) for farms with a higher risk of leaching nutrients - for animal effluent discharge, water take and use, land use for farming and nutrient discharge from an irrigation scheme. If you are part of an irrigation scheme, check with the scheme and go to *www.irrigationnz.co.nz*.

Refer also to the Hurunui Waiau River Regional Plan, the Selwyn-Waihora plan (Plan Change 1 of the LWRP), the Hinds Plains Plan (Plan Change 2, LWRP) and the South Coastal Canterbury Plan (Plan Change 3, LWRP) – see *www.ecan.govt.nz/lwrp*

Minimum FEP content is specified in Schedule 7 of the LWRP - see right. All farm environment plans must include:

- An assessment of the adverse environmental effects and risks associated with the farming activities
- An indication of how those effects and risks will be managed, including irrigation, application of nutrients, effluent application, stock exclusion from waterways, offal pits and farm rubbish pits.

FEPs must be auditable to provide independent validation that objectives and targets have been met.

Land user

Any land user on a property larger than 5 hectares must maintain a nitrogen baseline for their property.

From the nitrogen baseline, the land user assesses whether the nitrogen loss exceeds the threshold for resource consent for the nutrient allocation zone in which the property is located.

If resource consent is required, the land user must prepare a FEP. They may do this in any of these ways:

- Develop their own in accordance with Schedule 7 Part B, LWRP (see right);
- Obtain assistance from a rural professional to prepare a FEP as above; or
- Use an industry FEP template in accordance with Schedule 7 Parts A and B, LWRP (see right), provided that all sections of the industry template are designed to address the type of farming activities carried out on the property or farming enterprise.

Industry templates

An industry sector organisation may prepare a template, in accordance with Schedule 7 Parts A and B, LWRP, for adoption by land users in the relevant sector.

The proposed template must be lodged with Environment Canterbury and approved by the Chief Executive.

Information about approved templates can be found in the Farmer Information section of *www.ecan.govt.nz/lwrp*

Schedule 7, LWRP

Part A – Farm Environment Plans

A Farm Environment Plan can be based on either of:

1. The material set out in Part B below; or
2. Industry prepared Farm Environment Plan templates and guidance material that:
   a. Include the following minimum components:
      (i) The matters set out in 1, 2, and 3 of Part B below;
      (ii) Contains a methodology that will enable development of a plan that will identify actual and potential environmental effects and risks specific to the property, addresses those effects and risks and has a high likelihood of appropriately avoiding, remedying or mitigating those effects;
      (iii) Performance measures that are capable of being audited as set out in Part C below; and
   b. Has been approved as meeting the criteria in (a) and being acceptable to the Canterbury Regional Council by the Chief Executive of the Canterbury Regional Council.

Part B – Farm Environment Plan Default Content

The plan requirements will apply to:

1. a plan prepared for an individual property or farm enterprise; or
2. a plan prepared for an individual property which is part of a collective of properties, including an irrigation scheme, principal water supplier, or an Industry Certification Scheme.

The plan shall contain as a minimum:

1. Property or farm enterprise details
   a. Physical address
   b. Description of the ownership and name of a contact person
   c. Legal description of the land and farm identifier

Continued on back

Facilitating sustainable development in the Canterbury region

2. A map(s) or aerial photograph at a scale that clearly shows:
    a. The boundaries of the property or land areas comprising the farm enterprise.
    b. The boundaries of the main land management units on the property or within the farm enterprise.
    c. The location of permanent or intermittent rivers, streams, lakes, drains, ponds or wetlands.
    d. The location of riparian vegetation and fences adjacent to water bodies.
    e. The location on all waterways where stock access or crossing occurs.
    f. The location of any areas within or adjoining the property that are identified in a District Plan as "significant indigenous biodiversity".
3. A list of all Canterbury Regional Council resource consents held for the property or farm enterprise.
4. An assessment of the adverse environmental effects and risks associated with the farming activities and how the identified effects and risks will be managed, including irrigation, application of nutrients, effluent application, stock exclusion from waterways, offal pits and farm rubbish pits.
5. A description of how each of the following objectives will, where relevant, be met.
    a. Nutrient management: To maximise nutrient use efficiency while minimising nutrient losses to water.
    b. Irrigation management: To operate irrigation systems efficiently and ensuring that the actual use of water is monitored and is efficient.
    c. Soils management: To maintain or improve the physical and biological condition of soils in order to minimise the movement of sediment, phosphorus and other contaminants to waterways.
    d. Collected animal effluent management: To manage the risks associated with the operation of effluent systems to ensure effluent systems are compliant 365 days of the year.
    e. Livestock management: To manage wetlands and water bodies so that stock are excluded as far as practicable from water, to avoid damage to the bed and margins of a water body, and to avoid the direct input of nutrients, sediment, and microbial pathogens.
    f. Offal pits: to manage the number and locations of pits to minimise risks to health and water quality.

    The plan shall include for each objective in 5 above:
    a. detail commensurate with the scale of the environmental effects and risks;
    b. defined measurable targets that clearly set a pathway and timeframe for achievement and set out defined and auditable "pass/fail" criteria;
    c. a description of the good management practices together with actions required;
    d. the records required to be kept for measuring performance and achievement of the target.
6. Nutrient budgets prepared by a suitably qualified person, using the OVERSEER™ nutrient budget model, or equivalent model approved by the Chief Executive of Environment Canterbury, for each of the identified land management units and the overall farm or farm enterprise.

Part C – Farm Environment Plan Audit Requirements

The Farm Environment Plan must be audited by a Farm Environment Plan Auditor who is independent of the farm being audited (i.e. is not a professional adviser for the property) and has not been involved in the preparation of the Farm Environment Plan.

The farming activity occurring on the property will be audited against the following minimum criteria:

1. An assessment of the performance against the objectives, targets, good practices and timeframes in the Farm Environment Plan;
2. An assessment of the robustness of the nutrient budget/s;
3. An assessment of the efficiency of water use (if irrigated).

Part D – Farming Information

Whenever one of Rules 5.41-5.58 requires information to be submitted, the following is to be provided:

1. The OVERSEER®, or equivalent model approved by the Chief Executive of Environment Canterbury, input and output files for the property; or
2. Information detailing:
    a. The site area to which the farming activity relates;
    b. Monthly stocking rates (numbers, types and classes) including breakdown by stock class;
    c. Annual yield of arable or horticultural produce;
    d. A description of the farm management practices used on each block including:
        (i) Ground cover – pasture, crops, fodder crops, non-grazed areas (including forestry, riparian and tree areas) and any crop rotation;
        (ii) Stock management – lambing/calving/fawning dates and percentages, any purchases and sales and associated dates, types and age of stock;
        (iii) Fertiliser application – types and quantities per hectare for each identified block, taking into account any crop rotation;
        (iv) Quantities of introduced or exported feed;
    e. Farm animal effluent, pig farm effluent, feed pad and stand-off pad effluent management including:
        (i) Area of land used for effluent application;
        (ii) Annual nitrogen loading rate and nitrogen load rate per application;
        (iii) Instantaneous application rate;
    f. Irrigation – areas, rates, monthly volumes and system type.

The information is to be collated for the period 1 July to 30 June in the following year and be provided annually, no later than 31 October.

To read the LWRP and for more information, go to www.ecan.govt.nz/lwrp

E16/4814

Environment Canterbury Regional Council
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Facilitating sustainable development in the Canterbury region

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Schedule 7 - Farm Environment Plan

A Farm Environment Plan shall be prepared by a person with the appropriate professional qualifications. The plan shall take into account all sources of nutrients used for the farming activity and identify all relevant nutrient management practices and mitigation measures.

The plan requirements will apply to:

1. a plan prepared for an individual property; or
2. a plan prepared for an individual property which is part of a collective of properties, including an irrigation scheme, an Industry Certification Scheme, or catchment club.

Plan requirements

The farm environment plan must clearly identify how when the assigned industry 'good practices' and/or property nutrient allowances will be achieved. The plan shall contain as a minimum:

1. Property details
   (a) Physical address
   (b) Description of the ownership and name of a contact person
   (c) Legal description of the land and farm identifier
2. A map(s) or aerial photograph at a scale that clearly shows:
   (a) The boundaries of the property
   (b) The boundaries of the main land management units on the property.
   (c) The location of permanent or intermittent rivers, streams, lakes, drains, ponds or wetlands.
   (d) The location of riparian vegetation and fences adjacent to water bodies.
   (e) The location of storage facilities, offal or refuse disposal pits, feeding or stock holding areas, effluent blocks, raceways, tracks and crossings.
   (f) The location of any areas within or adjoining the property that are identified in a District Plan as "significant indigenous biodiversity".
3. An assessment of the risks to water quality associated with the major farming activities on the property and how the identified risks will be managed.
4. A description of how each of the following management objectives will, where relevant, be met.
   (a) ***Nutrient management:*** To maximise nutrient use efficiency while minimising nutrient losses to water in order to meet specified nutrient allowances.
   (b) ***Irrigation management:*** To operate irrigation systems that are capable of applying water efficiently and management that ensures actual use of water is monitored and is efficient.
   (c) ***Soils management:*** To maintain or improve the physical and biological condition of soils in order to minimise the movement of sediment, phosphorus and other contaminants to waterways.
   (d) ***Wetlands and riparian management:*** To manage wetland and waterway margins to avoid damage to the bed and margins of a water body, avoid direct input of nutrients, and to maximise riparian margin nutrient filtering.
   (e) ***Collected animal effluent management:*** To manage the risks associated with the operation of effluent systems to ensure effluent systems are compliant 365 days of the year.
   (f) ***Livestock management:*** To manage wetlands and water bodies so that stock are excluded as far as practicable from water, to avoid damage to the bed and margins of a water body, and to avoid the direct input of nutrients, sediment, and microbial pathogens.

   The plan shall include for each management objective;

   (i) user defined measurable targets that clearly set a pathway and timeframe for achievement of the objective
   (ii) a description of the good management practices together with actions required to achieve the objective and targets.
   (iii) the records for measuring performance and achievement of the target.
5. Nutrient budgets are prepared using the OVERSEER™ nutrient budget model, for each of the identified land management units and the overall farm.