

Huangarua River at Ponatahi Bridge

Dissolved Reactive Phosphorous (DRP)

Revision 1 DRAFT

Date: 2017-11-10

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamāhanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Reactive Phosphorous (DRP) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to periphyton, and river and lake water quality conditions.

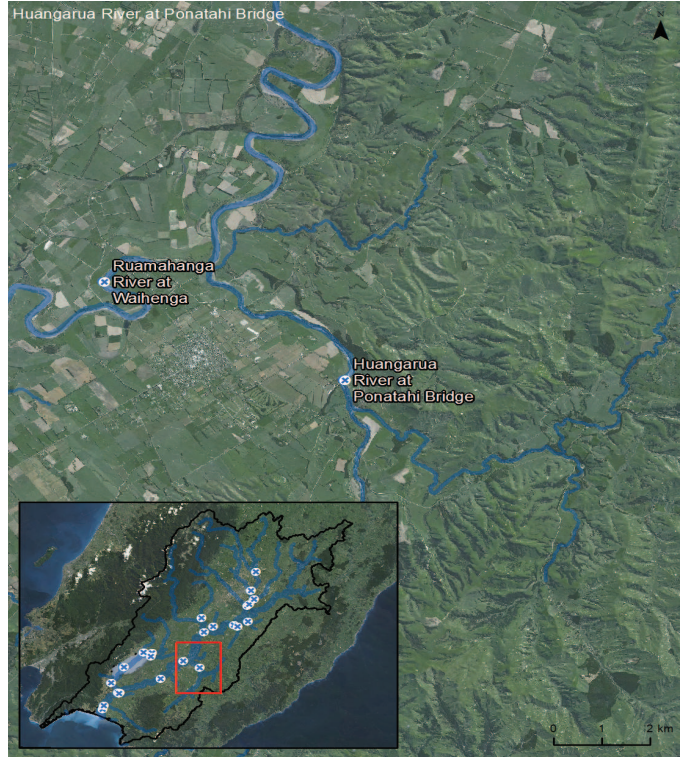
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

The Huangarua River at Ponatahi Bridge is ~30,239 ha. The catchment is primarily sheep and beef (84.6%), with limited dairy support (0.2%) and 2.3% native bush. The remaining area (13.0%) is a variety of 'other' land uses including lifestyle, mixed and arable of which no mitigations are applied. During BAU, median (50th) concentrations of DRP increase slightly by up to 1.7% by 2025 due to limited effects of stock exclusion and irrigation being modelled at 100% of the consented rates, where during the baseline model irrigation ramps up over time. Effectively this higher abstraction decreases flow, which contributes to an increase in concentrations. Limited retirement occurs in BAU (~107 ha or 0.35% of the catchment). By 2080, 1669 ha of pole planting at a rate of ~26 ha/yr from 2017 is >15 years old and considered to reduce DRP loads. In the BAU 2080 combined mitigations and landuse change are contributing to the 50th and 95th percentiles decreasing by 0.1% and 4.0% respectively.

In Silver and Gold scenarios, pole planting and retirement occurs at a greater rate. In addition to tier 1 mitigations (stock exclusion and effluent management), mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) lead to significant cumulative reductions in the EMC's of up to 80%, applied to DRP input values on sheep and beef landuses. In Silver/Gold 2080, 3,955 ha of land is pole planted and mature (~63 ha/yr from 2017), while 3,240 ha of land has been retired (~51 ha/yr from 2017). Significant reductions in 50th and 95th percentiles of up to 34.9% and 68.1% are simulated by 2080.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	-	46 (0.2%)	-	25581 (84.6%)	693 (2.3%)	3918 (13.0%)	30239

Table 2. Mitigation (area in ha)

Mitigation*	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	107	107	107	2285	3240	3240	3240	3240	3240
Pole Planting	0	204	1669	0	1697	3955	0	1702	3955

*Pole planting is effective for DRP at >15 years. Area given here is not reflective of the total area planted in the catchment.

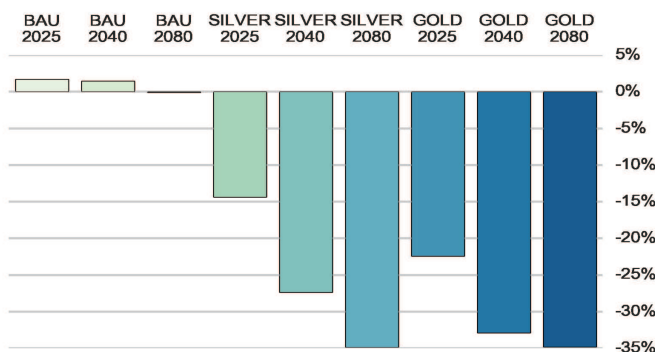
Disclaimer: This fact sheet should be read in conjunction with the report "I2090000_RP_Rua_Scenarios_Ecological_Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

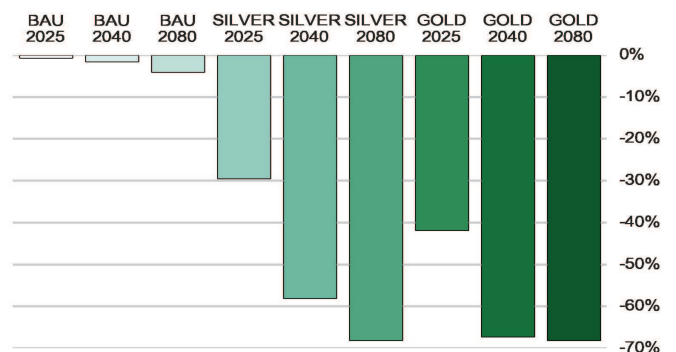
Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.009	0.009	0.009	0.009	0.007	0.006	0.006	0.007	0.006	0.006
95th Percentile (mg/L)	0.02	0.02	0.02	0.019	0.014	0.008	0.006	0.012	0.007	0.006
Median (% change from Baseline)		1.7%	1.4%	-0.1%	-14.4%	-27.4%	-34.9%	-22.4%	-32.9%	-34.8%
95th Percentile (% change from Baseline)		-0.7%	-1.5%	-4.0%	-29.5%	-58.1%	-68.1%	-41.8%	-67.3%	-68.1%

Median (% change from Baseline)



95th Percentile (% change from Baseline)



Kopuaranga River at Stuarts

Dissolved Reactive Phosphorous (DRP)

Revision 1 DRAFT
Date: 2017-11-10

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamāhanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Reactive Phosphorous (DRP) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to periphyton, and river and lake water quality conditions.

Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

The Kopuaranga River at Stuarts catchment is ~16,686 ha. The catchment is primarily sheep and beef (84.5%), with some dairy and dairy support (6.5%) and native bush (0.9%). The remaining area (8.0%) is a variety of 'other' land uses including lifestyle and mixed of which no mitigations are applied. During BAU 2080, no land is retired and only 2 ha of pole planting is >15 years old and considered to effect DRP (0.01% of the catchment at a planting rate of ~0.03 ha/yr since 2017). Stock exclusion and effluent management has a ~16.8% reduction to DRP loads on dairy farms, however only 1.5% on sheep and beef. The majority of the catchment is sheep and beef and as such these mitigations are only contributing to a slight decrease in the DRP 50th and 95th percentiles of up to 0.6% and 1.9%, respectively.

In Silver and Gold scenarios, there is a considerable increase in land retirement and pole planting in the catchment. In addition to tier 1 mitigations (stock exclusion and effluent management), mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) lead to significant cumulative reductions in the DRP-EMC input concentrations of up to 80% on sheep and beef and 20-30% on dairy/dairy support. Land retirement is up to 1,068 ha (6.4% of the catchment at a rate of ~16.9 ha/yr) and pole planting peaks at 899 ha (5.3% of the catchment at a planting rate of ~14.2 ha/yr since 2017). The Silver and Gold scenarios simulated significant reductions in 50th and 95th DRP percentiles of up to 30.9% and 49.1% by 2080.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	808 (4.8%)	281 (1.7%)	-	14103 (84.5%)	154 (0.9%)	1339 (8.0%)	16686

Table 2. Mitigation (area in ha)

Mitigation*	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	0	0	353	1068	1068	1068	1068	1068
Pole Planting	0	2	2	0	526	899	0	526	899

*Pole planting is effective for DRP at >15 years. Area given here is not reflective of the total area planted in the catchment.

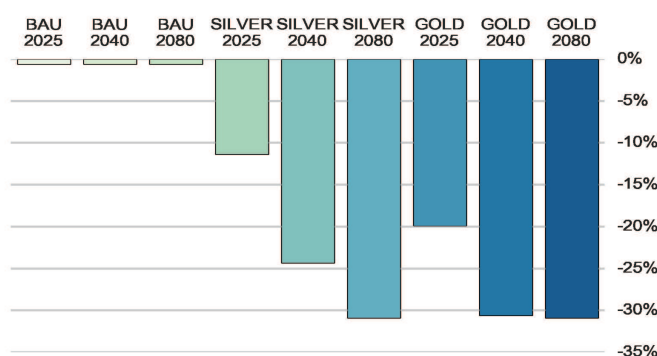
Disclaimer: This fact sheet should be read in conjunction with the report "I2090000_RP_Rua_Scenarios_Ecological Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

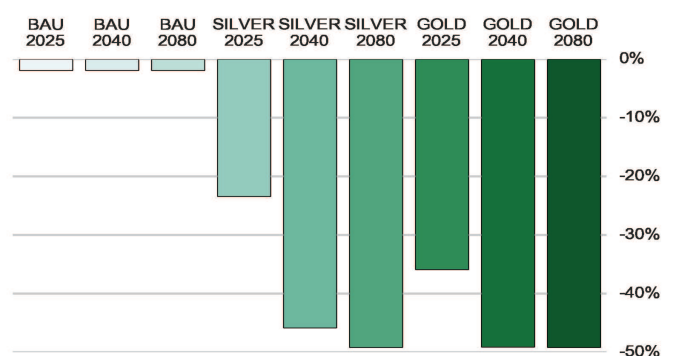
Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.023	0.023	0.023	0.023	0.021	0.018	0.016	0.019	0.016	0.016
95th Percentile (mg/L)	0.035	0.034	0.034	0.034	0.027	0.019	0.018	0.022	0.018	0.018
Median (% change from Baseline)					-11.4%	-24.3%	-30.9%	-19.9%	-30.6%	-30.9%
95th Percentile (% change from Baseline)					-23.4%	-45.8%	-49.1%	-35.9%	-49.1%	-49.1%

Median (% change from Baseline)



95th Percentile (% change from Baseline)



Makahakaha Stream at Mouth

Dissolved Reactive Phosphorous (DRP)

Revision 1 DRAFT
Date: 2017-11-10

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamāhanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Reactive Phosphorus (DRP) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to periphyton, and river and lake water quality conditions.

Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

A catchment of ~6,192 ha drains to the Makahakaha Stream Mouth. The catchment is primarily sheep and beef (83.3%), with some dairy and dairy support (8.4%) and native bush (0.1%). The remaining area (7.7%) is a variety 'other' land uses including lifestyle, horticulture and mixed of which no mitigations are applied. During BAU 2080, 50th and 95th DRP percentiles decrease marginally by up to 1.8% and 2.3%, respectively. These small decreases are as a result of 3 ha of pole planting that is >15 years old. There is no land retired in this catchment during BAU.

In Silver and Gold scenarios, pole planting does not increase from 3 ha in BAU, but the amount of retired land increases to 341 ha, equivalent to 5.5% of the catchment at a rate of ~6 ha/yr from 2017. In addition to tier 1 mitigations (stock exclusion and effluent management), mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) lead to significant cumulative reductions in the EMC's of 20–30% for dairy and arable landuses, and up to 80% for sheep and beef. In the Silver and Gold scenarios reductions in 50th and 95th percentiles of up to 49.6% and 61.2% are simulated by 2080.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	129 (2.1%)	389 (6.3%)	38 (0.6)	5155 (83.3%)	4 (0.1%)	477 (7.7%)	6192

Table 2. Mitigation (area in ha)

Mitigation*	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	0	0	218	341	341	341	341	341
Pole Planting	0	3	3	0	3	3	0	3	3

*Pole planting is effective for DRP at >15 years. Area given here is not reflective of the total area planted in the catchment.

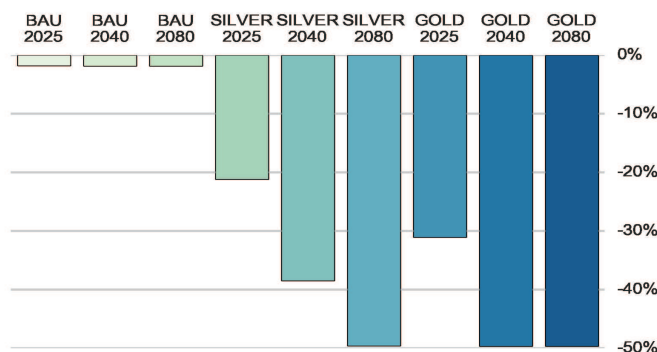
Disclaimer: This fact sheet should be read in conjunction with the report "I2090000_RP_Rua_Scenarios_Ecological_Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

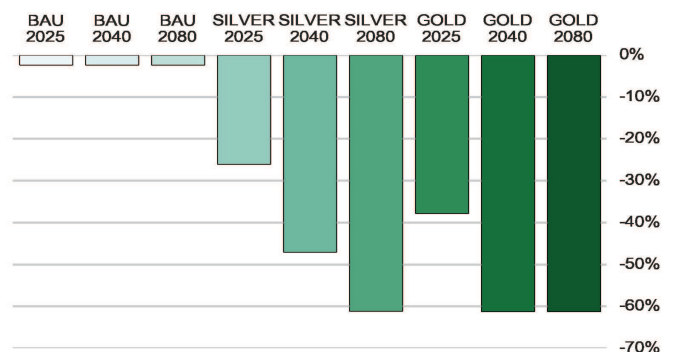
Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.017	0.017	0.017	0.017	0.013	0.011	0.009	0.012	0.009	0.009
95th Percentile (mg/L)	0.033	0.032	0.032	0.032	0.024	0.017	0.013	0.02	0.013	0.013
Median (% change from Baseline)					-1.8%	-38.4%	-49.6%	-31.0%	-49.6%	-49.6%
95th Percentile (% change from Baseline)					-2.3%	-47.0%	-61.1%	-37.7%	-61.2%	-61.2%

Median (% change from Baseline)



95th Percentile (% change from Baseline)



Mangatarere River at SH2

Dissolved Reactive Phosphorous (DRP)

Revision 1 DRAFT
Date: 2017-11-10

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamāhanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Reactive Phosphorous (DRP) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to periphyton, and river and lake water quality conditions.

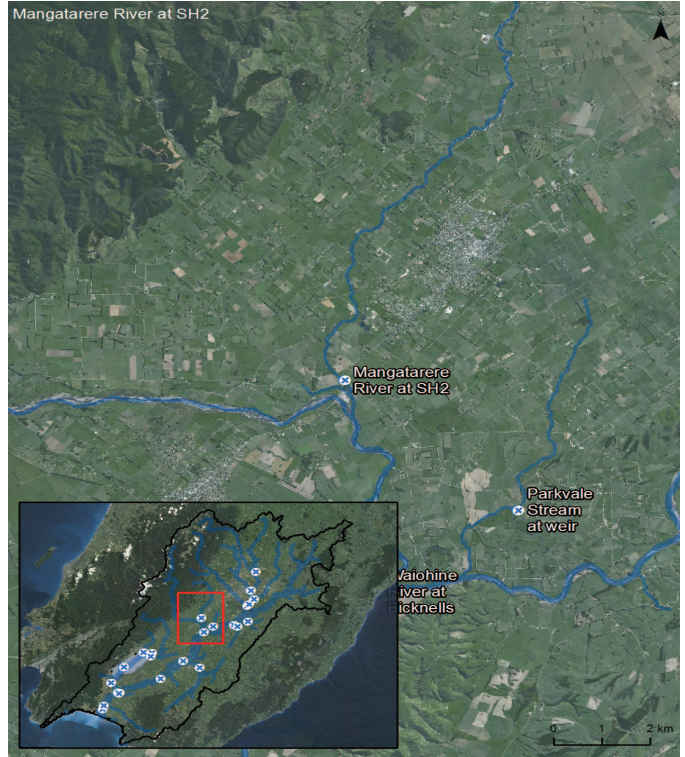
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

Mangatarere at SH2 has a catchment area of ~11,947 ha. The catchment is a mixture of landuses, including ~27% dairy/dairy support, 35% native bush and 21% sheep and beef. The remaining area is a variety 'other' (17%) land uses including lifestyle, mixed and arable. During BAU, 50th and 95th DRP percentiles decrease significantly (55.2% and 58.0% by 2080). While no land retirement occurs in this catchment in BAU, 784 ha of pole planted land is mature by 2080 (6.6% of catchment at a planting rate of ~12.5ha/yr since 2017) and will contribute to reduced DRP loads. Stock exclusion and effluent management has a ~16.8% reduction to DRP loads on dairy farms, however only 1.5% on sheep and beef. While these mitigations contribute to lower concentrations, the primary cause for significant decreases in DRP is due to a large amount of land treatment of the Carterton Waste Water Treatment Plant (WWTP), with 85% of the volume being treated by 2025.

In Silver and Gold scenarios, pole planting has increased to 1,526 ha of mature trees (>15 years old) by 2080 (12.7% of the catchment at a planting rate of ~24.2ha/yr since 2017), while no retirement occurs in the catchment. Mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) contribute to further decreases in median and 95th percentiles, with reductions of up to 63.7% and 75.7%, respectively in 2080. The Carterton WWTP has 100% land treatment in these scenarios, which reduces all the WWTP DRP loads by 98%.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	2842 (23.8%)	357 (3.0%)	40 (0.3)	2515 (21.0%)	4190 (35.1%)	2003 (16.8%)	11947

Table 2. Mitigation (area in ha)

Mitigation*	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	0	0	0	0	0	0	0	0
Pole Planting	0	0	784	0	1467	1526	0	1467	1526

*Pole planting is effective for DRP at >15 years. Area given here is not reflective of the total area planted in the catchment.

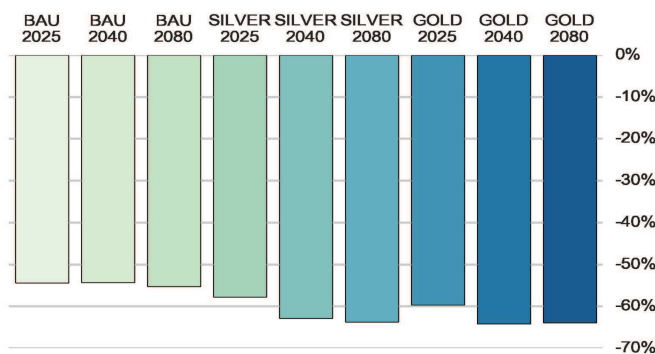
Disclaimer: This fact sheet should be read in conjunction with the report "I2090000_RP_Rua_Scenarios_Ecological_Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

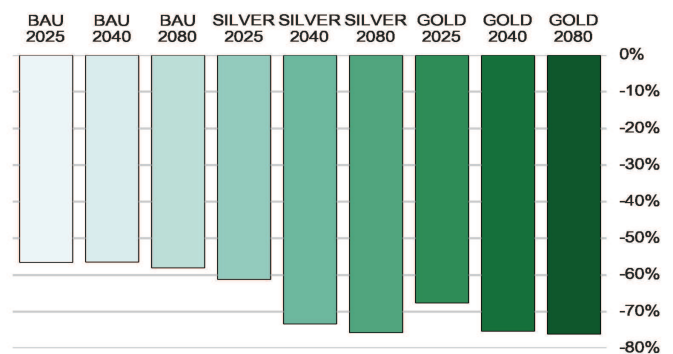
Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.091	0.042	0.042	0.041	0.039	0.034	0.033	0.037	0.033	0.033
95th Percentile (mg/L)	0.292	0.127	0.127	0.123	0.113	0.078	0.071	0.095	0.072	0.07
Median (% change from Baseline)		-54.4%	-54.2%	-55.2%	-57.8%	-62.8%	-63.7%	-59.6%	-64.1%	-63.9%
95th Percentile (% change from Baseline)		-56.5%	-56.4%	-58.0%	-61.1%	-73.3%	-75.7%	-67.6%	-75.3%	-76.0%

Median (% change from Baseline)



95th Percentile (% change from Baseline)



Otukura Stream at Mouth

Dissolved Reactive Phosphorous (DRP)

Revision 1 DRAFT
Date: 2017-11-10

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamāhanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Reactive Phosphorus (DRP) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to periphyton, and river and lake water quality conditions.

Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

The Otukura Stream at Mouth catchment is ~9,366 ha. The catchment is primarily dairy and dairy support (56.0%), with some sheep and beef (17.2%) and native bush (0.9%). The remaining area (25.9%) is a variety of 'other' land uses including lifestyle and mixed of which no mitigations are applied. During the BAU, there is no land retirement or pole planting. Stock exclusion and effluent management has a ~16.8% reduction to DRP loads on dairy farms, and only 1.5% on sheep and beef. In BAU 2080, the 50th and 95th percentiles decrease by up to 7.4% and 7.2%, respectively.

In Silver and Gold scenarios, there is marginal increase in land retirement and pole planting. In addition to tier 1 mitigations (stock exclusion and effluent management), mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) lead to significant cumulative reductions in the DRP-EMC input concentrations of up to 80% on sheep and beef and 20–30% on dairy landuses. In the Gold and Silver scenarios, land retired is 1 ha and pole planting peaks at 12 ha. The small amount of retirement and pole planting is due to the flat slopes and land classifications within the catchment not being identified as a priority for sediment control set out by the scenarios. However, in both scenarios there are substantial reductions in 50th and 95th percentiles due to on farm mitigations of up to 22.6% and 49.8%, respectively, simulated by 2080.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	2790 (29.8%)	2454 (26.2%)	-	1611 (17.2%)	83 (0.9%)	2428 (25.9%)	9366

Table 2. Mitigation (area in ha)

Mitigation*	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	0	0	0	1	1	1	1	1
Pole Planting	0	0	0	0	1	12	0	1	12

*Pole planting is effective for DRP at >15 years. Area given here is not reflective of the total area planted in the catchment.

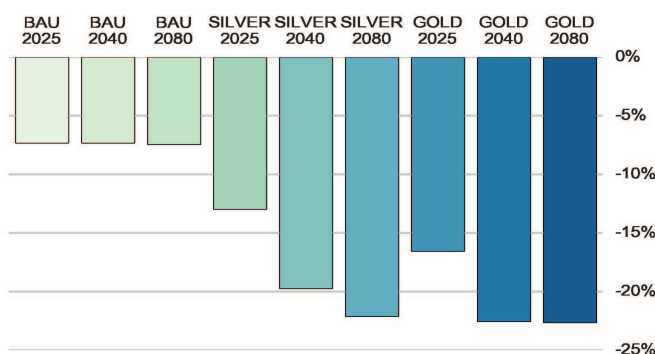
Disclaimer: This fact sheet should be read in conjunction with the report "I2090000_RP_Rua_Scenarios_Ecological Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

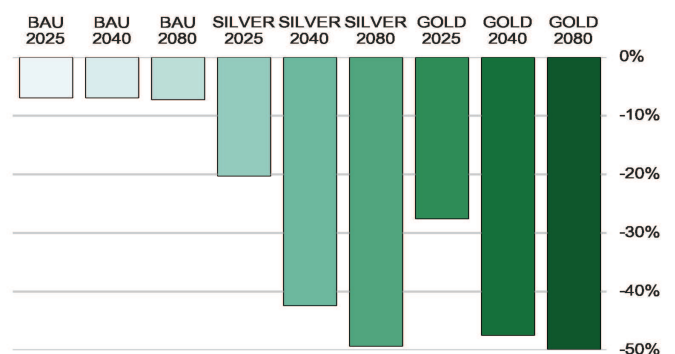
Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.001	0.001	0.001	0.001	0.001	0.0	0.0	0.001	0.0	0.0
95th Percentile (mg/L)	0.014	0.013	0.013	0.013	0.011	0.008	0.007	0.01	0.007	0.007
Median (% change from Baseline)		-7.3%	-7.3%	-7.4%	-13.0%	-19.7%	-22.1%	-16.5%	-22.5%	-22.6%
95th Percentile (% change from Baseline)		-6.9%	-6.9%	-7.2%	-20.3%	-42.3%	-49.3%	-27.5%	-47.4%	-49.8%

Median (% change from Baseline)



95th Percentile (% change from Baseline)



Parkvale Stream at weir

Dissolved Reactive Phosphorous (DRP)

Revision 1 DRAFT
Date: 2017-11-10

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamāhanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Reactive Phosphorous (DRP) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to periphyton, and river and lake water quality conditions.

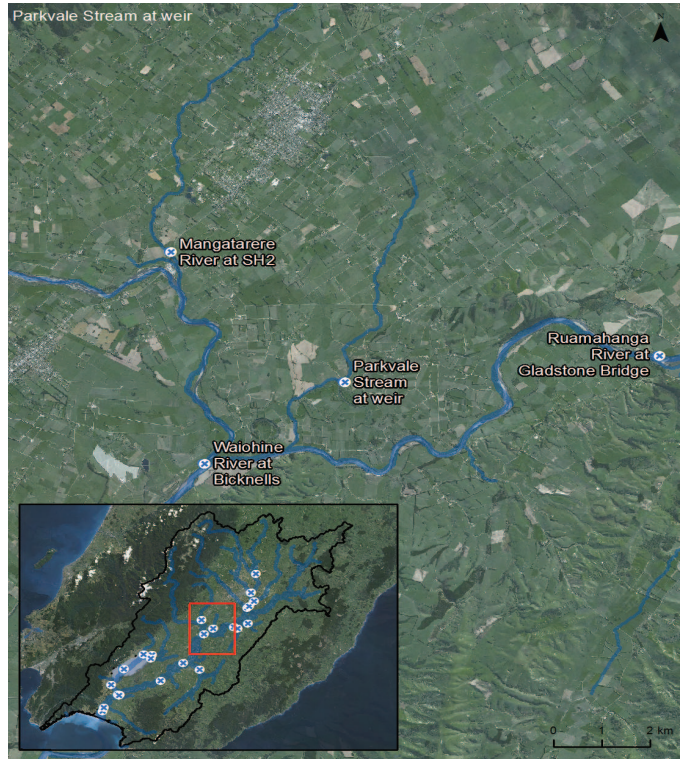
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

The Parkvale Stream at Weir has a catchment area of ~5,006 ha. The catchment is 35.9% dairy and dairy support, 19.6% sheep and beef and 0.8% native bush. The remaining area (43.6%) is a variety of 'other' land uses including lifestyle, deer and mixed of which no mitigations are applied. During the BAU 2080, no land is retired and 1 ha of pole planting is >15 years old and considered to effect DRP. Stock exclusion and effluent management has a ~16.8% reduction to DRP loads on dairy farms, however only 1.5% on sheep and beef. During BAU, the 50th percentile increases by up to 2.2% and 95th DRP percentile decreases by 0.1% by 2080. The slight increase in median DRP concentrations in the BAU is due to limited effects of stock exclusion, and irrigation being modelled at 100% of the consented rates where during the baseline model irrigation ramps up over time. Effectively this decreases flow, which contributes to an increase in concentrations.

In Silver and Gold scenarios, there is no land retirement as is the case in BAU, and a significant increase in pole planting. In addition to tier 1 mitigations (stock exclusion and effluent management), mitigations such as constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) lead to significant cumulative reductions in the DRP-EMC input concentrations of up to 80% on sheep and beef and 20–30% on dairy landuses. In the Gold and Silver scenarios, pole planting peaks at 1,284 ha (25.7% of the catchment at a planting rate of ~20.3 ha/yr since 2017). In both scenarios there are significant reductions in 50th and 95th DRP percentiles of up to 28.1% and 42.1% simulated by 2080.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	1246 (24.9%)	553 (11.0%)	-	980 (19.6%)	42 (0.8%)	2185 (43.6%)	5006

Table 2. Mitigation (area in ha)

Mitigation*	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	0	0	0	0	0	0	0	0
Pole Planting	0	1	1	0	41	1284	0	41	1284

*Pole planting is effective for DRP at >15 years. Area given here is not reflective of the total area planted in the catchment.

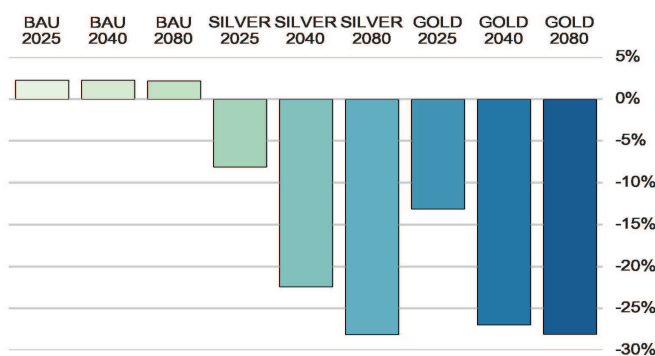
Disclaimer: This fact sheet should be read in conjunction with the report "I2090000_RP_Rua_Scenarios_Ecological_Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

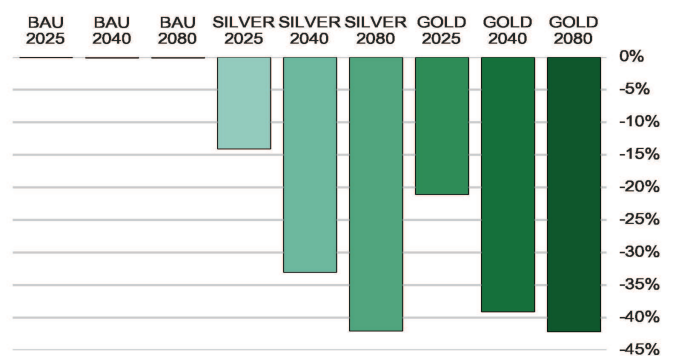
Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.02	0.021	0.021	0.021	0.019	0.016	0.014	0.018	0.015	0.014
95th Percentile (mg/L)	0.148	0.148	0.148	0.148	0.127	0.099	0.086	0.117	0.09	0.086
Median (% change from Baseline)		2.2%	2.2%	2.2%	-8.1%	-22.4%	-28.1%	-13.1%	-26.9%	-28.1%
95th Percentile (% change from Baseline)		-0.1%	-0.1%	-0.1%	-14.1%	-33.0%	-42.0%	-21.0%	-39.1%	-42.1%

Median (% change from Baseline)



95th Percentile (% change from Baseline)



Ruamahanga River at Gladstone Bridge

Dissolved Reactive Phosphorous (DRP)

Revision 1 DRAFT

Date: 2017-11-10

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Reactive Phosphorous (DRP) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to periphyton, and river and lake water quality conditions.

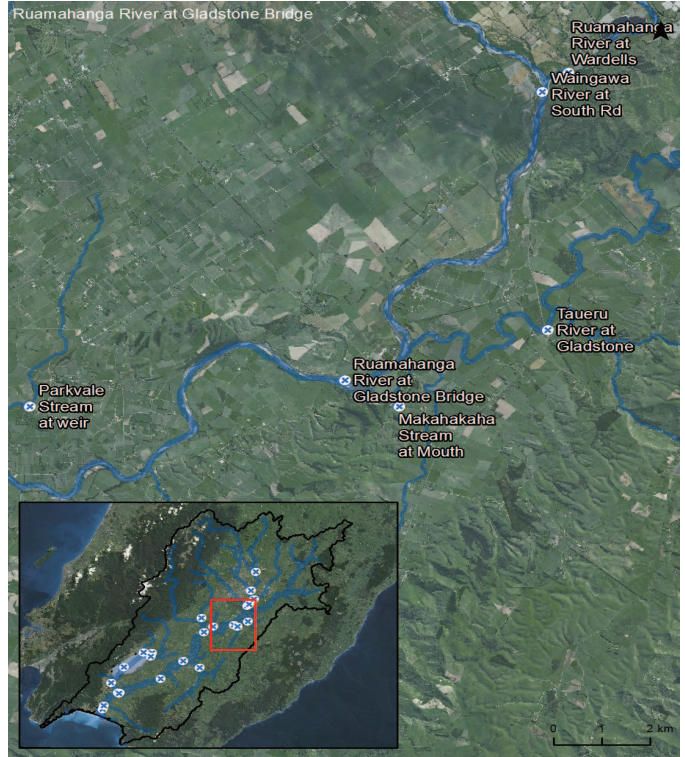
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

Ruamahanga River at Gladstone Bridge has an upstream catchment area of ~133,694 ha. The catchment is 4.3% dairy/dairy support, 15.3% native bush and 61% sheep and beef. The remaining area is a variety of 'other' (19%) land uses including lifestyle, mixed, urban and arable of which limited mitigations are applied. During BAU, 50th and 95th DRP percentiles decrease up to 45.5% and 27.8%, respectively by 2080. Land retirement of 231 ha occurs by 2080 (0.18% of the catchment at a rate of ~3.7ha/yr since 2017) while up to 3,146 ha of pole planted land (2.3% of catchment at a planting rate of ~50ha/yr since 2017) is mature by 2080 and will contribute to reduced DRP loads. Stock exclusion and effluent management has a ~16.8% reduction to DRP loads on dairy farms, however only 1.5% on sheep and beef. In addition, the Masterton Waste Water Treatment Plant (WWTP) has increasing land treatment in BAU, ~80% by 2040 and 100% by 2080.

Silver and Gold scenarios lead to a significant increase in pole planting, peaking at 16,750 ha by 2080 (12.5% of the catchment). This is equivalent to space planting upstream of the reporting point at a rate of ~266 ha/yr from 2017. Land retirement also rises to 6,340 ha (4.7% of the catchment area at a rate of ~100 ha/yr since 2017). Mitigations such as constructed wetlands (tier 2) and riparian planting/buffer strips (tier 3) contribute to further decreases in median and 95th percentiles, with reductions of 63.5% and 67.0%, respectively observed by 2080. Masterton WWTP has 100% land treatment in these scenarios, which reduces all the WWTP DRP loads by 98%.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	3564 (2.7%)	2095 (1.6%)	791 (0.6)	81249 (60.8%)	20401 (15.3%)	25593 (19.1%)	133694

Table 2. Mitigation (area in ha)

Mitigation*	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	138	231	2468	6340	6340	6340	6340	6340
Pole Planting	0	707	3146	0	5387	16750	0	5387	16750

*Pole planting is effective for DRP at >15 years. Area given here is not reflective of the total area planted in the catchment.

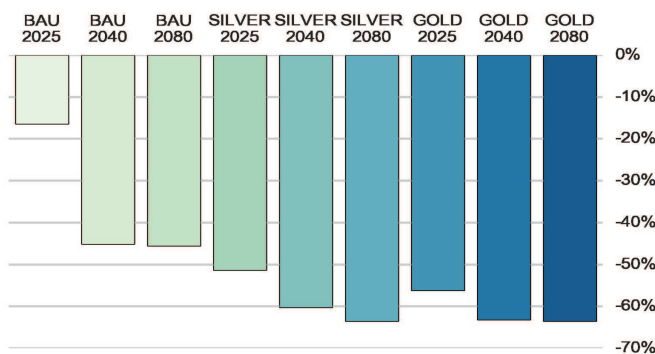
Disclaimer: This fact sheet should be read in conjunction with the report "I2090000_RP_Rua_Scenarios_Ecological_Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

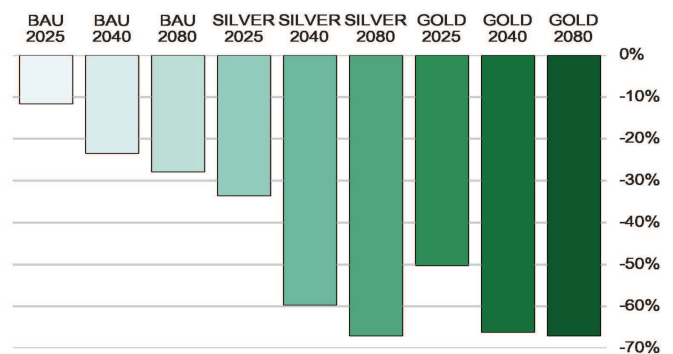
Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.015	0.013	0.008	0.008	0.007	0.006	0.006	0.007	0.006	0.006
95th Percentile (mg/L)	0.026	0.023	0.02	0.019	0.018	0.011	0.009	0.013	0.009	0.009
Median (% change from Baseline)		-16.4%	-45.1%	-45.5%	-51.4%	-60.2%	-63.5%	-56.1%	-63.2%	-63.5%
95th Percentile (% change from Baseline)		-11.6%	-23.5%	-27.8%	-33.5%	-59.6%	-67.0%	-50.2%	-66.1%	-67.0%

Median (% change from Baseline)



95th Percentile (% change from Baseline)



Ruamahanga River at Pukio

Dissolved Reactive Phosphorous (DRP)

Revision 1 DRAFT
Date: 2017-11-10

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Reactive Phosphorous (DRP) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to periphyton, and river and lake water quality conditions.

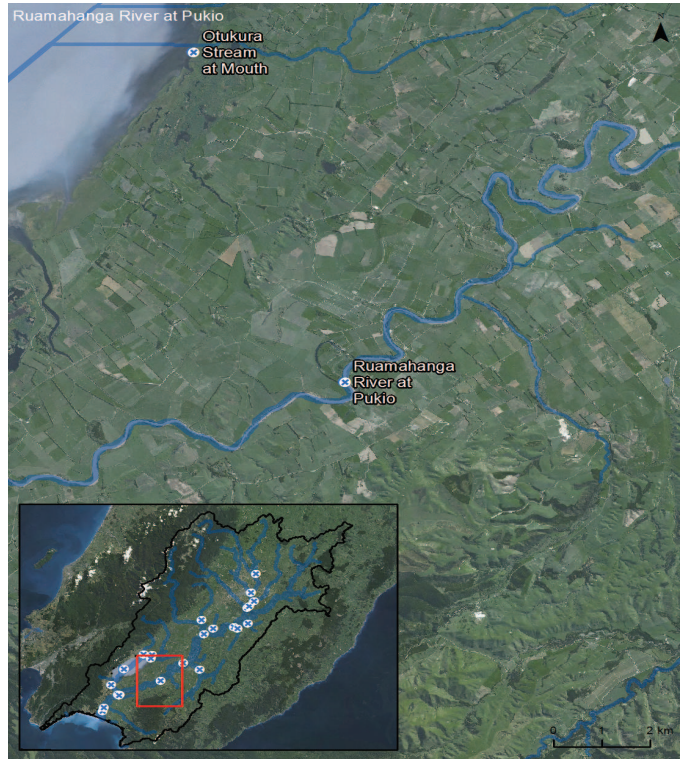
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

Ruamahanga River at Pukio has an upstream catchment area of ~246,366 ha. The catchment is 8.3% dairy/dairy support, 18.3% native bush and 53.9% sheep and beef. The remaining area (19%) is a variety of 'other' land uses including lifestyle, mixed, urban and arable of which limited mitigations are applied. During BAU, 50th and 95th DRP percentiles decrease up to 48.8% and 21.0%, respectively by 2080. Land retirement of 347 ha occurs by 2080 (0.14% of the catchment at a rate of 5.5% ha/yr since 2017) while up to 5,759 ha of pole planted land is mature by 2080 and will contribute to reduced DRP loads (2.3% of catchment at a planting rate of ~91.5 ha/yr since 2017). Stock exclusion and effluent management has a ~16.8% reduction to DRP loads on dairy farms, however only 1.5% on sheep and beef. Compounding effects of Waste Water Treatment Plant (WWTP) land treatment up to 80–100% at Masterton, Carterton, Martinborough and Greytown have a significant influence on BAU reductions simulated at Pukio.

Silver and Gold scenarios lead to an increase in pole planting peaking at 27,669 ha by 2080 (11.2% of the catchment). This is equivalent to space planting upstream of this reporting point at a rate of ~440 ha/yr from 2017. Land retirement also rises to 10,812 ha (4.4% of catchment at a planting rate of ~172 ha/yr from 2017). Mitigations such as 100% land treatment of the four WWTP's, constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) contribute to further decreases in median and 95th percentiles, with reductions of 62.3% and 58.6%, respectively, simulated by 2080 in both scenarios.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	14438 (5.9%)	5867 (2.4%)	1556 (0.6)	132684 (53.9%)	45104 (18.3%)	46717 (19.0%)	246366

Table 2. Mitigation (area in ha)

Mitigation*	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	107	245	347	5376	10812	10812	10812	10812	10812
Pole Planting	0	926	5759	0	8990	27669	0	8995	27669

*Pole planting is effective for DRP at >15 years. Area given here is not reflective of the total area planted in the catchment.

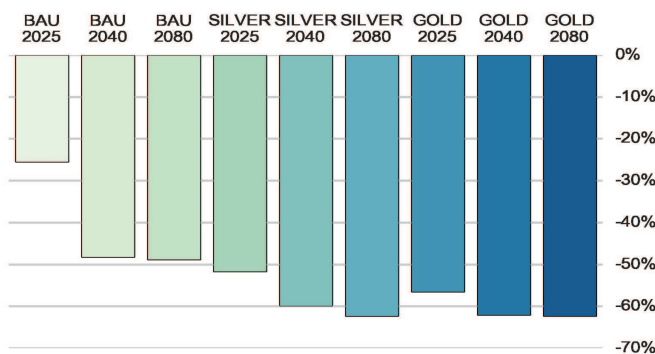
Disclaimer: This fact sheet should be read in conjunction with the report "I2090000_RP_Rua_Scenarios_Ecological Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

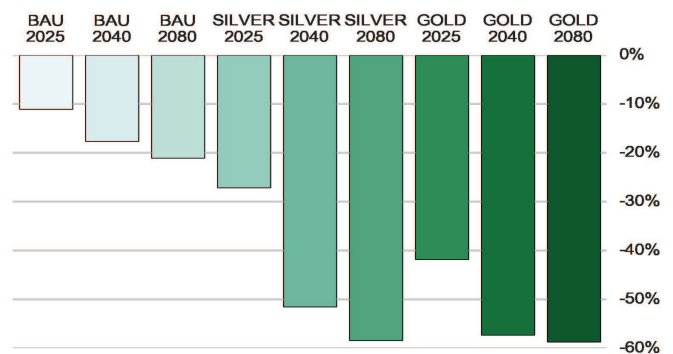
Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.016	0.012	0.008	0.008	0.008	0.006	0.006	0.007	0.006	0.006
95th Percentile (mg/L)	0.029	0.026	0.024	0.023	0.021	0.014	0.012	0.017	0.013	0.012
Median (% change from Baseline)		-25.5%	-48.3%	-48.8%	-51.7%	-59.9%	-62.3%	-56.6%	-62.1%	-62.3%
95th Percentile (% change from Baseline)		-11.0%	-17.6%	-21.0%	-27.1%	-51.5%	-58.3%	-41.8%	-57.2%	-58.6%

Median (% change from Baseline)



95th Percentile (% change from Baseline)



Ruamahanga River at Te Ore Ore

Dissolved Reactive Phosphorous (DRP)

Revision 1 DRAFT

Date: 2017-11-10

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Reactive Phosphorus (DRP) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to periphyton, and river and lake water quality conditions.

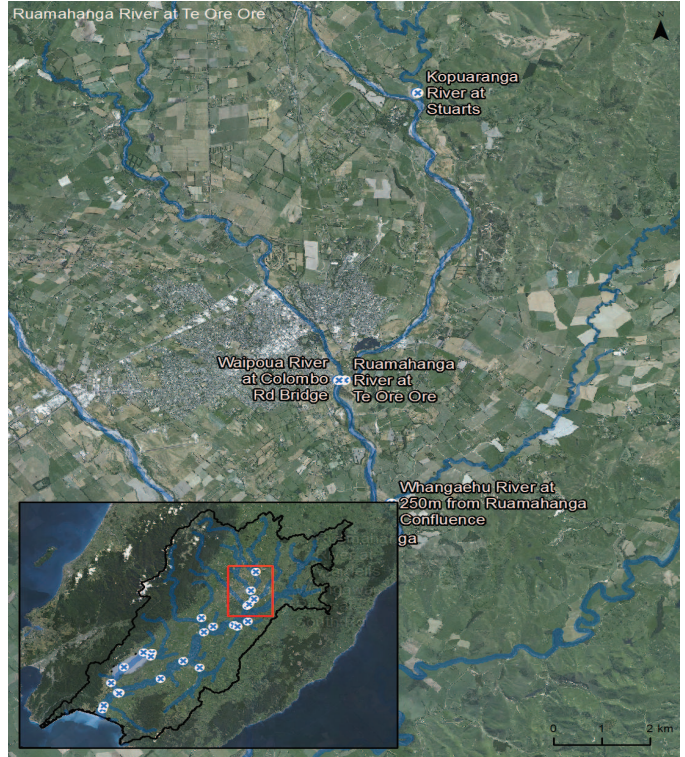
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

Ruamahanga River at Te Ore Ore has an upstream catchment area of ~31,078 ha. The catchment is 5.4% dairy/dairy support, 24.1% native bush and 57.8% sheep and beef. The remaining area (12.8%) is a variety of 'other' land uses including lifestyle and mixed of which no mitigations are applied. During BAU, 50th and 95th DRP percentiles decrease 1.1% and 1.9%, respectively by 2080. Land retirement of 61 ha occurs by 2080 (0.19% of the catchment at a rate of ~1 ha/yr from 2017), while only 3 ha of pole planted land is mature by 2080 and contributing to reduced DRP loads. Stock exclusion and effluent management has a ~16.8% reduction to DRP loads on dairy farms, however only 1.5% on sheep and beef. This tier 1 mitigation is the primary reason for the minor DRP reductions observed in BAU.

Silver and Gold scenarios lead to a significant increase in pole planting, peaking at 2,423 ha of mature trees by 2080 (7.8% of the catchment). This is equivalent to space planting upstream of this reporting point at a rate of ~38.5 ha/yr from 2017. Land retirement also rises to 1,244 ha (4.0% of catchment at a rate of 19.7 ha/yr from 2017). Mitigations such constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) contribute to further decreases in median and 95th percentiles, with reductions of 34.1% and 48.0% simulated by 2080 in both scenarios.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	1115 (3.6%)	549 (1.8%)	3 (0.0)	17950 (57.8%)	7487 (24.1%)	3974 (12.8%)	31078

Table 2. Mitigation (area in ha)

Mitigation*	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	0	52	61	452	1244	1244	1244	1244	1244
Pole Planting	0	2	3	0	1015	2423	0	1015	2423

*Pole planting is effective for DRP at >15 years. Area given here is not reflective of the total area planted in the catchment.

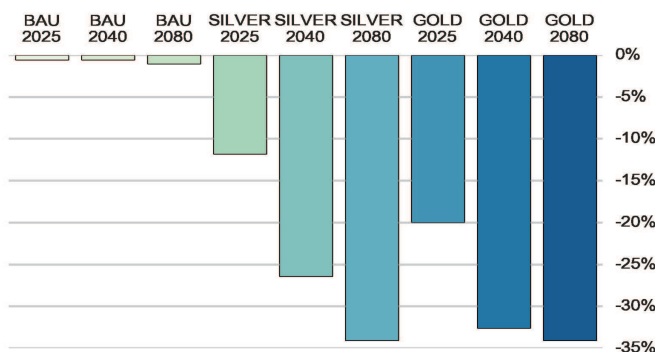
Disclaimer: This fact sheet should be read in conjunction with the report "I2090000_RP_Rua_Scenarios_Ecological Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

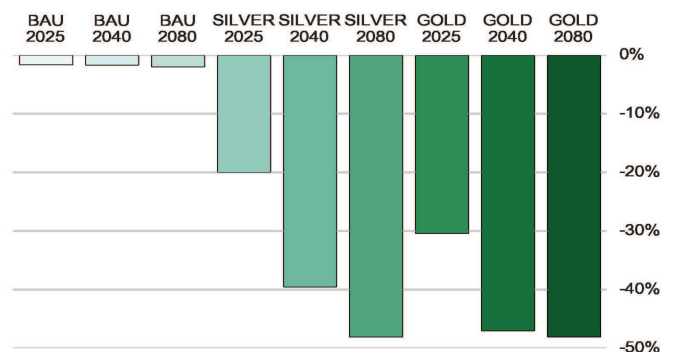
Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.012	0.012	0.012	0.012	0.01	0.009	0.008	0.009	0.008	0.008
95th Percentile (mg/L)	0.021	0.021	0.021	0.021	0.017	0.013	0.011	0.015	0.011	0.011
Median (% change from Baseline)					-11.8%	-26.4%	-34.1%	-20.0%	-32.6%	-34.0%
95th Percentile (% change from Baseline)					-20.0%	-39.5%	-48.0%	-30.4%	-46.9%	-48.0%

Median (% change from Baseline)



95th Percentile (% change from Baseline)



Ruamahanga River at U/S Lake Wai Outlet

Dissolved Reactive Phosphorous (DRP)

Revision 1 DRAFT
Date: 2017-11-10

Introduction

This fact sheet presents results generated from modelling nine scenarios for the Ruamahanga Catchment. The results are compared to the baseline model, with a focus on the change in concentrations in the median and 95th percentiles. Dissolved Reactive Phosphorous (DRP) has no limit setting criteria defined in the National Policy Statement for Freshwater Management 2014 (amended 2017), however is required to be considered in relation to periphyton, and river and lake water quality conditions.

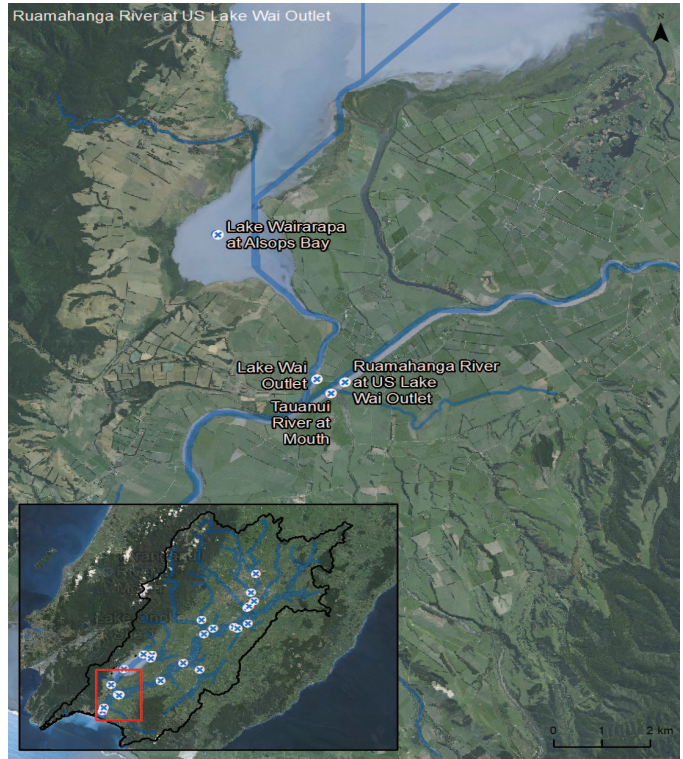
Summary

See Table 1, 2, and 3 for reference to the statistics presented in the summary below.

Ruamahanga River upstream of Lake Wairarapa Outlet is the most downstream reporting site in catchment modelling (excluding lakes). The site has an upstream catchment area of ~254,496 ha. The catchment is 8.7% dairy/dairy support, 18.5% native bush, 53.5% sheep and beef and 0.6% arable. The remaining area (18.7%) are all 'other' land uses including lifestyle, mixed, horticulture and urban of which no mitigations are applied. During BAU, 50th and 95th DRP percentiles decrease 47.1% and 13.2%, respectively by 2080. Land retirement of 347 ha occurs by 2080 (0.13% of the catchment at a rate of ~5.5ha/yr from 2017), while 5,759 ha of pole planted land (2.3% of the catchment at a planting rate of ~91.5ha/yr from 2017) is mature by 2080 and contributing to reduced DRP loads. Stock exclusion and effluent management has a ~16.8% reduction to DRP loads on dairy farms, however only 1.5% on sheep and beef. Significant reductions in DRP are attributed to nearly 80–100% land treatment of the upstream Waste Water Treatment Plants (WWTP) in Masterton, Carterton, Greytown and Martinborough by 2080.

Silver and Gold scenarios lead to an increase in pole planting, peaking at 28,724 ha of mature trees by 2080 (11.2% of the catchment). This is equivalent to space planting upstream of this reporting point at a rate of ~455.5 ha/yr from 2017. Land retirement also rises to 11,092 ha (4.4% of catchment at a rate of 176 ha/yr from 2017). Mitigations such as 100% land treatment of the WWTP's, constructed wetlands and optimal fertiliser use (tier 2) and riparian planting/buffer strips (tier 3) contribute to further decreases in median and 95th percentiles, with reductions of up to 61.4% and 54.7%, respectively, simulated by 2080 in both scenarios.

Location



Scenario Input Data

Table 1. Current landuse area in ha (% of total)

	Dairy	Dairy Support	Arable	Sheep and Beef	Native Bush	Other	Total
Baseline Landuse	16146 (6.3%)	6139 (2.4%)	1556 (0.6)	136133 (53.5%)	47016 (18.5%)	47506 (18.7%)	254496

Table 2. Mitigation (area in ha)

Mitigation*	BAU 2025	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement	107	245	347	5634	11092	11092	11092	11092	11092
Pole Planting	0	926	5759	0	8991	28724	0	8996	28724

*Pole planting is effective for DRP at >15 years. Area given here is not reflective of the total area planted in the catchment.

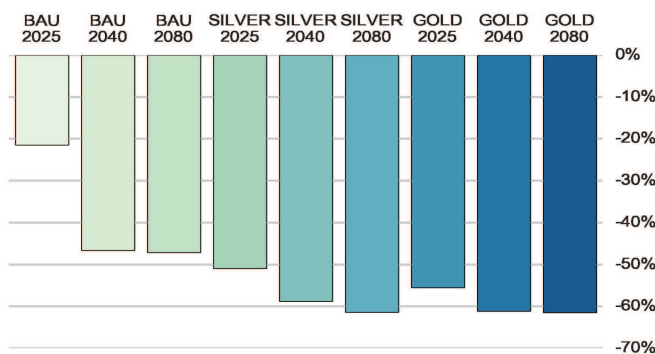
Disclaimer: This fact sheet should be read in conjunction with the report "I2090000_RP_Rua_Scenarios_Ecological_Health_Rev1", which provides further details on the scenario modelling, mitigations, assumptions and limitations. The results presented are based off modelling outputs and may not be an exact match to the observed data, which is dependent on the flow and water quality calibration achieved at various modelling sites. On farm mitigations reduce input concentrations, and are applied to Event Mean Concentrations (EMC's) linked to quickflow, and Dry Weather Concentrations (DWC's) which are linked to baseflows.

Scenario Results

Table 3. Water quality statistics

Statistic	Baseline	BAU 2025	BAU 2040	BAU 2080	SILVER 2025	SILVER 2040	SILVER 2080	GOLD 2025	GOLD 2040	GOLD 2080
Median (mg/L)	0.012	0.009	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.005
95th Percentile (mg/L)	0.026	0.025	0.023	0.022	0.021	0.014	0.012	0.016	0.012	0.012
Median (% change from Baseline)		-21.5%	-46.6%	-47.1%	-50.9%	-58.8%	-61.4%	-55.5%	-61.1%	-61.4%
95th Percentile (% change from Baseline)		-4.0%	-9.1%	-13.2%	-20.0%	-46.4%	-54.4%	-36.0%	-53.2%	-54.7%

Median (% change from Baseline)



95th Percentile (% change from Baseline)

