

Memo

Date	3 September 2018
To	Orari-Temuka-Opihi-Pareora Zone Committee
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Memo describing the impact of different Permitted Activity (PA) thresholds on water quality in groundwater provinces and surface waters in the OTOP zone

Key decision areas

- Are the PC5 PA thresholds for winter grazing adequate to apply across the OTOP zone? If not, what should these thresholds be?
- Do different PA thresholds need to be set for the high nitrate concentration areas?

Purpose

This modelling was done to support the Zone Committee's decision making on a PA threshold. This memo highlights the impacts of each PA scenario on drinking water for groundwater and national bottom lines for surface water.

Permitted activity threshold scenarios modelled:

Scenario	Winter forage PA threshold
Plan Change 5	10% of farm area, capped between 10 ha and 100 ha
Supplementary 1	Fixed 10 ha, irrespective of property size
Supplementary 2	5 ha of winter grazing + 2.5% of property size
Supplementary 3	5 ha of winter grazing + 5% of property size
Supplementary 4	5 ha of winter grazing + 7.5% of property size

Key results

Groundwater province nitrate-N concentrations modelled across five PA thresholds generally show an increase from current, however show little difference between the different threshold scenarios, Table 1. Result highlighted in orange show where the annual average ½ Maximum Allowable Value for nitrate-N (5.65 mg/L) is exceeded. Annual average of ½ MAV is considered to generally protect against exceedances of the drinking water standard of 11.3 mg/L.

Table 1. Impact of five PA thresholds on groundwater province nitrate-N concentrations

	Current measured (modelled)	PC5	Supp 1	Supp 2	Supp 3	Supp 4
Groundwater province	(mg/L) nitrate-N					
Fairlie Basin*	6.9	7.6	7.0	7.1	7.3	7.5
Geraldine*	2.8	3.1	3.0	2.9	3.0	3.1
Opihi*	4.7	5.0	5.0	5.0	5.0	5.0
Orari*	2.7	2.8	2.8	2.8	2.8	2.8
Pareora*	2.6	3.1	2.8	2.8	2.9	3.0

Rangitata Orton*	8.4	8.4	8.4	8.4	8.4	8.4
	(mg/L) nitrate-N - modelled only					
South Branch Pareora**	(5.4)	6.1	5.5	5.6	5.7	6
Taiko Stream**	(6.4)	6.8	6.6	6.6	6.7	6.8
Te Ana Wai**	(5.6)	6	5.7	5.7	5.8	5.9
Timaru**	(7.9)	9	8.7	8.6	8.8	9
Upper Pareora**	(5.7)	6.3	5.8	5.9	6	6.2
	High nitrate concentration (hnc) areas					
Fairlie Basin hnc*	6.9	7.4	7.0	7.1	7.2	7.4
Levels Plain hnc *	6.3	7.0	7.0	6.9	7.0	7.0
Rangitata Orton hnc*	8.4	8.4	8.4	8.4	8.4	8.4

Provinces with * show where monitoring data exists. Results shown are the likely groundwater concentrations including dilution or other attenuation that may exist between the rootzone and the groundwater monitoring sites.

Provinces with ** show where there is no monitoring data available. Results shown are modelled rootzone concentrations and do not include any dilution or other attenuation that may exist between the rootzone and the groundwater monitoring sites, and are therefore considered worst case.

Surface water concentrations

For surface waters that occur within each province, the modelled groundwater increases in Table 1 represent the maximum potential increase in surface water. None of the modelled increases from any PA threshold are sufficient to breach the national bottom line for nitrate-N (6.9 mg/L) in any of the State of the Environment surface water monitoring sites, except Old Orari Lagoon Outfall and Rhodes Stream Parke Road in the Orari Freshwater Management Unit. For these two sites, which currently exceed 6.9 mg/L, the various modelled PA thresholds are unlikely to make significant difference to the concentrations, as there was very little modelled change in groundwater concentrations, Table 1.

Recent short-term monitoring (2017-18) indicate that Seadown Drain and Ring Drain currently exceed 6.9 mg/L nitrate-N (at 7.0 and 10.5 mg/L respectively). Further intensification under modelled PA thresholds is likely to lead to an increase in these concentrations, however there is unlikely to be any difference between the modelled PA threshold scenarios.

Monitoring data for Waitarakao/Washdyke Lagoon currently exceeds the 0.75 mg/L national bottom line for total nitrogen. In 2017-18 median total nitrogen concentrations were at 6.7 mg/L. Further intensification under modelled PA thresholds is likely to lead to an increase in concentrations, however there is likely to be little difference between the PA threshold scenarios.

These ground and surface water assessments do not include the impact of consented activities moving to Good Management Practice (GMP). In provinces where there is a greater proportion of consented activities, especially more intensive operations, there is more likely to be a gain from moving to GMP. Rangitata-Orton, Orari, Te Ana Wai and to a lesser extent Fairlie groundwater provinces are likely to see some benefits in consented activities moving to GMP.

Modelling and assumptions

Key assumptions

- Assume full uptake to PA thresholds excluding biophysical and farm system caveats
- Biophysical caveats – New modelled winter forage crop excluded slopes above 20 degrees, avoids 10 m riparian margins and avoids bare, native vegetation, urban, wetland, water, tussock and exotic forest land covers.
- Farm system caveat – Assumes a farm does not put more than 15 % of their total area into winter forage cropping at any one time. This impacts on smaller farms and prevents, for example, an 11 ha property having 10 ha in continuous winter forage cropping.

Methodology

- Current distribution of forage crops was derived from a 2016 classification of winter forage paddocks (North et al., 2017). All paddocks were assumed to be grazed by cattle stock.
- The winter forage classification data was combined with the farm boundary and irrigation layers, and nitrate-N loss rates from the Matrix of Good Management OVERSEER® dataset were used to derive current nitrate-N losses.
- Under different PA threshold scenarios, additional winter forage areas could be permitted on properties above 10 ha, on slopes less than 20 degrees and on land greater than 10 m from a waterway. Properties exceeding the irrigation consent threshold (50 ha) and Department of Conservation land were excluded, as were bare, native vegetation, urban, wetland, water, tussock and exotic forest land covers.
- In all PA threshold scenarios, no more than 15 % of a farm total area was put into forage cropping and the maximum area of forage crop was 100 ha
- Additional forage crop was modelled using nitrate-N loss rates from the Matrix of Good Management OVERSEER® dataset.
- From the base nitrate-N loss rates and any additional permitted forage cropping, groundwater province rootzone nitrate N concentrations were generated for each PA threshold scenario.
- For all groundwater provinces, the % change from current modelled was calculated for each PA threshold scenario.
- Where measured data exists this % change was applied to current measured (average of previous 5 years data). Where no measured data exists the concentration is a modelled rootzone concentration.
- For surface waters, the % change from current measured to the National Bottom Line of 6.9 was calculated and compared with the % changes modelled in groundwater concentrations for the relevant groundwater province, to assess if any modelled changes would cause the surface waters to exceed 6.9 mg/L nitrate-N.

Map of OTO groundwater provinces and nitrate hotspot areas.

