LAKE ROTORUA NUTRIENT RULES

Penny MacCormick and Scott Kusabs

Bay of Plenty Regional Council
PO Box 364 Whakatane, New Zealand
Email: Penny.Maccormick@boprc.govt.nz

Introduction

Lake Rotorua has long been associated with poor water quality and algae blooms caused by sewage disposal into the lake in the 1970's and increasing agricultural intensification. The Rotorua Te Arawa Lakes Programme is responsible for protecting and restoring water quality in the 12 lakes of Rotorua. Together with our programme partners, Te Arawa Lakes Trust and Rotorua Lakes Council, the Bay of Plenty Regional Council (BOPRC) has consulted with the community to explore options to restore Lake Rotorua.

Through consultation with the community a nitrogen reduction strategy (the Integrated Framework) was agreed on. One component of the Integrated Framework was the Lake Rotorua Nutrient Rules (LRNR) which came into full legal effect in April 2021 following the Environment Court decision in 2020 (Decision No. [2020] NZEnvC 213). The LRNR required a 140T reduction in nitrogen leaching from the rural sector.

Nutrient rules have been drafted in various regions that refer to a single version of Overseer, and for the LRNR to work and the nitrogen target to be achieved an allocation methodology was required that was versatile and relevant to the current version of Overseer. A bespoke allocation and process of capturing data ensured that both the proposed and monitored farm system data could be captured at the individual farm level.

The data collected enables Council to monitor consents and permitted activity rules, capture both the authorised and current state of both the individual properties and the catchment as well as reporting on progress towards meeting the sustainable nitrogen target.

Integrated Framework

The Integrated Framework is the nitrogen reduction plan for the Lake Rotorua groundwater catchment. A nitrogen load of 755T was calculated through actual data and modelling in 2011 using the ROTAN model. The sustainable nitrogen load of the lake was calculated to be 435T nitrogen. This figure corresponds to the amount of nitrogen in the lake associated with the water quality aspired to by the community.

Consultation with the community took place with the Stakeholder Advisory Group (StAG) between 2011 and 2013 and through this extensive consultation period with the community, the required reductions were broken down into various tranches of work.

The difference between the modelled load in 2011 and the sustainable nutrient target is 320T nitrogen. The agreed breakdown of this reduction included:

- 140T to be removed through 'Land Use Rules'
- 100T to be removed through the voluntary purchase of nitrogen from landowners,
- 80T to be removed through other Council projects.

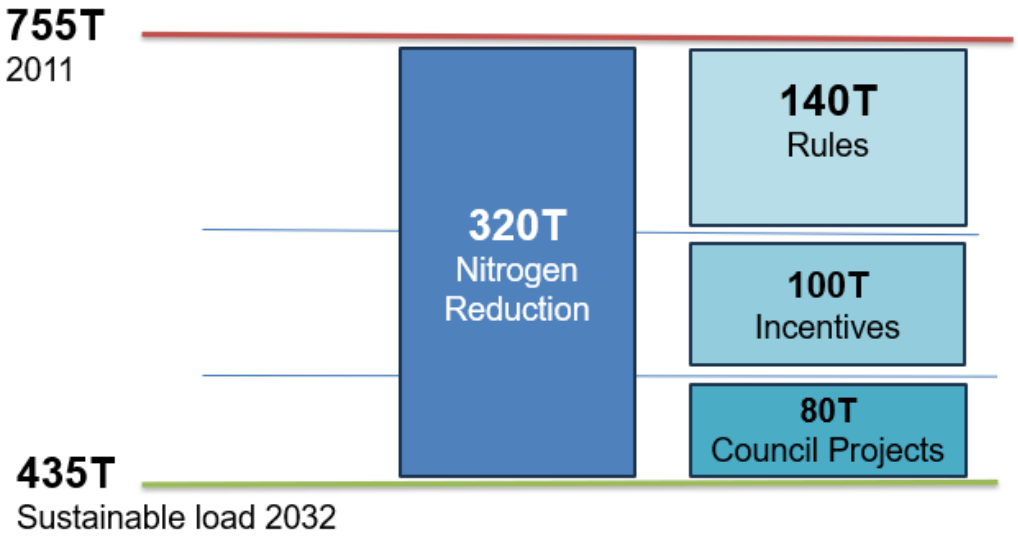

Figure 1. Nitrogen Reduction Integrated Framework.

Nitrogen Allocations and GIS layer

The principles of the nitrogen allocation methodology were developed in consultation with the community to achieve the 140T reduction by 2032 using the Overseer nutrient model. The nitrogen allocation was apportioned using version 6.2.0 and a bespoke allocation methodology enables the nitrogen allocation to be updated as new Overseer versions are released.

The 'Start Point' was based on 2001-04 nutrient losses that were captured in part during a benchmarking project. From the start point an average of 17% reduction was required from dry stock blocks and an average of 35% reduction was required from dairy blocks. These reductions are large and managed reduction targets were identified at five yearly intervals as step downs to enable landowners to utilise a staged approach to meeting their allocation by 2032. There are three step downs occurring in 2022, 2027 and 2032, with the total nitrogen reduction being equally distributed over the three step down periods.

The nitrogen allocations are captured in a GIS layer and this geospatial approach provides the ability to calculate the allocation for any area within the catchment. One of the benefits for landowners of having a geospatial allocation is that the nitrogen allocation of a specific area is known, and the landowner or agent can then model a farm system in Overseer and make appropriate business decisions while considering the nitrogen constraints on the property when looking to lease or purchase land.

The Nitrogen Allocation GIS layer includes land-use, nitrogen and phosphorus losses at the block level and the farm identifier from the benchmarking data. The land use during the start point period (2001-04) is the land use that the nitrogen reductions are calculated from, and this is identified in the Nitrogen Discharge Allocation report -see figure 2. Every polygon in the layer has also been identified with a Start Point, the Managed Reduction Targets and the allocation in the current version of Overseer. The Nitrogen Allocation GIS layer is the source layer for the Nitrogen Discharge Allocation report to be calculated at the property level.

BAY OF PLENTY REGIONAL COUNCIL TOI MOANA

Nitrogen discharge allocation (NDA) for Holdem Farm Ltd, 05 09 004 00

Illustrated in Figure 1, NDA data extracted on 04 May 2022, 8:05:46 am

ROTORUA TE ARAWA LAKES PROGRAMME

****The data in this report is valid for OverseerFM Version 6.5.4****

This **Nitrogen Discharge Allocation (NDA)** data relates to the Lake Rotorua nutrient management provisions approved by Council on **4 May 2021**.

The rules require that NDAs are met by 2032. Five-year targets (2017, 2022 and 2027) have been set to manage reductions towards the final NDA (2032).

Although the rules do not apply to land outside the Bay of Plenty Region, reductions are necessary from all land within the groundwater catchment in order to achieve the water quality targets.

Table 1: Total N losses for the property and effective area within the PC10 boundary for the timeframes illustrated below.

	Property in PC10 boundary		**Effective area* in PC10 boundary** (based on 2001-04 landuse)		**Effective Dairy area* in PC10 boundary** (based on 2001-04 landuse)			**Effective Drystock area* in PC10 boundary** (based on 2001-04 landuse)		
Area (ha)	308.3		279.7		276.5			3.2		
Timeframes	Per hectare (kg N/ha/y)	Total (kg N/y)	Per hectare (kg N/ha/y)	Total (kg N/y)	Per hectare (kg N/ha/y)	Total (kg N/y)	Dairy change from Start Point cumulative %	Per hectare (kg N/ha/y)	Total (kg N/y)	Drystock change from Start Point cumulative %
Start Point	54.0	16650	59.0	16507	59.3	16392		35.4	115	
2022-2027	49.1	15145	53.6	15003	53.9	14902	-9.09%	31.2	101	-11.77%
2027-2032	43.8	13502	47.8	13360	48.0	13273	-19.03%	26.7	86	-24.62%
2032-	**38.1**	**11754**	**41.5**	**11612**	**41.7**	**11541**	**-29.60%**	**21.9**	**71**	**-37.99%**
% change from Start Point to 2032 NDA				**-29.7%**		**-29.6%**			**-38.0%**	

* Where effective area is based on 2001-2004 landuse, unless adjustments to the allocation have occured through an agreement.

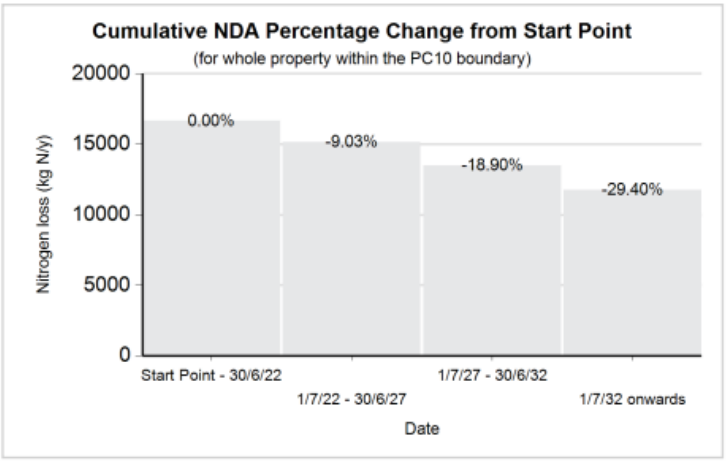

Figure 2. NDA Report

Nitrogen Rules

As well as controlled activities, a suite of permitted activity rules were drafted to deal with properties that have a lower level of nitrogen loss risk when compared to larger commercial farms. The Rotorua catchment has many small lifestyle properties of up to 10ha and while properties less than 5 ha are permitted, properties of 5-10ha of effective area are permitted provided they remain within a set stocking rate table.

Most of the larger (greater than 20ha) and higher nitrogen loss properties are managed as a controlled activity. These properties require a Nutrient Management Plan (NMP) that includes a description of the farm system and an Overseer analysis that models the intended farm system and meets the Managed Reduction Target for the set period. The NMP also captures farm information that demonstrates what changes are required to meet the 2027 and 2032 Managed Reduction Targets. This ensures that landowners have considered possible farm system changes that will be needed to meet the future nitrogen allocations.

The farm system that meets the nitrogen allocation is the basis for the consent ie stock numbers and farm practices become the farm system that the consent is applied for. This enables the landowner to manage the farm system within the nitrogen allocation of the property. The farm system can then be changed provided the new farm system is submitted to Council and meets the nitrogen allocation.

The Overseer predictive analysis for the current managed reduction period must be submitted by a suitably qualified and experienced person (consultant). Council has developed a set of data input protocols to ensure that data is entered in a consistent manner. The geospatial data is calculated and provided to the consultant along with a .kml file to import into the analysis. Data input guidelines are used to ensure that any change in nitrogen loss is a result of a change in the farm system rather than geospatial attributes. The Overseer analysis is submitted to council and closed ensuring the farm system submitted for consent is unable to be edited.

Landowners with a consent are required to submit Overseer Year End analyses annually. This is the actual farm system on the property during the previous 12-month period and is saved by block into the Rule Monitoring layer. The primary purpose of requiring a year end Overseer analysis to be submitted is to monitor the consent and to ensure the nitrogen limit has not been breached.

Authorised Activity and Rule Monitoring GIS layers

One of the consent conditions under the LRNR is that the consent holder is required to submit an Overseer analysis which models the farm system described in the NMP. The proposed farm system Overseer data is saved by block into the Authorised Activity GIS layer. The farm system data is entered as one of 23 possible 'block types' which is then automatically condensed into one of 9 'land-uses'. These land-uses then fit within one of the five 'sectors' of Dairy, Dry stock, Bush and Scrub, Forestry or House. This description of the farm management unit provides Council with a comprehensive dataset that can be reported on at the catchment level depending on the degree of complexity required.

This GIS layer enables Council to report on the authorised activity within the catchment and assess tracking towards catchment targets as well as individual landowner targets. This GIS layer also provides Council with detailed information on farming practices within the catchment.

Consented properties also require a year end analysis to be submitted by a consultant. The data capture occurs in the same manner as for the Authorised Activity GIS layer. This Rule Monitoring GIS layer provides Council with actual farm losses across the catchment as well as detailed information on actual farming practices that occurred in the catchment over the 12-month period.

For monitoring purposes, a comparison report has been developed in house and is generated once the Year end analysis has been submitted and closed – see figure 3. This report compares the submitted year end analysis with the predictive analysis generated for the NMP. This report compares the main farm system parameters between the two Overseer analyses and the percentage difference:

- effective area;
- nitrogen loss;
- dairy and dry stock stocking rate;
- nitrogen, and phosphorus fertiliser applied;
- milk solid production;
- crop area;
- pasture production and
- imported nitrogen from supplements.

The comparison report is then reviewed by Council and compliance completed. Overseer also has a comparison report which is more comprehensive and can be referred to in cases of possible non-compliance.

Overseer Version:	6.5.2				
		22-27	2023		
Farm Overseer Outputs	**Data source**	**Predictive**	**Year End**	**Unit**	**Passed**
Total N losses	Overseer model output	22230	19350	kg	-13.0
Nitrogen conversion efficiency	Overseer model output	29	29	%	0.0
Greenhouse gas emissions	Overseer model output	11123	10793	GHGs/ha	-3.0
Total P losses	Overseer model output	976	953	kg	-2.4
Region	Overseer model output	CentralPlateau	CentralPlateau		No change
Nutrient Parameter	**Data source**	**Predictive**	**Year End**	**Unit**	**Passed**
Total Area	Overseer model input	387	387	ha	0.0
Effective Area	Overseer model input	345.9	345.9	ha	0.0
Irrigation	Overseer model input	0	0	mm	0.0
Total pasture production	Overseer model output	4853968	4537719	kg DM/yr	-6.5
Average pasture production	Overseer model output	14033	13119	kg DM/ha/yr	-6.5
Production					
Milk production	Overseer model input	300000	279598	kg MS	-6.8
Revised stock units by enterprise					
Dairy	Overseer model output	7307	7201	RSU	-1.5
Dairy replacements	Overseer model output	1480	940	RSU	-36.5
Beef/dairy grazing	Overseer model output	0	9	RSU	0.0
Sheep	Overseer model output	0	0	RSU	0.0
Deer	Overseer model output	0	0	RSU	0.0
Other	Overseer model output	0	0	RSU	0.0
Total RSUs	Overseer model output	8787	8150	RSU	-7.2
Fertiliser					
Total nitrogen in fertiliser	Overseer model input	39606	32489	kg	-18.0
Total phosphorous in fertiliser	Overseer model input	7708	5840	kg	-24.2
Supplements					
Nitrogen from imported supplement	Overseer model input	26	41	kg N/ha	
Cropping					
Crop area	Overseer model input	0	0	ha	0.0
Crop nitrogen losses	Overseer model output	0	0	kg	0.0
Fodder crop area	Overseer model input	14	0	ha	0.0
Fodder crop nitrogen losses	Overseer model output	2753	0	kg	0.0
Plantain in pasture	Overseer model input		Y		
Effluent reporting					
Effluent depth	Overseer model input	Item12mm	Item12mm	mm	No change
Effluent system	Overseer model input	HoldingPond	HoldingPond		No change
Effluent area	Overseer model input	65	68	ha	

Figure 3. BOPRC Overseer comparison report

Nitrogen Dashboard

Capturing data from both predictive and year end Overseer analyses for farms in the catchment in separate GIS layers has provided an opportunity for council to share meaningful data with our community and key stakeholders. Capturing this data will enable Council to report back to the community on progress towards the nutrient rule component of the sustainable nitrogen targets that are needed for a healthy lake. This knowledge sharing will go a long way towards fostering positive working relationships with our rural landowners and encouraging collaborative engagement with our key stakeholders.

Presenting this information through a GIS dashboard will enable up to date information to be displayed. Council is looking to compare the area and nitrogen loss between the Authorised Activity GIS layer and the Rule Monitoring GIS layer by the various rule categories. For example Figure 4 shows the area and nitrogen losses from the properties that are consented under the LRNR. The Authorised Activity area of 15,800ha is greater than the Rule Monitoring area of 13,500 ha and once all the properties are engaged and submitting year end Overseer analyses these figures will come into alignment and the nitrogen loss between the Authorised Activity and Rule Monitoring data can be compared with more confidence.

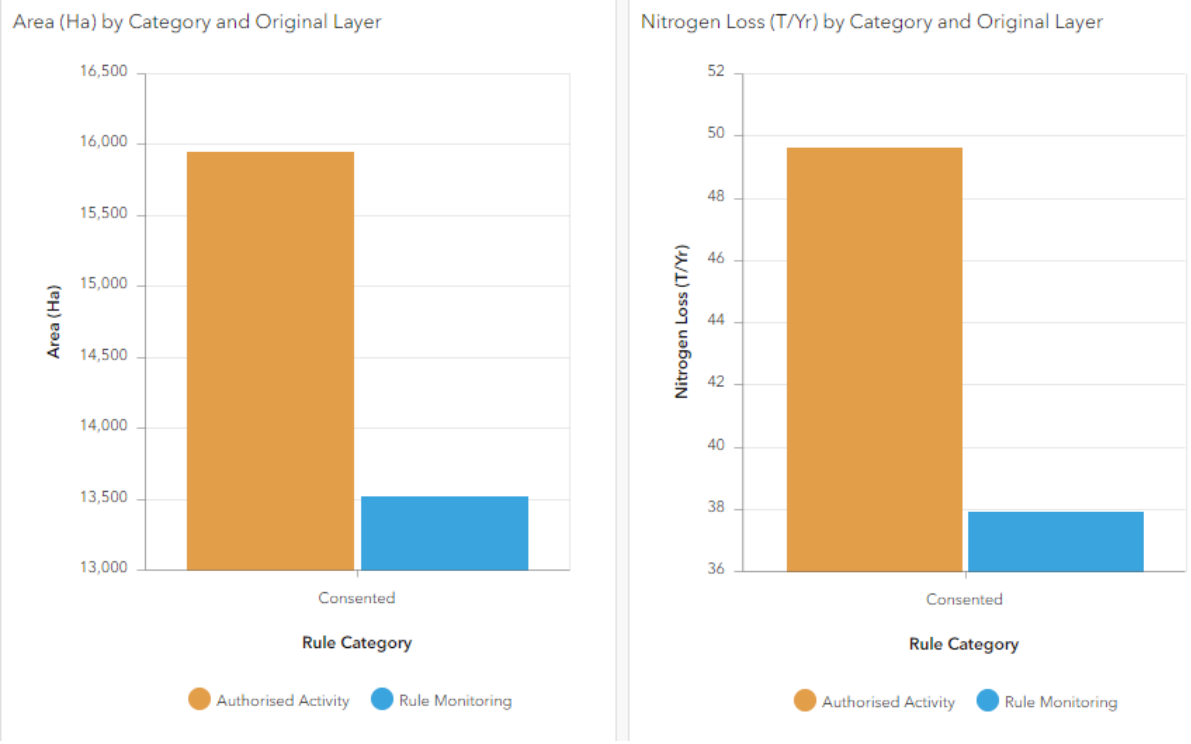

Figure 4. Authorised vs Monitored GIS Dashboard

As well as the area and nitrogen losses of the different rules categories, the collection of land use data provides the opportunity to look at the land uses within these rules. Figure 5 shows the authorised land uses by area for the rule category of 'consented' properties.

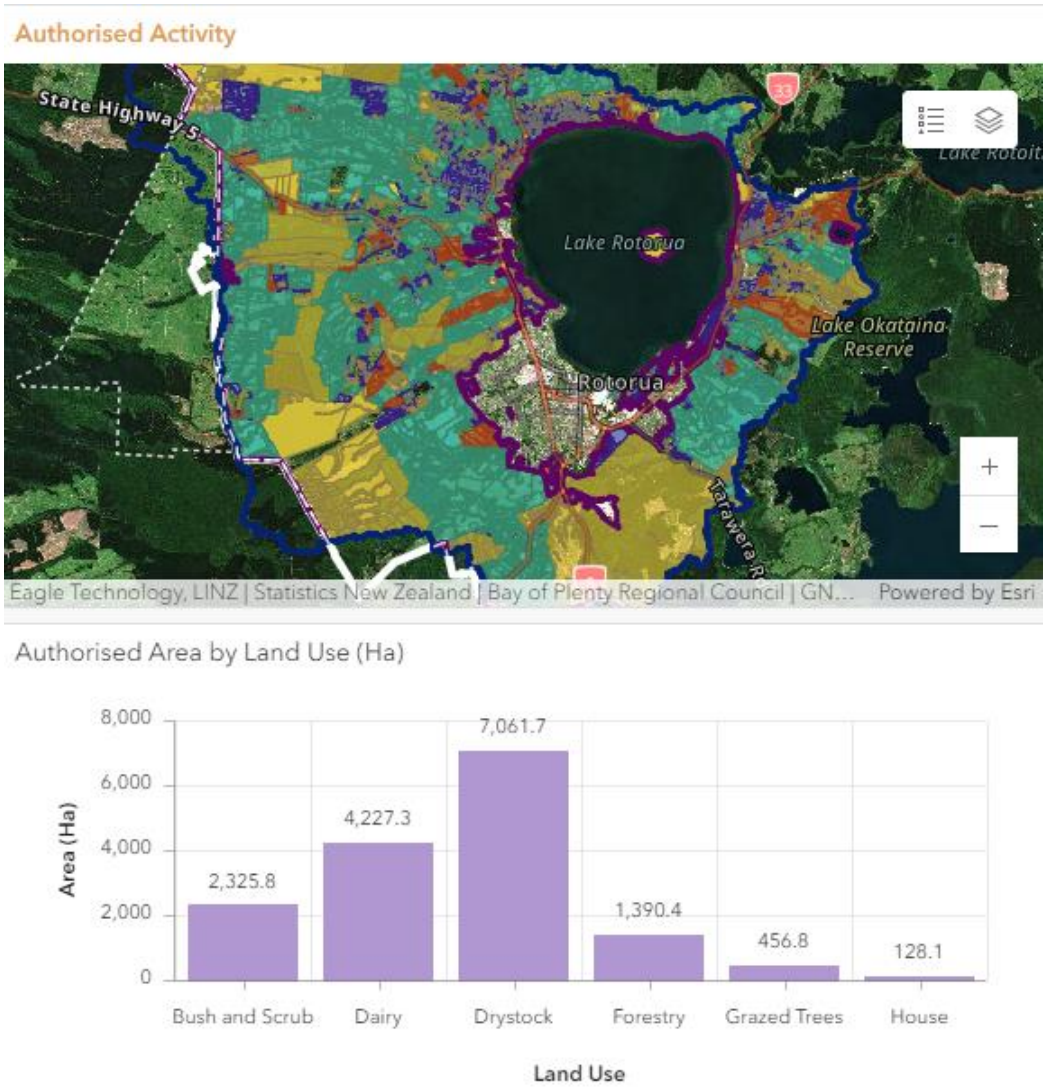

Figure 5. Rule category authorised land use Lake Rotorua

Summary

The Integrated Framework outlines the required nitrogen reductions to achieve the community target of 435T nitrogen/year. Nitrogen allocations, authorised activity block data and monitoring block data are geospatially captured and can be reported on a property or block basis. Council is then able to monitor, track and report on progress towards the 435T sustainable nitrogen load of Lake Rotorua. A dashboard is being created to report on the reduction efforts being made by the community toward the target.

BOPRC is required to provide a five yearly report on progress towards achieving the Integrated Framework in the form of a Science Review. This method of capturing the data and displaying the nitrogen reductions required by the rules offers a consistent approach to reporting Council's progress at each of the 5 yearly reviews.

Although we have only reached the first step down managed reduction target, landowners are engaged and consent holders are meeting their nitrogen targets. The nitrogen rules are working with a reduction of nitrogen being leached below the root zone from farm systems within the catchment and most landowners engaged and on-track to achieve the 140T nitrogen reduction by 2032.

Acknowledgements

I would like to thank the team at Overseer, the many teams in Council including GIS, Business and Data Analysts, Lakes and Land Management, Planning, Legal, Compliance and Consents as well as the many landowners in the catchment that have actively worked with Council. Special thanks to Steve and Paula Holdem for allowing me to share their data.