Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments.

SubForm	PC12016	COVER SHEET	
FOR OFFICE USE ONLY			
		Submission Number	
Entered		Initials	
File Ref		Sheet 1 of	

Submission form on publicly notified – Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments.

FORM 5 Clause 6 of First Schedule, Resource Management Act 1991

SUBMISSIONS CAN BE	
Mailed to	Chief Executive, 401 Grey Street, Private Bag 3038, Waikato Mail Centre, Hamilton 3240
Delivered to	Waikato Regional Council, 401 Grey Street, Hamilton East, Hamilton
Faxed to	(07) 859 0998 ***Please Note:*** *if you fax your submission, please post or deliver a copy to one of the above addresses*
Emailed to	healthyrivers@waikatoregion.govt.nz ***Please Note:*** *Submissions received my email must contain full contact details. We also request you send us a signed original by post or courier.*
Online at	www.waikatoregion.govt.nz/healthyrivers
We need to receive your submission by 5pm, 8 March 2017.	

YOUR NAME AND CONTACT DETAILS		
Full name Janet Taylor		
Full address 4/4 Moana St, Frankton, Hamilton		
Email taylorjanet220@gmail.com	Phone 022 1866 196	Fax

ADDRESS FOR SERVICE OF SUBMITTER		
Full name as above		
Address for service of person making submission		
Email	Phone	Fax

TRADE COMPETITION AND ADVERSE EFFECTS *(select appropriate)*

☐ I could / √☐ could not gain an advantage in trade competition through this submission.

☐ I am / √☐ am not directly affected by an effect of the subject matter of the submission that:
(a) adversely effects the environment, and
(b) does not relate to the trade competition or the effects of trade competition.
Delete entire paragraph if you could not gain an advantage in trade competition through this submission.

THE SPECIFIC PROVISIONS OF PROPOSED PLAN CHANGE 1 THAT MY SUBMISSION RELATES TO
Please state the provision, map or page number e.g. Objective 4 or Rule 3.11.5.1
(continue on separate sheet(s) if necessary.)

see attached.

The Erosion Soil Management Plan and the

Overseer software tool for nutrient balance calculations

I SUPPORT OR OPPOSE THE ABOVE PROVISION/S
(select as appropriate and continue on separate sheet(s) if necessary.)

☐ Support the above provisions conditional support for both, so long as ammendments are considered by collaborative planning group

√☐ Support the above provision with amendments

☐ Oppose the above provisions

MY SUBMISSION IS THAT
Tell us the reasons why you support or oppose or wish to have the specific provisions amended.
(Please continue on separate sheet(s) if necessary.)

see attached

I SEEK THE FOLLOWING DECISION BY COUNCIL
(select as appropriate and continue on separate sheet(s) if necessary.)

☐ Accept the above provision

√☐ Accept the above provision with amendments as outlined below

☐ Decline the above provision

☐ If not declined, then amend the above provision as outlined below

Amend as follows:

That the soil erosion mitigation factors include vegetative control measures

That the Overseer software farm management tool for use in calculating nutrient gains and losses that impact water quality, and the use of water, be developed further and used more appropriately by Council rather than an adaptation of a largely Fertiliser and Dairy-led interested party tool for on-farm management.

PLEASE INDICATE BY TICKING THE RELEVANT BOX WHETHER YOU WISH TO BE HEARD IN SUPPORT OF YOUR SUBMISSION

☐ I wish to speak at the hearing in support of my submissions.

√☐ I do not wish to speak at the hearing in support of my submissions.

JOINT SUBMISSIONS

√☐ If others make a similar submission, please tick this box if you will consider presenting a joint case with them at the hearing.

IF YOU HAVE USED EXTRA SHEETS FOR THIS SUBMISSION PLEASE ATTACH THEM TO THIS FORM AND INDICATE BELOW

√☐ Yes, I have attached extra sheets.	☐ No, I have not attached extra sheets.

SIGNATURE OF SUBMITTER

(or person authorised to sign on behalf of submitter)

A signature is not required if you make your submission by electronic means.

Signature Janet L taylor	Date 11/11/16

Personal information is used for the administration of the submission process and will be made public. All information collected will be held by Waikato Regional Council, with submitters having the right to access and correct personal information.

PLEASE CHECK that you have provided all of the information requested and if you are having trouble filling out this form, phone Waikato Regional Council on 0800 800 401 for help.

Additional sheet to assist in making a submission

Section number of the Plan Change	Support /Oppose	Submission	Decision sought
Please refer to title and page numbers used in the plan change document	Indicate whether you support or oppose the provision.	State in summary the nature of your submission and the reasons for it.	State clearly the decision and/or suggested changes you want Council to make on the provision.

From: Janet Taylor
To: Healthy Rivers
Subject: Submission # 9543113
Date: Friday, November 11, 2016 4:19:42 PM
Attachments: Healthy Rivers.docx
Submission form (1).doc

Hi there
Attached is my submission form and Word document outlining my concerns for Healthy Rivers Waikato.
Please confirm receipt of information by email, and confirm that an additional hard copy is not necessary
Regards
Janet Taylor

Healthy Rivers (Jan Taylor, M.Sc)

In 2009 I had the privilege of paddling in one of the Tainui wakas from Cambridge to Turangawaiwai marae, to train Science students from Ngaruawahia High school in river health awareness.

The Waikato and Waipa river riparian margins were historically colonised by harakeke (flax) which provided soil filtering capacity and land stabilisation, and habitat for invertebrate and vertebrate life. This flax buffer was subsequently stripped for economic profit, impacting on water quality and plant and animal life.

With this bold Waikato District Council collaborative river management plan, the economic costs of excessive water use and pollution by stakeholders can finally be addressed.

I have identified several issues that need further development within both land management options and the allocation of nutrient credits. I have outlined these below, and have provided scientific references that address my concerns.

As a scientist and educator, I see several training opportunities that could increase the effectiveness of Council water pollution mitigation measures. There is room for independent, and iwi-led, science initiatives to collate factual data on the effectiveness of drainage and plant-based water-filtering systems. In addition, more sophisticated farm nutrient-balance profiles and combinations for land management practice that mirror international trends for clean water legislation, could be developed. This interest is reflected in my choice of science attachments.

Healthy Rivers –Erosion and Sediment Control Guidelines (AgriLink)

Riparian valuation

The information provided on erosion and soil control lacks focus and economic value of riparian river margins.

The definition of riparian margin is the vegetative area along a watercourse designated as a non-disturbance zone. Not only is this supposed to be a buffer for runoff from a cultivated paddock (stated in the document to be “largely ineffective”), but the term riparian also encompasses active soil filtering root systems of plants like flax (harakeke) that have been demonstrated to improve water quality and foster invertebrate and vertebrate life.

No scientific studies have been carried out to quantify the economic value of restoring flax at stream and river margins in order to improve water quality by soil and nutrient trapping.

In contrast, the AgriLink document lists range of effectiveness and cost per hectare to a farmer of other soil loss mitigation measures (Table 1).

Paddock water control plans

Drain culvert size by calculation of anticipated volume of water (Table 3). This table is important because it gives the farmer values for water flow (L/sec) at flooding times (1:5 year event, 1:20 year event). But there is no explanation of the catchment area, or units given. Does this data reflect current revised climate estimates of flooding events?

Soil water infiltration rate (mm/hr)

(Table 4). I am concerned about the accuracy of this data. There is no equation stated, or methods section for this data. While the rate of winter drainage from a wheel track left unscored (uncultivated) at 0.5mm/hr in winter is plausible, the value of **>60metres/hr** for scored (cultivated) wheel tracks is not possible. Yet this data is further utilized to calculate erosion rates (Table 5). I assume t=time (no units provided), but this important table forms the basis of conclusions and justifications for recommended erosion control measures. **AgriLink** needs to revisit this data and produce evidence before it is scientifically sound.

Healthy Rivers – Best Practice Farm Input Nutrient Balance software Overseer®

This is the required software tool for calculating farm runoff and dairy nutrient budget. It will be used by Waikato Regional Council for costing out river pollution burden from individual water users.

Overseer® is one third owned by the Fertiliser Association of NZ. While AgResearch Ltd and Ministry of Primary Industry are co-owners, the only Doctoral scientists on the software development panel are employed by **Ravensdown Ltd, and Dairy NZ.**

4.1 Wetland block data

Recommendation: Ignore the Riparian specific option.
Justification: "much of the data required is very complex and difficult to determine to make the model accurate enough to be worthwhile".

4.5 Soil properties

N immobilization is the net transfer of nitrogen from plants to and from the organic pool.

Overseer® asks: "Do you want to enter more detail about soil properties?"
Recommendation: Ensure all boxes are unchecked.
Justification: "changing these values will overwrite set data and will have a large impact on leaching losses". "Currently there is no reliable method to determine sites with low or high N immobilization"

This means that fertilizer and nitrogen-based cow urine deposits to soil that overwhelm the ability of plants and organisms to metabolise, is unaccounted for in the farm nutrient budget.

It has been shown elsewhere that both nitrogen (N) and phosphorus (P) inputs in a range of farming systems can be quantified (**see Science Journal abstracts**).

N and P losses from dairy farms have been modelled previously in farm nutrient management systems, as required by the EU Nitrates Directive.

The role of soil organisms is acknowledged as impacting on nutrient leaching, but no provision is made to explore this option. Plants with lower critical P requirements have been identified elsewhere.

The value of leguminous, nitrogen-fixing forage crops is not included in the Overseer® N farm budget. The only legume included in the crops section (Appendix 2) has been classified as "green manure".

In the Description of NZ Soils section (Appendix 4), the only biologically-active soils listed are Melanic (5). It has been shown elsewhere that farm drainage flux is altered with soils of higher organism content (manured and green manure) than inorganic fertilized soil. Manured soils not only alter the mineral soil profile, but also increase water conductivity (termed hydrophobicity, the negative, in Overseer®) and therefore drainage, as well as the aggregate stability of the soil.

4.7 Drainage

Hydrophobic soil conditions (that reduce nutrient loss, eg high biological active soils) are ignored by Overseer®
Justification: "it will be practically impossible to determine in the field".

Susceptibility to pugging and soil compacting:

"Dairy Industry: select occasionally for all soil types". Soil compaction: "Leave unchecked"

This highlighted exemption for the dairy industry in the main water use section of Overseer® software tool is contrary to farm knowledge where animal hoofs compact the soil and pool the water in winter and spring grazing paddocks.

Justifications: "Pugging tends to be a within-year paddock phenomenon".
"Soil compacting is a temporary phenomenon and not equal over the entire block"

This is in stark contrast to the drainage method outlined in other 4.7 scenarios where a paddock is estimated as percentage of block drained.

Also in this section is the default, unchecked box option whereby "all of the drainage from the block is captured by artificial wetland".

4.8 Pasture

In contrast to the stated objectives of Overseer®, there is no provision for phosphate in the entire manual.

4.11 Irrigation

Management options:

Controlled flood

Overseer® parameters for depth per application and frequency of use are set to default. These programme parameters control water use according to fertiliser use, to solubilize fertilizers and render them effective.

Justification: "depth of application is not recommended as it is difficult to align rate and climate data"

The relationship between inorganic and organic fertiliser use, in terms of water use (reduced irrigation to minimise leaching and gaseous N loss) and water loss (leaching) has been calculated elsewhere (see Science Journal abstracts).

Science Journal abstracts:

1. Nitrogen balance and groundwater nitrate contamination: Comparison among three intensive cropping systems on the North China Plain**.** Ju XT, Kou CL, Zhang FS, Christie P **Environmental Pollution (**143**)** 2006

2. The long-term effects of manures and fertilisers on soil productivity and quality: a review. Edmeades D **Nutrient Cycling in Agroecosystems** (66) 2003

3. NUTGRANJA 2.0: a simple mass balance model to explore the effects of different management strategies on nitrogen and greenhouse gases losses and soil phosphorus changes in dairy farms. Del Prado A, Corre WJ, Gallejones P et al **Mitigation and Adaptation Strategies for Global Change** (21) 2016

4. Pasture plants and soil fertility management to improve the efficiency of phosphorus fertiliser use in temperate grassland systems. Simpson RJ, Richardson AE, Nichols SN, Crush JR. **Crop and Pasture Science** 2014 (CSIRO)

5. Nitrogen soil surface balance of organic vs conventional cash crop farming in the Seine watershed. Anglade J, Billen G, Garnier J, Makridis T **Agricultural Systems** (139) 2015

6. Water and nitrogen budgets under different production systems in Lisbon urban farming. Cameira MR, Tedesco S, Leitao TE **Biosystems Engineering** (125) 2014

7. Farm gate level nitrogen balance and use efficiency changes post implementation of the EU Nitrates Directive. Buckley C, Wall DP, Moran B, O'Neill S, Murphy PNC **Nutrient Cycling in Agroecosystems** (104) 2016

8. Mass balances of nitrogen and phosphorus in an integrated culture of shrimp (*Litopenaeus vannamei*) and tomato (*Lycopersicon esculentum* Mill) with low salinity groundwater: A short communication. Mariscal-Lagarda MM, Paez-Osuna F et al **Aquaculture Engineering** (58) 2014

1) **Nitrogen balance and groundwater nitrate contamination: Comparison among three intensive cropping systems on the North China Plain (2006)**

Abstract

The annual nitrogen (N) budget and groundwater nitrate-N concentrations were studied in the field in three major intensive cropping systems in Shandong province, north China. In the greenhouse vegetable systems the annual N inputs from fertilizers, manures and irrigation water were 1358, 1881 and 402 kg N ha^{-1} on average, representing 2.5, 37.5 and 83.8 times the corresponding values in wheat (*Triticum aestivum* L.)–maize (*Zea mays* L.) rotations and 2.1, 10.4 and 68.2 times the values in apple (*Malus pumila* Mill.) orchards. The N surplus values were 349, 3327 and 746 kg N ha^{-1}, with residual soil nitrate-N after harvest amounting to 221–275, 1173 and 613 kg N ha^{-1} in the top 90 cm of the soil profile and 213–242, 1032 and 976 kg N ha^{-1} at 90–180 cm depth in wheat–maize, greenhouse vegetable and orchard systems, respectively. Nitrate leaching was evident in all three cropping systems and the groundwater in shallow wells (<15 m depth) was heavily contaminated in the greenhouse vegetable production area, where total N inputs were much higher than crop requirements and the excessive fertilizer N inputs were only about 40% of total N inputs.

2) **The long-term effects of manures and fertilisers on soil productivity and quality: a review (2003)**

Abstract

The results from 14 field trials comparing the long-term (20 to 120 years) effects of fertilisers and manures (farmyard manure, slurry, and green manure) on crop production and soil properties are reviewed. In total there were 24 paired comparisons of the effects of manure and fertiliser. Some of the trials also contained a control (no nutrient inputs) treatment. The input of nutrients as either fertilisers or manures had very large effects (150–1000%) on soil productivity as measured by crop yields. Manured soils had higher contents of organic matter and numbers of microfauna than fertilised soils, and were more enriched in P, K, Ca and Mg in topsoils and nitrate N, Ca and Mg in subsoils. Manured soils also had lower bulk density and higher porosity, hydraulic conductivity and aggregate stability, relative to fertilised soils. However, there was no significant difference ($P < 0.05$) between fertilisers and manures in their long-term effects on crop production. In the context of this set of international trials, the recent evidence from the Rothamsted classical long-term trials appears to be exceptional, due to the larger inputs of manures and larger accumulation of soil OM in these trials. It is suggested therefore that manures may only have a benefit on soil productivity, over and above their nutrient content, when large inputs are applied over many years. The evidence from these trials also shows that, because the ratio of nutrients in manures is different from the ratio of nutrients removed by common crops, excessive accumulation of some nutrients, and particularly P and N, can arise from the long-term use of manures, relative to the use of fertilisers. Under these conditions greater runoff of P, and leaching of N may result, and for soils with low P retention and/or in situations where organic P is leached, greater P leaching losses may occur. The use of manures, relative to fertilisers, may also contribute to poor water quality by increasing its chemical oxygen demand. It is concluded therefore that it cannot generally be assumed that the long-term use of manures will enhance soil quality – defined in terms of productivity and potential to adversely affect water quality – in the long term, relative to applying the same amounts of nutrients as fertiliser.

3) **NUTGRANJA 2.0: a simple mass balance model to explore the effects of different management strategies on nitrogen and greenhouse gases losses and soil phosphorus changes in dairy farms (2016)**

Abstract

Farm nutrient management has been identified as one of the most important factors determining the economic and environmental performance of dairy cattle (*Bos taurus*) farming systems. Given the environmental problems associated with dairy farms, such as emissions of greenhouse gases (GHG), and the complex interaction between farm management, environment and genetics, there is a need to develop robust tools which enable scientists and policy makers to study all these interactions. This paper describes the development of a simple model called NUTGRANJA 2.0 to evaluate GHG emissions and nitrogen (N) and phosphorus (P) losses from dairy farms. NUTGRANJA 2.0 is an empirical mass-balance model developed in order to simulate the main transfers and flows of N and P through the different stages of the dairy farm management. A model sensitivity test was carried out to explore some of the sensitivities of the model in relation to the simulation of GHG and N emissions. This test indicated that both management (e.g. milk yield per cow, annual fertiliser N rate) and site-specific factors (e.g. % clover (*Trifolium*) in the sward, soil type, and % land slope) had a large effect on most of the model state variables studied (e.g. GHG and N losses).

4) **Pasture plants and soil fertility management to improve the efficiency of phosphorus fertiliser use in temperate grassland systems**

Abstract

Phosphorus (P) fertilisers are important for productivity in many grassland systems. Phosphorus is a non-renewable and finite resource, and there are environmental and economic reasons for using P more effectively. We review the P balance of temperate pastures to identify the factors contributing to inefficient use of P fertiliser and discuss ways to improve P-balance efficiency. Immediate gains can be made by ensuring that P fertiliser inputs are managed to ensure that the plant-available P concentrations of soil do not exceed the minimum concentration associated with maximum pasture production. Unnecessarily high soil P concentrations are associated with greater potential for P loss to the wider environment, and with higher rates of P accumulation in soils that have a high P-sorption capacity. Soil microorganisms already play a crucial role in P cycling and its availability for pasture growth, but are not amenable to management. Consequently, plants with lower critical P requirements, particularly because of better root foraging, will be an important avenue for improving the P-balance efficiency of fertilised pastures. Traits such as long fine roots, branching, root hairs, and mycorrhizal associations all contribute to improved root foraging by pasture plants; some of these traits are amenable to breeding. However, progress in breeding for improved P efficiency in pasture plants has been minimal. It is likely that traditional plant breeding, augmented by marker-assisted selection and interspecific hybridisation, will be necessary for progress. There are practical limits to the gains that can be made by root foraging alone; therefore, plants that can 'mine' sparingly available P in soils by producing organic anions and phosphatases are also needed, as are innovations in fertiliser technology.

5) Nitrogen soil surface balance of organic vs conventional cash crop farming in the Seine watershed (2015)

Abstract

In major cash crop farming areas like those of the Paris basin, nitrogen surpluses related to the synthetic fertilization of arable soils are the main cause of severe nitrate contamination of the groundwater and river network. Based on farmer interviews and the Nitrogen Soil Surface Balance integrated at the scale of the entire crop rotation cycle, we assessed the current agronomical and environmental performance of 68 organic rotations (with or without livestock) and compared them with those of the dominant conventional crop rotation in the same pedoclimatic areas. We demonstrated that, compared to conventional systems, organic cropping systems receive 12% less of total N inputs (including legume symbiotic fixation) without significant reduction in N yield. Consequently, the N surplus is 26% lower in organic than in conventional cropping systems. Forage legumes are the key component of the organic cropping systems studied, accounting for around 70% of total N inputs and for 52% of N yield. Therefore, the extension of organic farming to a broader scale to reconcile water quality and food production will substantially depend upon local opportunities of valorizing legume fodder cereal by-products. We also evidenced that the provisional N balance approach that has been promoted in the Nitrate Directive does not guarantee the infiltration of sub-root water fluxes meeting the drinking water standard of 11 mg N.l^{-1} without a downward revision of yield objectives.

6) Water and nitrogen budgets under different production systems in Lisbon urban farming (2014)

Abstract

Public concern is growing over soil and groundwater contamination from the use of agrochemicals in urban farming. Heavily used nitrogen (N) fertilisers are converted to nitrates that can be a health hazard. In this study, water and N budgets over a 1-year period are presented for typical urban vegetable gardens in Lisbon. A conceptual analysis supported by an integrated methodology of field experiments and modelling identified the N surpluses associated with conventional and organic gardens. It is concluded that the gardening systems are continuously cropped using high N and water application rates. For all of the case-study allotments, the N inputs, mainly from organic amendments with diverse N release rates, were higher than the crop uptake generating surpluses that were lost by different processes. On one study site a drainage flux of 280 mm yr^{-1} was calculated, with a mean concentration of 295 mg NO_3^- l^{-1}. On another site N accumulated in the lower soil depths at a rate of 420 kg NO_3^- ha^{-1} yr^{-1}. The cumulative impact of N surpluses on the environment and human health must be considered. To minimise adverse impacts, we propose the selection of organic fertilisers with N release rates close to the crop N uptake, the prevention of excess irrigation to minimise N leaching and gaseous losses and the inclusion of the non-fertiliser N sources in the fertiliser calculations. It is shown how an integrated model can be used to predict the N release dynamics from the organic fertilisers as affected by the moisture conditions.

7) **Farm gate level nitrogen balance and use efficiency changes post implementation of the EU Nitrates Directive (2016)**

Abstract

Farm gate nitrogen (N) balance and use efficiency was estimated across 150 specialist Irish dairy farms over a 7 year period between 2006 and 2012 using nationally representative data. The study period coincided with the introduction of EU Nitrates Directive regulations aimed at minimising losses of N to the aquatic environment and results indicated that N balance declined by 25.1 kg ha^{-1} from 180.4 to 155.3 kg ha^{-1} over the study period. This decline can almost entirely be attributed to reduced chemical N fertiliser inputs of 23.1 kg ha^{-1} over the period, equivalent to 1247 kg N, or a cost saving of €1347 per annum across the average dairy farm. Nitrogen use efficiency also increased by 2.1 % points over the period from 20.8 to 22.9 %. This was achieved while increasing milk solids output from 405.3 to 449.6 kg ha^{-1} in the context of a declining stocking rate (1.86–1.84 livestock units ha^{-1}). These results suggest some positive impact of the regulations on N management on Irish dairy farms at the nutrient source end of the nutrient transfer continuum. This increased N management efficiency has a potential double dividend effect of increased returns to agricultural production while reducing the risk of N transfer to the aquatic environment. In addition to the introduction of the regulations, results of a random effects panel data model indicated that N balance and use efficiency are significantly influenced by factors such as fertiliser prices, stocking rates, land use potential, contact with extension services and climatic variables.

8) **Mass balances of nitrogen and phosphorus in an integrated culture of shrimp (*Litopenaeus vannamei*) and tomato (*Lycopersicon esculentum* Mill) with low salinity groundwater: A short communication (2014)**

Abstract

This study re-examines the performance of an integrated shrimp-tomato system using the nutrients mass balance approach. A budget was calculated based on nutrients analysis, water management, feeding, fertilization, stocking, harvest and sludge removal. Nitrogen and P content in the input water (groundwater) were low, contributing 33.5% and 0.5%, of the total inputs, respectively. Most of the N (43.6%) and P (98.8%) entered to the system as shrimp food. Likewise, 15.2% and 2.5% of the input N, and 8.9% and 4.3% of the input P, were converted to harvested shrimp and tomato plants, respectively; 4.1% N and 24.6% P remained in the organic sludge, while the environmental losses expressed per unit of production were relatively low, 57 kg N $ton^{-1}$and 7.1 kg P ton^{-1} of product harvested. About 13.4% of input N was unaccounted for, and was assumed to be lost to the atmosphere via denitrification and volatilization. Comparison between these results and previous studies indicate that the shrimp-tomato system produces a relatively low recovery of N and P as harvested products, however, the main progress reached with this system is the reduction of the environmental losses of N and P in terms of kg of each nutrient per ton of the product harvested.