Report to the Collaborative Stakeholder Group – for Agreement and Approval

File No:	23 10 02
Date:	16 November 2015
To:	Collaborative Stakeholder Group
From:	Chairperson – Bill Wasley
Subject:	CSG subgroup: Managing nitrogen and phosphorus at a property-level 23 October 2015 workshop
Section:	**Agreement and Approval**

Disclaimer
This report has been prepared by Waikato Regional Council policy advisors for the use of Collaborative Stakeholder Group Healthy Rivers: Wai Ora Project as a reference document and as such does not constitute Council's policy.

1 Purpose

The purpose of this report is for Collaborative Stakeholder Group (CSG) to understand the sub-group's discussion on key options for ensuring property level action and next steps in allocating responsibility to reduce nutrient losses (including possible use of OVERSEER® (Overseer) model) and their implications.

Recommendations:

1. That the report [CSG subgroup: Managing nitrogen and phosphorus at a property-level 23 October 2015 workshop] (Doc #3574906 dated 16 November 2015) be received, and

2. That the CSG confirm that the CSG sub-group which met on 23rd October 2015 (representatives for dairy, drystock, rural professionals, Māori interests, rural advocacy) have satisfactorily identified:
    a. How sub catchment contaminant loading information received from the Technical Leaders Group (TLG) could be used in options to reduce nitrogen and phosphorus in a staged approach to achieving the Vision and Strategy.

3. That the next step toward preparing the CSG for December CSG workshops on who takes responsibility for contaminant reductions in the 2016 plan change, is to focus on geographic differences between the subcatchments. This includes:
    a. How the land in each subcatchment is currently used,
    b. What sources of different contaminants can be managed downwards and
    c. Using the TLG 'heat maps' to discuss where the largest contaminant reductions need to occur.

4. That the CSG sub-group meets again on 18 November (open to other interested CSG members), and works with the catchment load information, to:
    a. Further consider options for allocating responsibility for managing nitrogen and phosphorus at a property level, and
    b. Widen its focus to include sediment and microbes, as well as nitrogen and phosphorus, and therefore be referred to as "Contaminant reduction CSG sub-group" or similar, and
    c. Report back verbally to the CSG at their 23-24th November meeting, with a follow up written report for 9-10th December CSG meeting.

2 Background

Since the CSG's last two day meeting on 13th-14th October, there have been other CSG sessions where important information has been presented and discussed. In this report there is an:

- Overview of the sub-group process since the last CSG workshop (two meetings, 23 October and 18 November)
- Overview on some of the technical information being used by the CSG (contaminant load data on portal, and mitigations workshop 21 October)
- Key points made by the sub-group about how they could use the technical information

3 CSG sub-group process

A CSG sub-group met for the third time[1] on 23 October 2015. The group included the representatives for dairy (Rick Pridmore, George Moss), drystock (James Bailey), rural professionals (Phil Journeaux) and rural advocacy (James Houghton), representative for Māori interests Weo Maag, community representative Gwyn Verkerk and delegates for some of the above sectors Graeme Gleeson, Charlotte Rutherford and Sally Millar.

CSG sub-group were assisted by Helen Ritchie and WRC policy, consents and extension staff. Bryce Cooper and Mike Scarsbrook from the Technical Leaders Group (TLG) attended. The TLG had put some information about subcatchment loads on the CSG portal several days earlier, with a covering note (see attachment 1 for the covering note). The day before the meeting, the facilitator Helen Ritchie emailed a message to the whole CSG, reminding them of the meeting and setting out the purpose of the meeting on 23 October as:

> ***What are the options and mechanisms to prioritise where nutrient reductions should take place?***
>
> *We will be thinking about spatial considerations i.e. How could we prioritise more reductions in some places? (Does where you are in the catchment make a difference to the amount of reduction in contaminant you will have to make?)*
> *We will relate this back to property planning i.e. how will a certified property planner know the actions specified would be enough on this particular property?*

[1] Members had volunteered at CSG 15 in August, and the sub-group met on 9th September and 7th October, reporting back to the CSG on 21st September and 13th October respectively.

We will bring this information back to the upcoming CSG meetings in November and December where we will start to have discussions about allocating responsibility to change, and options for underdeveloped land.

This report summarises the sub-group findings from the 23 October, including reference to a 21 October CSG workshop on the TLG biophysical modelling and mitigations used.

A next sub-group meeting was set for 18 November. Because this is the day after the agenda is sent out for the CSG meeting on 23-24 November, the sub-group will provide a verbal report back.

The recommendations to this report ask the CSG to approve the sub-group's approach so far, in order to set up for CSG discussions about cost sharing and allocation in December.

In addition this report contains:

- Explanatory note to the CSG to accompany spreadsheets of contaminant loads prepared by TLG and dated 20 October 2015 (Attachment 1).
- Notes from subgroup discussion on 23/10/15 . Butcher paper and whiteboard notes taken by Helen Ritchie (Attachment 2)
- Draft CSG meeting notes from 13-14th October meeting, responding the 7th October second sub-group, with response the CSG to that report back (attachment 3)

4 Re-cap on approach taken so far

Using technical information and modelling generated for the CSG

The CSG has given future scenarios to the TLG to model, including a step-wise or staged approach to achieving the Vision and Strategy. In their 7 October meeting, the sub-group discussed the implications of a staged approach and some options for nutrient limits. It reported back to CSG[2] that the modelling approach has given us:

a) Aggregated farm-scale costs (where farm types have been clustered and averaged) of a step-wise approach toward Scenario 1: Water quality improves everywhere and all attributes move up a whole band everywhere.

b) The 'optimal' set of mitigations and land use change for this step-wise improvement.

c) Reliance on mitigations that researchers have confirmed are effective at removing contaminants, but which are relatively untested in a planning context (for instance, requiring a constructed wetland or a sediment trap with overflow into a wetland).

d) That the steps toward achieving Scenario 1 get progressively harder. It becomes much more expensive and there are more breaches of the water quality attributes after we get past the first few steps. Major land use change becomes important.

The CSG sub-group agreed that choosing a viable way forward relies on knowing the scale of nitrogen or phosphorus reductions at a property level.

[2] See Report to CSG titled "CSG subgroup: Managing nitrogen and phosphorus at a property-level. "Doc #3574906 dated 9 October 2015

Understanding the land and water model

At the CSG mitigations workshop on 21 September, TLG members and other subject experts involved with TLG, spoke about the modelling work[3] and outlined:

- That the economic and mitigations components of the TLG scenario model rely on land-water aspects within the model. NIWA scientists were contracted by TLG and used nutrient, clarity and E.coli catchment models, built around modelled or monitored water quality points and subcatchments.
- That the loads for all contaminants were calculated for each of the 74 sub-catchments by adding up estimates of all the sources of contaminants from different land uses and point sources.
- That the amount of each contaminant changes (is attenuated or decays), from the time it is first discharged, to when it reaches surface or groundwater and then as contaminants are carried downstream. Each of the 74 subcatchments was assessed and an attenuation factor estimated.

Sub-catchment contaminant load data

To assist them in their work on policy options and allocation the CSG requested load data from the scenario of the staged approach to achieving the Vision and Strategy (see workshop notes from CSG 18). The TLG subsequently provided load data in a spreadsheet and an explanatory note dated 20 October 2015, which was put on the CSG portal and used by the CGS subgroup. Bryce Cooper helped the sub-group understand the spreadsheets[4] on the 23 October.

The next step requested by the CSG sub-group was for TLG was to prepare maps of the load data which will visually show 'hotspots'. These are being referred to as "heat maps".

Productive hectares defined in sub-catchment contaminant load data

In the load data supplied to CSG, 'productive hectares' included everything that was not native forest or shrubland. Point sources and forestry land use were included (see Attachment 1 TLG explanatory note dated 20 October 2015).

The TLG have not modelled mitigations for plantation forestry for two reasons. First, as assumed by the sub-group, New Zealand forestry companies follow international forestry good practice. Second, Graeme Doole noted at CSG17, that TLG took into account the requirements of conditions of Waikato Regional Plan permitted activities. They assumed foresters already undertake mitigations in line with the plan rules (for example, when harvesting, slash and other debris must be piled away from water ways).

The sub-group discussed whether contaminants from plantation forestry could be mitigated further. While the CSG sub-group felt that contaminant losses from plantation pine forest were usually significantly lower than pastoral or horticultural land use, some people in the sub-group meeting felt that contaminant losses (especially sediment) could possibly be reduced further through additional mitigations, particularly during harvest periods.

For future discussions of sub-catchment contaminant load data, the sub-group requested that figures excluding production forest land use should also be presented to help in assessing how contaminant reductions should be shared.

For point sources, policy staff have assumed these sources should continue to be managed through resource consents in the Regional Plan because all point source discharges have

[3] See Sandy Elliot's presentation to 21 September CSG workshop document number

[4] Subsequent to the subgroup meeting a second version was put on the CSG providing an updated version of the load data – a minor error in labelling corrected

conditions related to water quality in their discretionary activity resource consents. Staff will bring more information to the December 9-10th CSG meeting on point source discharge consents and consent review conditions.

How the CSG could use modelled information – load data and mitigations

Bryce Cooper pointed out to the sub-group on 23 October that:

- "Contaminant load" is the flow multiplied by the concentration of contaminant.
- Load information is the annual average load and is estimated using measured samples.
- The model is calibrated to those loads everywhere then used for scenario testing.
- Load removed per productive hectare in each subcatchment gives a feel for the mitigations needed.
- In some subcatchments, loads of nitrogen to come are high and the model couldn't mitigate all of it in the steps on the way. Therefore nitrogen will rise in some places. The question then, is whether landowners should be required to mitigate in other subcatchments to hold measured total nitrogen in the water.
- In order to know how much to reduce on the land, more detailed information is needed.
- A good first step is to look at measured water quality concentrations in the streams and see where the hotspots are, remembering that for nitrogen, there is an attenuation factor that applies to each different sub-catchment.

Bryce also reminded the sub-group that there are two areas of uncertainty (load from land, load to come and timing and the load in the water) for nitrogen:

1. On the land, where root zone nitrogen loss is modelled by OVERSEER
2. In the water, where there may be removal before total Nitrogen is measured at a monitoring site (attenuation), as well as how long it takes to reach water (lag time).

5 Optimisation models, mitigations and 'reality check' of behaviour change

The modelling work done so far uses an optimisation model that is designed to seek the least cost combination of mitigations required to meet water quality attribute limits. The cost implications of meeting the water quality limits are modelled at a subcatchment, regional and national scale.

One of the challenges for the CSG is to be able to use the modelling work as an input into their discussions on achieving the Vision and Strategy. Members of the CSG have already noted that the modelling can only give us an indication of what is possible. For instance, they noted that landowners would prefer to hold off putting in mitigations such as constructed wetlands that have high up front costs, and/or are less well known or tested. Another consideration is whether the mitigation is easy to integrate into the business, or whether other aspects have to be shifted around, as this takes more thinking through and is higher risk.

As the sub-group continues its discussions, they are keeping the modelled outputs in their mind while applying their collective experience of 'real world' behaviour change. The sub-group noted that the assumptions made in the mitigations work wouldn't necessarily hold up as contaminant reductions are required in the plan change. For instance, individual landowners may prefer, in a property plan approach, to start with mitigations that are easiest to fit into their particular farm context, but are not the 'optimum' in effectiveness.

6 The job ahead for the CSG sub-group

The first stage of achieving the Vision and Strategy should involve a 10% water quality improvement towards scenario 1 over the first 10 years. This was the CSG agreement on the1st – 2nd October meeting (to be tested with community and sectors). The sub-group is taking this direction and going into more detail about how this could be achieved. Property plans are a key element and this was reported back to the CSG and confirmed it was a policy option to get feedback on, through the intensive engagement period.

On 23 October, the sub-group suggested that landowners, and those helping to prepare property plans, will want to have an idea of the degree of change that is likely to be required of them from 2016 onwards. If there is to be a staged approach to reductions, landowners need to know this, so they can plan for their businesses.

The sub-group discussed the technical information available and how it could be used to assist CSG discussions on:

- which locations are the 'hot spots' to prioritise contaminant reductions,
- when, and
- from whom

TLG mitigations modelling – some assumptions

TLG member Graeme Doole has been clear about the strengths and uncertainties of the modelling approach in his presentations to CSG. Responding to a question at the mitigations workshop on 21 October[5], he noted that:

- The model doesn't attempt to estimate the rate of landowner adoption of mitigations over time because this multiples the uncertainties
- Adoption of mitigations is based on cost and efficacy, resulting in the model assuming cost and effectiveness of each mitigation is as predicted

Load information and geographic differences

CSG sub-group discussion with Bryce Cooper highlighted that:

- The model is at steady state, so doesn't try to phase in time to implement changes to reduce contaminants. This is particularly important for nitrogen because in some sub-catchments, the load to come is very large (nitrogen from recently converted pine-pasture land use is in transit in groundwater and hasn't yet reached surface water).
- The model is set up to model so there is not a big 'slug' of nitrogen to come. To prevent contaminant concentration going up in the water, the model compensates with mitigations to deal with the load to come.

There was some conversation about the complexity in the catchment that is captured in the modelling and the catchment load data extracted from that. It is not yet clear how that complexity could be reflected in the policy options, particularly as the 2016 plan change is expected to be the first stage.

Implications of geographic differences in contaminant reductions

In light of the:

- estimated catchment load information,
- modelled mitigations (change on land needed), and
- how and where to prioritise change in behaviour

[5] See notes of a CSG workshop with Technical Leaders group on 21 October. WRC document

The sub-group identified some high level options on where to focus policy options:

1. Keeping the level of complexity from the modelling (i.e. the spatial variability in where mitigation need to occur in relation the loads in the water) and do this for 74 different subcatchments or
2. Simplifying it back to a certain percentage reduction (per FMU) in the first plan change, or
3. Identifying the hotspots and say "in these catchments you have to go further" than the baseline percentage.

The sub group intends to explore some of these options for achieving contaminant reductions in more detail.

Option 2 above was considered in slightly more detail. For this option, everyone could begin by reduce by the same amount. The 2016 Plan change would require the same reduction regardless of whether it comes from farms in the Upper Waikato FMU or from farms and vegetable growers near Pukekohe. However, the sub-group felt this does not take into account the spatial variability in Waikato and Waipa River catchments.

Compared to a lake, rivers are more complicated because there are additions of water and contaminants as it flows downstream. Sub-catchments have a different mixes of land uses and hydrogeology. On 23 October, the sub-group agreed they needed to account for spatial differences.

The concern was also noted that the CSG has yet to discuss how to allocate responsibility for change, and that a blanket percent reduction represents a 'grandparenting by default' approach to allocation. It was also noted that there are areas of underdeveloped land where there is an aspiration to intensify, and these issues are yet to be fully explored by the CSG.

The next meeting of the sub-group on 18 October will look at visual information about sub-catchment loads, and consider land use and landownership in relation to this, in order to report back to the CSG on options.

5 Summary

The sub-group is taking the CSG direction to achieve 10% in the first ten years of achieving the Vision and Strategy, and going into more detail about how this could be achieved. Property plans are a key element. Landowners will want to know how much change we are looking at from 2016 onwards. If there is to be a staged approach to reductions, landowners need to know this, so they can plan for the future.

The sub-group suggested that landowners, and those helping to prepare property plans, will want to have an idea of the degree of change that is likely to be required of them from 2016 onwards. If there is to be a staged approach to reductions, landowners need to know this, so they can plan for their businesses. TLG information could be used to assist CSG discussions on:

- which locations are the 'hot spots' to prioritise contaminant reductions,
- when, and
- from whom

The sub-group identified that further discussions are required to progress this further.

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Attachment 1 - Explanatory note to the CSG to accompany spreadsheets of contaminant loads prepared by TLG and dated 20 October 2015

Attachment 2 – Notes from subgroup discussion on 23/10/15. Butcher paper and whiteboard notes taken by Helen Ritchie Preparation material sent to meeting participants

Attachment 3 - Draft CSG meeting notes from 13-14th October meeting, responding the 7th October second sub-group, with response the CSG to that report back

6 References

Arbuckle, Chris. August 2015. Stocktake of Regional Council Uses of OVERSEER® Prepared for Ministry for Primary Industries; Regional Council Resource Managers Group and Regional Government.

Collaborative Stakeholder Group Workshop 14 Notes. 10th and 11th August 2015, DM #3471459.

Collaborative Stakeholder Group Workshop 17 Notes. 13th and 14th October 2015, DM #

Elliot, S. How do the catchment models for *E. coli*, nutrients, and clarity work? Powerpoint presentation at CSG Mitigations workshop on 21 October 2015 WRC document number 3594449.

Waikato Regional Council 2014. Report to CSG workshop 2 Case Study I: Lake Taupo catchment property-level nitrogen discharge limits document number 3034258.

Waikato Regional Council 2015b. Exploring industry farm plans as a policy option; including industry-supported farm plan with regulatory backstop" DM# 3454905.

Waikato Regional Council 2015c. Policy options for sediment, microbes, nitrogen and phosphorus. Agreement and Approval report dated 22 June 2015. DM #3425911.

Waikato Regional Council 2105. Policy option of a property-level limit for nitrogen and phosphorus. Agreement and Approval report to CSG Document #3476854 dated 24 August 2015.

Waikato Regional Council 2105. Options for using Overseer model to manage nitrogen and phosphorus at a property-level. Agreement and Approval report to CSG. Doc #3507568 dated 17 September 2015.

Waikato Regional Council 2015. Report to CSG entitled Options for Tailored Property Plans. Doc #3563987 dated 9th October 2015.

Waikato Regional Council 2015. CSG subgroup: Managing nitrogen and phosphorus at a property-level. Agreement and Approval report to CSG. Doc #3574906 dated 9 October 2015

WRC CSG workshop with Technical Leaders group on 21 October.

Attachment 1 Explanatory note to the CSG to accompany spreadsheets of contaminant loads prepared by TLG

Explanatory note to the CSG to accompany spreadsheets of contaminant loads

Prepared by the TLG

20th October 2015

At CSG #18 the CSG requested the detailed sub-catchment contaminant load data emanating from the 'stepping stone' scenario modelling to assist them in their deliberations on policy options and allocation. The accompanying spreadsheet contains the model data requested in the forms requested by the CSG.

As explained at CSG #18, in the timeframe available and with the other commitments to the project over the last week it has not yet been possible for the TLG to 'sanity' check the outputs (so therefore results are draft), to prepare maps of the load data (which will visually show 'hotspots'), or to prepare an interpretive narrative. This document is merely an explanatory note to help interested CSG members understand what they are looking at.

The load data for the four contaminants (nitrogen, phosphorus, sediment and microbes) for the current state (Base) and for the stepping-stone scenarios '10%', '25%', '50%', '75%' and '100%' of Scenario 1 are set out in the accompanying spreadsheet *Load data for CSG* for each of the 74 sub-catchments in the model. Location of each of the numbered sub-catchments and their FMU are shown in Map 1 at the end of this note.

The database contains two sets of four sheets, with the data set out either by parameter or contaminant – i.e., parameter (e.g., load/ha) for all 4 contaminants, or contaminant for all 4 parameters – take your choice.

The first four sheets in the excel database are:

- ***Catchment load***: the total load of contaminant per year for each sub-catchment at the current state (base) and after the mitigations applied in the '10%', '25%', '50%', '75%' and '100%' Scenarios.
- ***Load per total ha***: the load of contaminant for each sub-catchment expressed as kg/ha/year (except *E.coli* expressed as number per ha per year), for current state (base) and after the mitigations applied in the '10%', '25%', '50%', '75%' and '100%' Scenarios.
- ***Load removed***: the total load of contaminant removed from each sub-catchment per year by the mitigations applied in the '10%', '25%', '50%', '75%' and '100%' Scenarios compared to current state (base).
- ***Load removed per productive ha***: the annual load of contaminant removed from each sub-catchment expressed as kg/ha in production (i.e., excluding miscellaneous areas such as native forest), by the mitigations applied in the '10%', '25%', '50%', '75%' and '100%' Scenarios compared to current state (base). This is a measure of the 'intensity' of the load reduction as it relates to that area of the sub-catchment that is treatable by the mitigations.

The second four sheets repeat these data, arranged by contaminant. Each of the sheets labelled ***nitrogen***, ***phosphorus***, ***ecoli*** and ***sediment*** contain for the respective contaminant the catchment load, load per total ha, load removed and load removed per productive ha.

Please note that point sources are included in the above within the sub-catchment that they fall. These can often be spotted as 'odd-ball' high loads per hectare (e.g. Central Waikato sub-catchment #25 which includes the point source load from the Hamilton City Council Wastewater Plant).

Terms in italics below refer to the named sheets in the excel database.

Total contaminant loads
The total annual mass load of each contaminant in the current state (base) for each scenario is summarised by FMU in Table 1. Total load from each sub-catchment within each FMU is shown for all contaminants in c*atchment load* and for individual contaminants in *nitrogen, phosphorus, ecoli, and sediment*.

Comparing FMUs shows that current state (base) total mass loads of nitrogen and phosphorus are highest from the Upper Waikato FMU and lowest from the Central Waikato. Sediment load and microbial load are greatest from the Waipa FMU. Microbial load is lowest from the Central Waikato FMU.

Table 1: The total mass load entering water in the current state (base) and for scenarios '10%', '25%', '50%', '75%' and 100% of Scenario 1, for each contaminant and each FMU

	scenario	Upper Waikato	Central Waikato	Lower Waikato	Waipa
Nitrogen load (tonnes/yr)	Base	4135	871	3833	3887
	10%	3943	852	3547	3766
	25%	3636	794	3325	3499
	50%	3370	640	2795	3037
	75%	3102	384	2219	2347
	100%	3219	382	2223	2347
Phosphorus load (tonnes/yr)	Base	391	124	257	231
	10%	321	122	237	214
	25%	296	116	219	200
	50%	271	80	171	171
	75%	247	32	142	138
	100%	256	32	142	138
Sediment load (tonnes/yr)	Base	165,000	20,478	223,997	224,525
	10%	121,628	19,458	203,641	199,446
	25%	120,099	16,388	171,195	172,602
	50%	117,785	13,662	120,505	133,112
	75%	112,916	11,197	84,033	110,501
	100%	112,962	11,153	83,894	110,431
Microbial load (10^{15}/yr)	Base	13.5	6.3	26.2	40.2
	10%	11.1	5.9	21.8	35.6
	25%	10.5	5.2	18.8	31.5
	50%	10.2	4.0	13.2	22.3
	75%	8.2	2.8	10.6	18.3
	100%	8.0	2.8	10.5	18.3

Total mass load per FMU depends on catchment size, land use mix, and point sources. Total land area and area of productive land are given in *catchment load* for each sub-catchment. The areas of total and productive land in each FMU are summarised in Table 2. The percentage of the total area in each FMU that is classified as productive land is slightly higher for Upper Waikato than for the other FMUs (83, 71, 73 and 75%, respectively, for Upper, Central, Lower and Waipa).

Sub-catchment areas both within each FMU and across FMUs vary substantially in both total size and in the fraction of land classified as productive (see *catchment load*).

Table 2 Area of each FMU (ha)

FMU	Productive ha	Total ha
Upper Waikato	364,408	440,795
Central Waikato	39,946	56,573
Lower Waikato	216,265	295,604
Waipa	233,327	309,332

Contaminant loads and loads removed can therefore be expressed on a per ha basis for better comparison between sub-catchments and FMUs (*load per ha* and *load removed per productive ha*).

Load removed

The total load removed by mitigations for each of the stepwise scenarios to reach Scenario 1 is shown in *Load removed* for each sub-catchment and for each FMU or separately for each contaminant in *nitrogen, phosphorus, ecoli, and sediment*. The load to be removed is that derived from all land in the catchment.

Mitigations used in the model are management practices on productive land or at the edge of field of productive land, **only**. Total load removed and load removed per ha of productive land for each sub-catchment within each FMU are shown in the excel sheets *load removed* and *load removed per productive ha*, and for each contaminant in *nitrogen, phosphorus, ecoli, and sediment*. The loads to be removed are summarised in Tables 3 and 4.

Within any given scenario and FMU, sub-catchments vary widely in the load removed per hectare of productive land (Table 4). For example, in the Lower Waikato at 10%, the load of N to be removed ranges from 0.23 to 4.14 kg N/ha/yr for individual sub-catchments. The high extremes of load removal required per hectare of productive land can be distorted by point sources within those sub-catchments.

Relative differences between sub-catchments at the '10%' level may not be reflected at the '25', '50', '75' or '100%' level, e.g. sub-catchment 20 in the Lower Waikato has the lowest removal rate at 10% but the highest at 50, 75 and 100%. This reflects the way in which the model optimises the use of mitigations at least cost. This is particularly obvious when sub-catchments with point sources are part of the comparison – e.g. sub-catchment 25 in the Central Waikato, where the mitigation of improved point source treatment only gets invoked in scenarios of '50%' and above.

Table 3: The total load entering water in the current state (base) and the load removed by mitigations to achieve 10%, 25%, 50%, 75% and 100% of the change in concentration of contaminant to meet Scenario 1, for each contaminant and each FMU

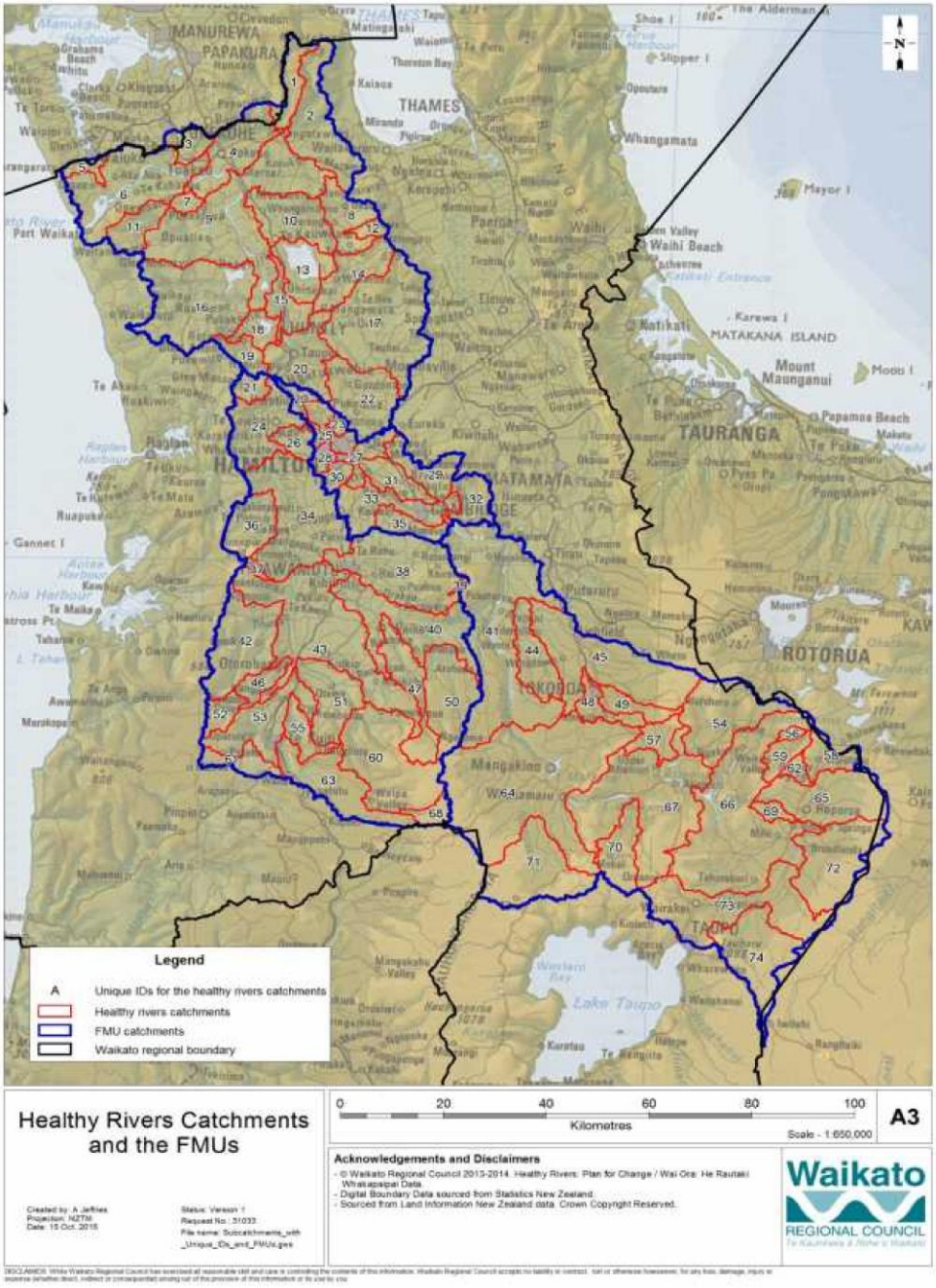
	scenario	Upper Waikato	Central Waikato	Lower Waikato	Waipa
Nitrogen (tonnes/yr)	Base	4135	871	3833	3887
N load removed (tonnes/yr)	10%	192	19	286	122
	25%	499	78	507	389
	50%	765	231	1038	850
	75%	1033	488	1613	1541
	100%	916	489	1610	1541
Phosphorus (tonnes/yr)	Base	391	124	257	231
P load removed (tonnes/yr)	10%	70	1.9	20	17
	25%	95	7.5	38	31
	50%	119	44	86	60
	75%	144	91	115	93
	100%	135	91	115	93
Sediment (tonnes/yr)	Base	165,000	20,478	223,997	224,525
Sediment load removed (tonnes/yr)	10%	43,372	1019	20,355	25,079
	25%	44,901	4089	52,802	51,922
	50%	47,215	6816	103,492	91,413
	75%	52,084	9281	139,964	114,024
	100%	52,038	9325	140,103	114,093
Microbial load (10^{15}/yr)	Base	13.5	6.3	26.2	40.2
Microbial load removed (10^{15}/yr)	10%	2.4	0.5	4.3	4.6
	25%	2.9	10.1	7.3	8.7
	50%	3.3	2.4	13.0	17.9
	75%	5.3	3.6	15.5	22.0
	100%	5.5	3.6	15.6	22.0

Table 4 Average, median and range across sub-catchments within each FMU of load removed per ha productive land

	FMU	Upper Waikato			Central Waikato			Lower Waikato			Waipa		
	scenario	average	median	range	average	median	range	average	median	range	average	median	range
N load removed (kg/ha)	10%	1.39	0.92	-3.88-6.33	0.63	0.49	0.11-1.34	1.05	0.73	0.23-4.14	0.60	0.60	-0.16-2.06
	25%	2.16	1.69	-3.88-8.33	1.74	1.54	0.26-4.45	1.99	1.80	0.30-7.71	1.62	1.64	0.22-3.93
	50%	3.03	2.22	-3.88-17.5	9.09	3.90	0.44-52.61	3.96	2.83	0.44-15.1	3.04	2.86	0.29-6.03
	75%	3.75	2.49	-3.88-23.5	21.84	7.74	1.37-155.2	6.57	5.22	0.99-21.7	5.66	5.27	0.80-9.18
	100%	3.54	2.49	-3.88-23.5	21.89	7.74	1.37-155.3	6.61	5.25	0.99-21.7	5.66	5.27	0.80-9.18
P load removed (kg/ha)	10%	0.26	0.28	-0.10-0.55	0.08	0.05	0.00-0.27	0.12	0.06	0.02-0.40	0.08	0.07	0.03-0.25
	25%	0.33	0.30	0.03-0.86	0.19	0.17	0.11-0.37	0.18	0.16	0.02-0.40	0.16	0.16	0.05-0.33
	50%	0.39	0.31	0.03-1.14	2.62	0.48	0.14-22.46	0.39	0.33	0.02-1.53	0.30	0.29	0.05-0.53
	75%	0.46	0.36	0.07-1.78	5.94	0.55	0.17-55.06	0.55	0.49	0.02-1.55	0.43	0.44	0.09-0.77
	100%	0.44	0.32	0.04-1.78	5.95	0.55	0.18-55.06	0.56	0.50	0.02-1.55	0.43	0.44	0.09-0.80
Sediment load removed (kg/ha)	10%	149	124	3.2-586	24	25	0.0-62	250	60	0.0-1845	193	43	0.0-834
	25%	157	134	3.1-586	103	103	1.2-229	342	97	0.0-1875	355	306	35.3-1156
	50%	164	150	7.2-586	171	188	1.6-385	517	269	6.8-1875	597	365	36.9-1696
	75%	173	155	8.0-586	211	194	22.2-576	651	433	6.8-1875	735	588	36.9-2299
	100%	173	155	8.0-586	212	198	22.2-576	653	433	6.8-1875	737	588	36.9-2299
Microbial load removed (10^{18}/ha)	10%	0.25471	0.010765	-0.006-0.026	0.02260	0.01202	0-0.08	0.01956	0.01214	0-0.09	0.44703	0.014944	0.003-0.06
	25%	0.31181	0.015568	-0.006-0.035	0.04843	0.03267	0.007-0.12	0.03030	0.02266	0.001-0.12	0.87469	0.034862	0.02-0.086
	50%	0.35282	0.015836	-0.006-.05	0.10314	0.07708	0.007-0.25	0.05227	0.04646	0.01-0.10	1.84923	0.083287	0.03-0.16
	75%	0.45498	0.022981	0.003-0.07	0.15423	0.08637	0.04-0.64	0.06600	0.06107	0.01-0.15	2.29771	0.100389	0.03-0.185

	100%	0.47463	0.022993	0.003-0.07	0.15423	0.08637	0.04-0.64	0.06700	0.06107	0.01-0.15	2.29772	0.100389	0.03-0.185

Map 1 Sub-catchment number and FMU map



Attachment 2 Meeting notes of a sub-group of the Collaborative Stakeholder Group

Notes from the Overseer subgroup meeting #3

Date: 23 October 2015 9:00am - 12:00pm
Location: Waikato Room, Kakariki House
Attendees:
CSG members and delegates: Weo Maag, Charlotte Rutherford, Gwyn Verkerk, Sally Millar, James Bailey, George Moss, Phil Journeaux, Rick Pridmore
TLG: Bryce Cooper, Mike Scarbrook
WRC staff: Justine Young, Ruth Lourey, Emma Reed, Chris McLay, Bruce McAuliffe, Mark Brockelsby, Jon Palmer
Facilitator: Helen Ritchie

What are the options and mechanisms to prioritise <u>where</u> nutrient/contaminant reductions should take place?

- Spatial considerations
- How to prioritise more reductions in some places (may vary for different contaminants)
- Relate this back to property-level planning
- How will a certified property planner know the actions in the plan will be enough?
- Info to go back to CSG for November and December meetings

Information we have that can help with this task

- Subcatchment information:

    Concentration

    Load - annual average

    Waikato Regional Council data conc. – monthly flow measured/estimated

  <u>Base</u>
  Current state - estimated using measured samples (except the virtual sites). Note that clarity samples use 90% and exclude the top 10% of flows.

  <u>Scenario</u>
  Model calibrated to base information
  Each subcatchment has a fraction to estimate attenuation

  Spreadsheet: Load that must be removed per productive ha (in the water) → can do a ‘heat map’

Measured concentration

- In some subcatchments, the load of N to come is so much, the model couldn't mitigate all of it in the steps on the way → N will rise in some places (subcatchments) – however, can mitigate in other subcatchments to hold N in mainstem

- Chlorophyll in river is predominantly P-limited (meaning that it responds by growing when more P is added to the water). Nitrogen does influence chlorophyll growth in the river at particular flow and temperatures.

- 'Heat map' (intensity of need for action)
    - Load reduction needed per productive ha (currently includes pine forestry)

  Is this manageable? (nutrients from forestry)

    - Are there extra actions that could be taken?

    - How realistic is that?

- Produce heat map per contaminant

- Produce heat map overlaid with land use and sources of contaminant

  Then overlay spatial land use or a percentage of each land use and show point sources

- Heat maps will identify priority subcatchments (where to get started)

- We would then look at the 74 catchments

- Noting model doesn't take into account current conversions

- Useful information would be load removed per productive land (excluding forestry)

- What farmers want to know is what percentage of change are we looking at in this Healthy Rivers Wai Ora project?

- Do you keep the level of complexity at 74 different subcatchments

  or

- Do you simplify it back to a certain percentage reduction (per FMU) in the first plan change

  or

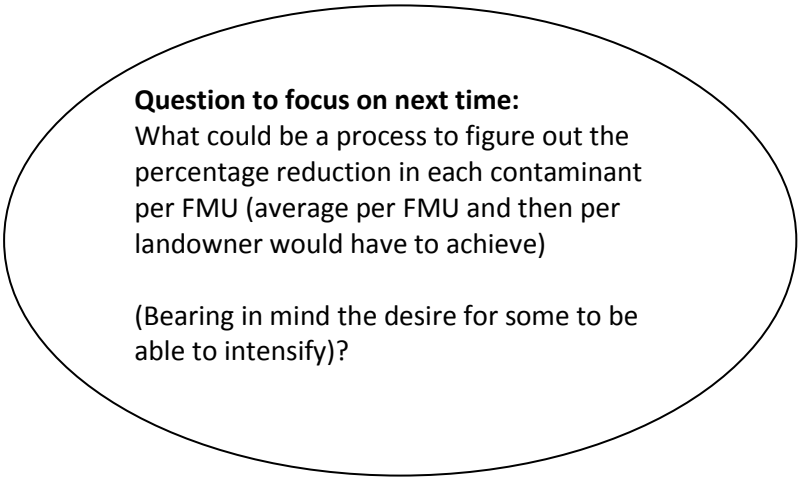
- Do you identify the hotspots and say "in these catchments you have to go further" than the baseline percentage

- FMU-wide percentages so they focus on the contaminants in each FMU. Could subdivide further but would need good reason. Use the heat maps to guide where to start first

- Need to be clear what the next stages are

- Heat map can help with risk assessment at a farm level (first part of planning)
- Possible extra catchment-wide mitigations like wetlands could be used in areas with more intensity of reduction required (using public money)

- What will we use for the 'heat maps'?
- Current loads?
- 10% (10 years) and 25% (20 years)?
    - Fixed land use?
    - Constrained land use?
- Constrained land use 25%
- Fixed land use at 25% if possible?



- Farm plan could assess risk
- Headroom – means others have to reduce more
    - Through individuals' actions to reduce
    - Or catchment-scale mitigation
- Get information on how much land and how much intensification is wanted
- Depends on where and by when
- LAWF may recommend that regional councils give headroom to iwi first
- Would it be possible to allow some increase in N, knowing what we do about nutrient sensitivity in the lakes
  → would this be possible under the NPS/V & S noting swimmability is also affected by conversion (E. coli)
- Need room for within-property shifts in intensity for drystock/dairy as optimisation of land use occurs

→ focus on reductions, not intensifications

- Real conversations are about who has to do what

Attachment 3 Excerpt of CSG workshop notes with CSG response to CSG Sub-group report back on 13th October 2015

Draft Facilitation session notes from CSG Workshop 18

Item	Day One 13 October 2015	Action
1.	**Opening waiata**	

Overseer sub-group report back

• Issue – you can have different people use the model and get varying results.
• Protocols have been developed in Taupo to deal with this issue.
• Trading also has 'cons' e.g. if you trade away your surplus and a new version shows you need it back.
• You can apply Overseer to forestry but it's not designed for that. Overseer assigns a rate of 3kg/ha to forestry
• Overseer not used in all types of farming (e.g. horses) and also deals better with some farming types than others. In other regions some land uses are assigned a number i.e. BOP for gorse.
• Tourism developments with on-site sewerage - dealt with via consenting - how does something like that get an allocation? This has to be thought about.
• How hard is it to develop these tailored property plans? How long will it take? Is it a more timely approach to use the modelling approach?
• Doing the Overseer model is still a 1 on 1 approach – just focus is wider. Both are resource hungry.
• Benchmarking – if this is against current practise – concern people are doing different levels of intensity now and low intensity have little room to move and already doing a good job.
• Benchmarking is just to know what everyone's doing - who has to reduce by how much is another discussion.
• Efficiencies in dealing with all four contaminants through one property plan.
• What is happening at national level with Overseer?
  ◦ It's always catching up/ evolving
  ◦ Checking its algorithms ('ground truthing' against actual losses)
  ◦ Overseer may stabilise over time.
• Could phase in over time e.g.
  ◦ First years: benchmarking data, establishing sub-catchment loads and reductions.
  ◦ Then take time to prepare plans and achieve a % reduction.
  ◦ Then move to a hard number over time.
• We don't know now what a 10% means at a farm level so we will be asked, how do you know you are going to achieve the 10%?
• Horticulture operations span a number of properties

- Taupo – individual properties (done by block), or covering multiple blocks (issue if they cross FMU's)
- Benchmarking over 1 year or several? Average of 3 to 5 is common.