beef+lamb new zealand

Practical solutions for sheep and beef farming in 2025

Onetai Station Environment Focus Farm

YEAR 3 FIELD DAY – THURSDAY 15 FEBRUARY 2018

Health and safety

In the spirit of the Occupation, Health and Safety Act, the owners have taken all reasonable care in making your visit to the property as safe as possible. They clearly point out that you enter the property at your own risk. The owners will accept no responsibility for any accident or injury to any person or property that takes place while you are visiting their property. Please abide at all times to the instructions given by farm owners, managers and field day organisers.

Woolshed

- Evacuation meeting point is at the car park
- Maria Shanks from B+LNZ is the first aider on site, 027 556 8836

Farm Tour

- Have full vehicles
- All occupants must wear seat belts
- Stay within the convoy
- 4x4 only

Agenda

10.00am	Cuppa
10.30am	Outline day, introduce team, H&S
10.35am	Programme Intro and Onetai Update • Update from Rafa • How the last year has gone? • What has been achieved? • Observations of interaction between environment and farm management • What does Farmax and OVERSEER® tell us?
11.05am	Forestry—*Malcolm McKenzie, Waitomo Farm Forestry Association*. The role of forestry in hill country farm systems including the economics and environmental considerations. What does the future look like?
11.35am	Crusader Meats—pelts and relationship with Onetai
12.00pm	**Lunch**
12.30pm	**Farm tour:** Stop 1: Wetland site • Wetland protection • Manuka Honey (Egmont Honey) Stop 2: Coastal yards • Fertiliser trial and greenhouse gases—what can we do on-farm? • Water quality on the West Coast
2.30pm	Return to shed
3.00pm	Tying it together
3.10pm	Panel discussion
3.55pm	Wrap-up and close

BBQ kindly sponsored by Crusader Meats with refreshments from Farmlands.

Crusader Meats New Zealand Ltd

Thank you!

Farmlands co-operative

The Onetai Project is funded by B+LNZ with additional support from Waikato Regional Council, NZAGRC/PGGRC and Farmax. We appreciate the support these organisations provide to the project

Waikato Regional Council

FARMAX YOUR ADVANTAGE

A welcome message from Rafa...

Hello, my name is Rafa and I am one of the owners of Onetai Station.

Perhaps some of you have already met me, or have seen my video at the previous field day, but for the ones who have not, we are living in Argentina and our main activity is running a tannery which this year has celebrated 90 years of operation. We are the third generation running the company.

Quite an achievement!

Within this field day, we are glad to have Crusader Meats supporting us—thanks Mike.

We have worked a good deal with Crusader's and we are now buying salted, new season lamb skins, of which part of them come from Onetai Station. The skins are sent to Argentina for processing and then further exported worldwide as rugs.

New Zealand skins make one of the best rug materials. Some skins are available at the field day to see and touch. It is great to have full traceability of product and that we are connecting actual farm to end retailer or consumer.

I think 2017 has been a great year for Onetai Station, despite the massive rain which created a lot of extra expenses, we have been able to keep up with the development and we had a significant improvement in our KPI's.

The property is still surprising us every year, we are discovering and learning a lot of things, and the challenge is just outstanding.

For us, this is a long-term project. I see New Zealand as a top producer and world supplier of food products, and New Zealand should be one of the leading countries setting the direction on where farming should go.

It is the responsibility of farmers to take ownership of this task and make it their own, otherwise someone else will end up deciding what you will do and then it will be too late.

I feel blessed having the opportunity of running this project in New Zealand. You have a wonderful country with great people, and you cannot imagine how different and difficult it would be doing similar things here where I live.

I would like to take the opportunity to thank Erica and the rest of the crew for the support and organising this field day. A very special thanks and congratulations to Patrick and his family for the outstanding effort and being the engine of our project. To Mike and Robert, our directors, for the wise advice and help and also for being great friends. Finally, to John, Paul, Grandad and Jim for the great help as well and to everyone who is connected to this business. All of you make a great team, without the power of team work, this project could not be viable. Thanks again!

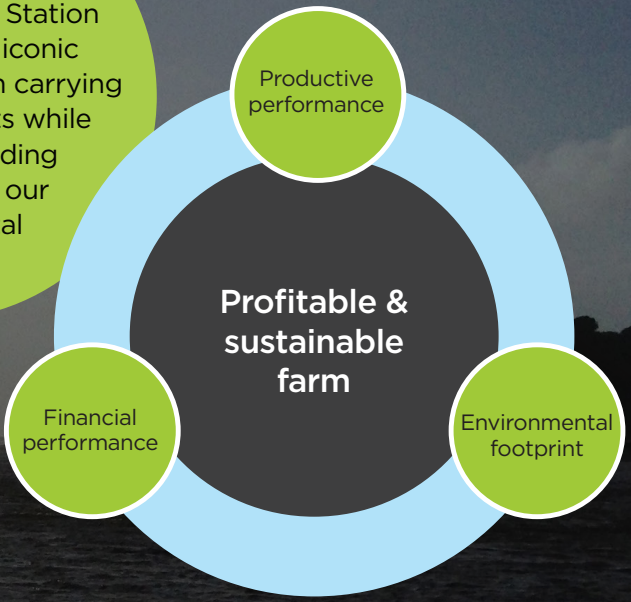
Well, I hope you have a wonderful day and enjoy the field trip.

If you have any questions, Erica will set-up a mail box and I will be happy to answer you back via email.

Cheers, Rafa

Vision

To develop Onetai Station into a profitable, iconic sheep and beef farm carrying 10,000 Stock Units while truly understanding and managing our environmental footprint.



Onetai Station

The farm is owned by the Grozovsky family

The family has had long-standing business relationships with New Zealand through the purchase of large quantities of raw lambskins over many years. They have been truly impressed with New Zealand and wanted to connect further with the country and its people through farm ownership.

They spent several years looking at properties before purchasing Onetai in 2014.

The property appealed because it has potential to be made into a truly iconic breeding and finishing station.

In addition to the two owners there are two New Zealand Directors—Robert Burrow (a leading leather tanner) and Mike Barton (a beef farmer from Taupo). Onetai is very ably managed by Patrick Kowalewski.

Field day introduction and general update

Mike Barton

Since the last field day, we have been able to focus on developing the infrastructure and improving the stock performance at Onetai. This has been very satisfying, and we are starting to see real progress against a number of goals and key indicators—(outlined in detail in the booklet)

There continues to be robust discussion between the directors and Patrick over how we should be proceeding and what our priorities should be. Patrick's common-sense arguments have a habit of prevailing on a regular basis—as someone commented at the last field day we cannot be accused of "group think".

The two cyclones that hit the west coast in mid-2017 did considerable damage to our tracks and fences and we have had a large digger onsite for several months as a result. This unbudgeted expense has impacted other intended projects but at the same time has advanced a good portion of the track development and fence lines we had planned for future years.

We are gaining a clearer picture of the strengths and weaknesses of the property and are learning to farm Onetai to its potential.

As fencing has been completed we have needed to confront the reticulation of water to maximise the benefits of the newly created subdivision. Equally we have begun a cropping/development programme to provide summer finishing of lambs and to improve pasture composition and contour. As a general rule of thumb—we don't consider the cropping returns a profi—rather it provides some summer flexibility and leads to better pasture/paddocks.

Hopefully by the time you read this you will be able to see the harvesting of the stand of pines opposite the woolshed. The issues raised by this harvesting will make for an interesting discussion and we look forward to your input.

We have tried to anticipate the pending water quality legislation, which will impact all farmers on the west coast, when making decisions over Onetai's development.

We want to be transparent about the environmental consequences of our development programme and have valued the input and support from Waikato Regional Council. Their decision to outline the potential rules for the West Coast for debate at this field day is a brave move and they deserve our support and considered responses.

On behalf of Rafa and Federico (owners) Robert (newly returned from retirement), myself and Farm Manager Patrick we welcome you to Onetai Station.

Enjoy the day and participate as fully as you can—that way we will all benefit!

Beef + Lamb New Zealand

Onetai Environment Farm Programme

The Onetai Farm Programme is aimed at farmers who want to help identify tools and practices that will result in real, concurrent environmental & financial improvements to their farm business.

The objective is to help and support farmers to better understand environmental stewardship and its benefits in the context of the wider farm system, particularly on a developing property.

The programme utilises a team approach to work through the practicalities of developing a property, analysing environmental and financial risk, and understanding what strategies can be implemented to manage that risk. The programme is guided and supported by a community group with specialists' input to aid planning, research and implementation.

Sufficient monitoring of the system prior to, during, and after implementation is undertaken to determine the value of the new change or tool implemented on the property.

Lessons from the programme will be shared widely so that farmers with similar systems can evaluate the merit of implementation on their own farms. Considering financial aspects is a key element of the programme as well as long-term environmental, economic and social sustainability.

Key information

Size

1450ha total, 891ha effective

Rainfall

Coast Block: 1471mm, Mid Block: 1985mm; Front Block: 2143mm, lower summer rainfall, higher autumn/ early winter rainfall (based on 2017 data collection).

Altitude

Sea level to 380m

Soils

Typic Orthic Allophanic, Typic Orthic Brown, Mottled Orthic Brown and Typic Orthic Recent.

Natural capital

220ha bush, 212ha scrub (Manuka/ Kanuka), 25ha beach

Overview of Year 3

The first field day for the B+LNZ Onetai Environment Farm Programme was on 8 September 2015. The booklet from this field day outlined the goals and objectives for the business, including performance objectives. A further field day in Year 2 outlined the progress to date, and the following data presents updates from the current financial year.

Farm performance

AgFirst Consultants

Goal: To increase carrying capacity to 10,000 stock units by 2020

Table 1: Summary of physical performance since 2014 (estimating year "0") compared to Farmax average for 2016/17

	Yr 0	14/15	15/16	16/17	17/18	2020	Farmax Group Average 16/17
Total Area (ha)	1450	1450	1450	1450	1450	1450	
Effective Area (ha)	891	891	891	891	891	1,000	1236.6
Stock Units	6700	7,300	7200	7782	7,800	10,000	12489
Stocking rate (SU/ha)	7.7	8.2	8.1	8.7	8.8	10.0	10.1
kgDM eaten/ kg of product	33	34	35.3	34.3	38.7		26.8

"Year 0" is a high-level picture of what the farm looked like before the current management team took possession—it is the baseline year. In addition to the stocking rate shown in the table, it is estimated there were a further 1700 feral goats eating a further 0.6T DM/ha in "Year 0".

The development program to-date has focused on subdivision to reduce paddock sizes. This means stock can be rotationally grazed through paddocks which in-turn increases grazing pressure and ensures paddocks are cleaned up well. Water reticulation has also been invested in and there are plans to extend this further. There is an additional 3km of fencing being undertaken over this summer. New yards have been put in at the North Coast, and diggers are being used to clean up crop paddocks. Since "Year 0", there has also been the ability to put in crops primarily to be able to establish new grass.

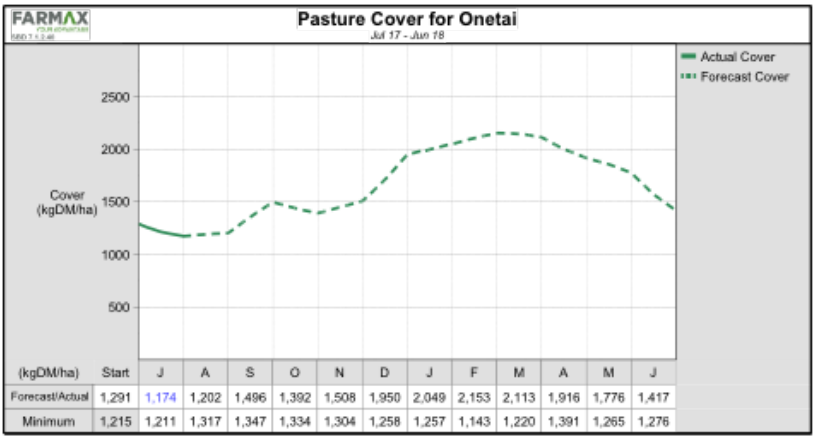
To reach the 2020 target, the stocking rate will need to increase further. This should be aided by the continued development investment which is producing more feed for the farm and generating improved performance.

Pasture management

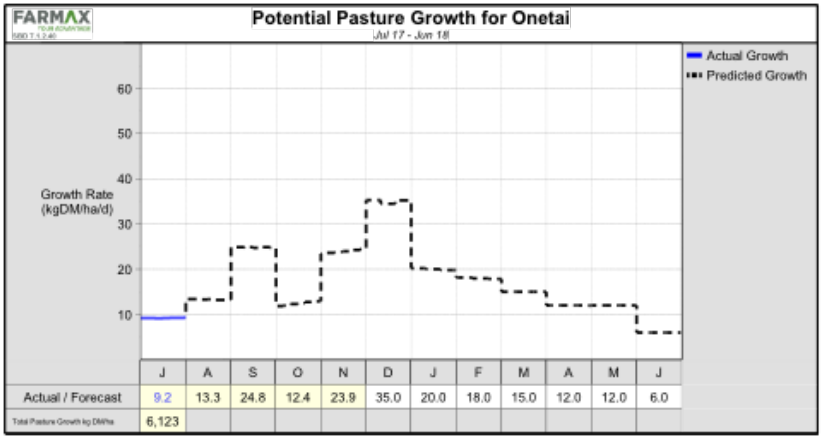
Pastures are a mixture of old, unimproved pastures across the farm. Areas of the farm are reverting to ring fern and manuka. Each year a chopper is used to spray thistles and gorse with an annual budget of around $10k for this.

Based on Farmax monitoring of stock performance and pasture cover assessments, pasture growth has been increasing and has grown around 6.2t in previous years.

Figure 1: Monthly estimate of pasture growth



(kgDM/ha)	Start	J	A	S	O	N	D	J	F	M	A	M	J
Forecast/Actual	1,291	1,174	1,202	1,496	1,392	1,508	1,950	2,049	2,153	2,113	1,916	1,776	1,417
Minimum	1,215	1,211	1,317	1,347	1,334	1,304	1,258	1,257	1,143	1,220	1,391	1,265	1,276



	J	A	S	O	N	D	J	F	M	A	M	J
Actual / Forecast	9.2	13.3	24.8	12.4	23.9	35.0	20.0	18.0	15.0	12.0	12.0	6.0
Total Pasture Growth kg DM/ha	6,123											

Note: Areas highlighted in yellow in Figure 1 are based on expected pasture growth rates calculated from pasture covers which are shown by the blue dots.

Fertiliser applied

Since the purchase of Onetai in 2014 the following fertiliser has been applied:

May 14—DAP @ 175kg/ha to 781 ha

Dec 14—Cropmaster 15S to 10 ha (baleage paddocks)

Oct 15—Cropmaster 15S @165kg/ha to 34 ha

June 16—Superphosphate @ 250-350kg/ha to 100 ha

Jan 17—Cropmaster DAP to crop paddocks

April 17—Cropmaster DAP to crop paddocks

August 17—Urea to new grass

September 17—Ammonium sulphate to flats and Cropmaster to baleage paddocks.

Supplements

A small amount of baleage is cut each year and fed over the following winter. No other supplements are purchased or made.

Baleage harvested

- 11 ha Nov 14
- 11 ha Jan 15
- 13 ha Dec 15
- 11 ha Dec 16
- 11 ha Jan 18

Cropping

The farm has been using leafy turnip and rape effectively to be able to get areas into new grass. 26 ha of crop, 8 ha in rape, 1 8ha in leafy turnip, 8 ha new grass.

Olsen P levels were around 3 at the start. The area that has gone into new grass following last year's crop, now has an Olsen P of 20.

Sheep

Policy

Perendale flock rearing own replacements.

5yr ewes run as terminal flock to a black face ram.

Sheep stock numbers

The aim is to grow the flock to 4,000 ewes. Table 2 shows sheep numbers to date.

Table 2: Sheep numbers at opening for Onetai Station since July 2014

Stock Numbers	1st July 14	1st July 15	1st July 16	1st July 17
Ewes (incl Two-tooths)	2480	3010	3000	3171
Ewe Hoggets	950	1000	930	1000
Trade lambs	230	928	1670	1108
Breeding Rams	55	36	41	44

Table 3: Sheep reproductive performance

Breeding Performance	2014	2015	2016	2017	Farmax Average 16/17
Mating date	1st March (terminals), 1st April (MA ewes)				27th Mar
Mating Weight	49 (estimate)	62	62	60.7	62.1
Scanning %	138	132	146	170	173
Weaning %	109	113	116	133	132.7
Weaning Weight (kg)	27.5	28	28	28	30

Finishing Lambs

The farm target is to finish all lambs at 17kg before May. Actual finishing performance shows there is more work needed to achieve this target. Rape and leafy turnip summer crops are being used to lift growth rates post-weaning.

Actual performance of finishing lambs:

- 14/15—70% finished by May at 16.7 kg carcase weight
- 15/16—44% finished by May at 16.4 kg carcase weight
- 16/17—69% finished by July 17. 4kg carcase weight
- 17/18—Target to finish 100% at 17 kg carcase weight utilising crop.

Beef cows

Policy

Angus x Hereford herd breeding own replacements.

75% steer calves sold store at weaning, 25% are sold the following spring.

Cattle stock numbers

The plan is to hold the herd at the current 340 cows and to lift beef finishing stock as the stocking rate increases. Table 4 shows the cattle stock numbers since 2014.

Table 4: Cattle stock numbers for Onetai Station since 2014

Stock Numbers	1st July 14	1st July 15	1st July 16	1st July 17
Cows (incl 1st calvers)	382	343	339	330
R2 Heifers	111	92	112	111
R1 Steers	27	21	31	48
Breeding Bulls	13	11	11	13

Reproductive performance

The reproductive performance of the cattle has increased since taking over the farm in 2014 and is forecast to be consistent with the previous season. There is still room for improvement as shown in Table 5.

Table 5: Reproductive performance of cattle compared to Farmax Average for 2017

Breeding Performance	14/15	15/16	16/17	17/18	Farmax Average 16/17
Mating date	10th Dec MA Cows, 1st Dec R3 heifers				20th Nov
Scanning %	75	94	90		91.2
Weaning % (of cows wintered)	65	78	78	79 f	85.5
Weaning Weight (kg) (200 day)	152	208	220	220 f	203.3

f = forecast

Financial performance

Goal: To be a profitable business with a 3% return on total investment.

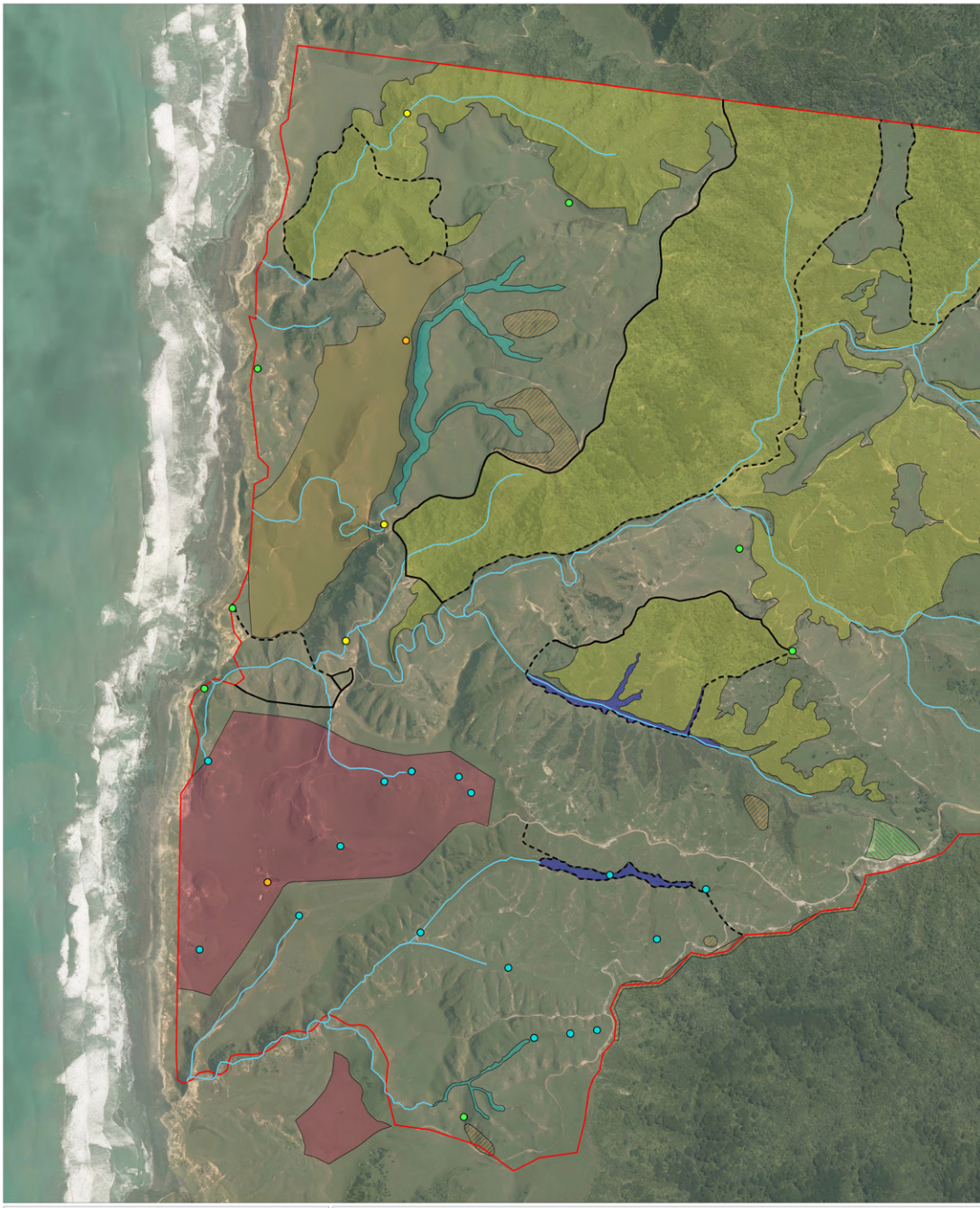
The gross margin analysis to date is presented in Table 6.

Table 6: Gross Margin analysis by enterprise for Onetai Station since 2014/15

c/kg DM	14/15	15/16	16/17	17/18 (forecast)
Whole Farm (c/kg DM)	8.2	9.8	9.8	9.8
Whole Farm ($/ha)	369	436	470	466
Sheep Breeding (c/kgDM)	10.1	9.4	10.9	12.6
Trade Lambs (c/kgDM)	11.1	-	-	-
Beef Cows (c/kgDM)	7.2	8.3	11	7
Dairy Grazers (c/kgDM)	42 (winter 15)	42 (winter 15)	-	-
Bull Beef (c/kgDM)	-	-	14.7	-

Key points:

- Gross margin was low through 14/15 as the farm had just been taken over, and the focus was on building stock condition and undertaking significant pest control
- The overall gross margin has improved and provides a good platform for the next step up in future years.



Onetai Station (Val ID: 05831/075/04)

Created by: A Jeffries
Projection: NZTM
Date: 20/04/2016

Status: Version 1
Request No.: 32228
File name: 32228_Digitise_Mark_Ups_for_Onetai_Station.gws

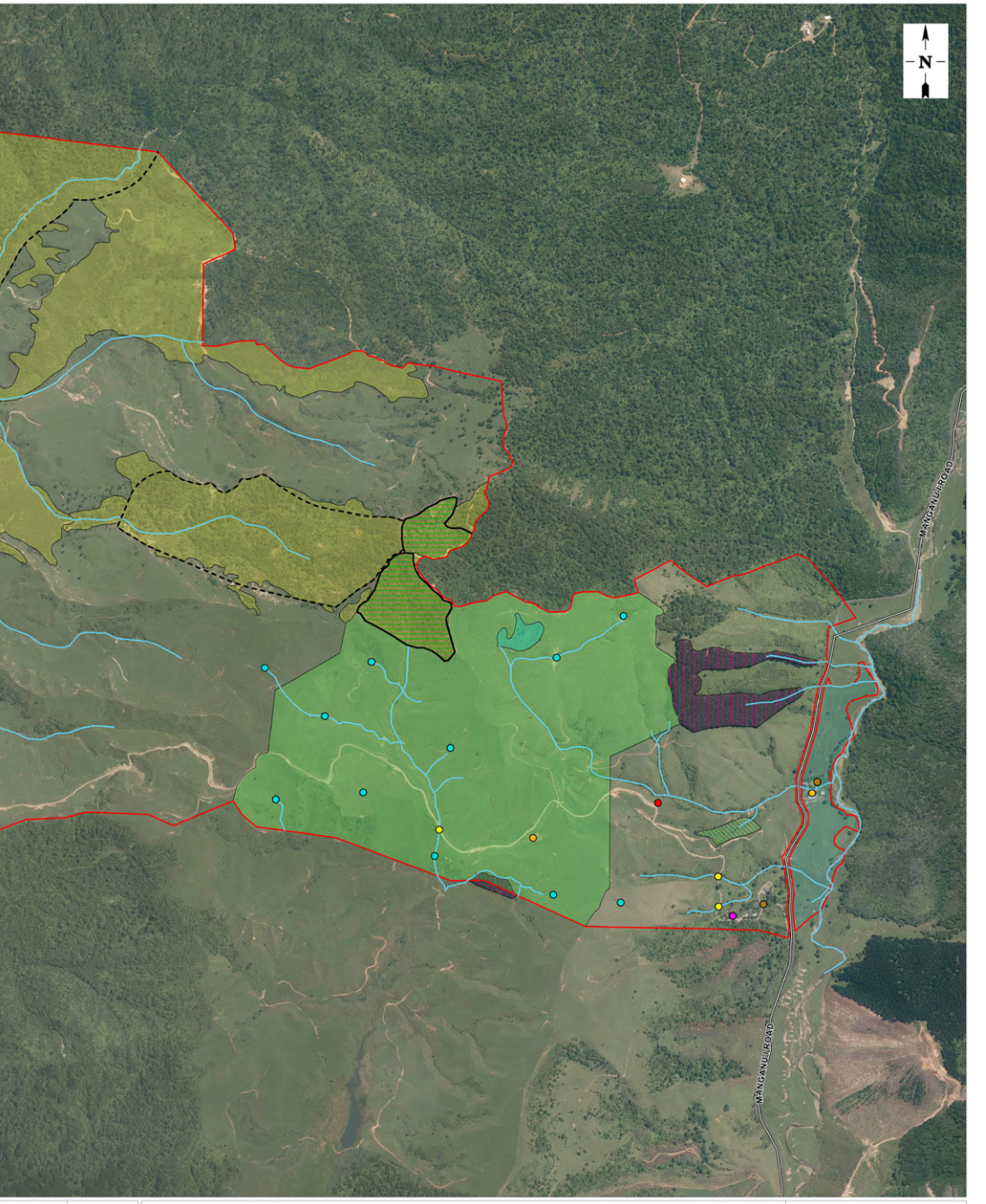
0 250 500 750 1000 1250 1500
Metres

Legend

- Bridge
- Chemical storage
- Dam
- Dump
- Offal pit
- Pa / archeological site
- Yards / woolshed
- Protection fencing
- Proposed fencing
- Waterways
- Fenced bush
- Forestry
- Poplars (proposed)
- Gorse control
- Wetland
- Wet area

Land Management Units:

- Bush
- Easy coast



A0

cale - 1:6,000 at A0

Flats
Front easy
North coast
Onetai Station property boundary

Acknowledgements and Disclaimers

1. Cadastral information derived from Land Information New Zealand's Landonline Cadastral Database. CROWN COPYRIGHT RESERVED. Valuation Data Sourced from Territorial Authority District Valuation Roll.

Waikato REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

Opportunities for farm forestry

Radiata pine makes up approximately 90% of all NZ exotic forests. It is a species with a history of good growth and minimal disease in a wide range of locations and environments nationwide.

It has been subject to a huge research effort over the years, so its silviculture is well understood, and it has been genetically improved far more than any other forestry species. It also has a huge advantage in being a multiple use species, not necessarily first choice for any one use but ok for nearly all uses. Radiata has a big industry infrastructure for harvesting and marketing that small growers can hook into, so it is generally easy to sell.

In comparison the other options, e.g. eucalypts, cypress, Douglas fir, blackwood, redwood or natives are all more site specific, generally considerably more expensive to plant and tend to be, more disease prone, less well known in terms of silvicultural requirements, less improved genetically, and more demanding to market. They may produce better timber for a particular end-use and potentially more valuable per m3 of timber, but we have few examples of growers actually realizing that potential. This is particularly so in terms of economic return whether it is calculated on a per hectare, per year basis or on a rate of return per $ invested. I am not saying these alternatives don't have a place – they are more suited to smaller plantings where economic return from wood production is not the primary driver. Aesthetics and carbon forestry (amongst others) can certainly alter the equation.

However, farmers will no doubt be well aware of others who have been disappointed with the returns from even pine forestry. Often little attention is given at planting time to forest size, labour demands for pruning and thinning, and siting relative to roading. Some understanding of harvest methods and requirements is needed prior to planting.

Radiata doesn't suit very small woodlot or riparian zone planting for example. But equally it is easy to over emphasize the need for economies of scale. A well sited small (5-10 hectares) woodlot requiring minimal additional roading and of easy harvest contour (that doesn't mean flat but merely short hillslopes) can produce surprisingly good returns. A recent harvest of a little over 5 ha on our own property near Otorohanga netted about $280,000 (over $50,000/ha). The block was well pruned and handy to the pruned log market in Te Kuiti so the cartage for that component was minimal. The branched saw logs were exported from Mount Maunganui and a little pulp was carted to Kinleith so that cartage was more expensive. Other harvest returns I've heard of recently have been in excess of $40,000/ha.

So, if I was to give some take home messages they would be:

- Do your homework before planting, consider joining the Farm Forestry Association
- Don't just follow what others in the district are doing without understanding
- Understand the demands of silviculture right through the rotation
- Take an interest in your investment, don't plant and forget then moan about poor returns
- Consider radiata if you want a low risk, reasonable return on marginal farm land that is reasonably well sited relative to infrastructure and of sufficient scale
- Only consider other species if you fully understand the additional cost, risk and marketing demands
- Don't think that because the large forest owners concentrate on radiata that small growers need to look at alternative species
- Radiata pine is, and will remain the mainstay of our forest industry for the foreseeable future.

FARMAX is the leading decision support tool used by New Zealand farmers and rural professionals to model the complex variables of farm systems. The software helps predict the biological and financial outcomes, in order to identify opportunities for improvement and refinement. FARMAX provides a distinct advantage. FARMAX customers consistently perform above the New Zealand average.

Commercially launched in 1993, FARMAX was developed by AgResearch and was born out of 20 years of research. It is an evidence-based software system developed for the industry, by the industry. We believe FARMAX is good for pastoral farmers, good for the industry and good for New Zealand. Farmax Ltd is proud to continue sponsorship of the Beef + Lamb New Zealand Environmental Focus Farm Project at Onetai.

Why are wetlands awesome?

Adrian Jepson—Waikato Regional Council

Wetlands improve water quality, create biodiversity, add to farm aesthetics and provide for recreation.

Most farms have a wetland of some description, many have been drained but more recently many wetlands are being recognised for their role as a water filter. Wetlands are efficient natural factories that turn unclean water into clean water.

Often considered nature's kidneys, many wetland plants, animals and soil organisms will actually consume precipitates, such as nitrogen and phosphorus, in the process of filtration. These precipitates usually remain in the wetland, allowing the filtered water to enter streams, lakes, rivers, estuaries and groundwater.

Nitrogen and phosphorous enter waterways through ground water, surface runoff and effluent. Wetland vegetation uses these nutrients for growth. Wetlands remove up to 90 per cent of nitrates from ground water through a process called denitrification. Wetland plants trap sediment suspended in water, improving water quality. In riparian areas, their roots hold riverbank soil together, reducing erosion. Bacteria living in wetlands absorb and break down nitrogen from farm run-off and leaching thus improving water quality.

Wetlands regulate the flow of water by slowing water flow from land, soaking up excess floodwater and then slowly releasing water to maintain summer flows or recharge ground water.

Providing habitat for many different plants and animal life, including rare or threatened species, is another role for wetlands. Wetlands are also essential breeding areas for whitebait species and other native fish as they provide a rich source of food for fish, birds and amphibians.

Fishers, shooters, naturalists and other water-based recreationalists also make extensive use of wetlands. Wetlands' importance to Maori, as mahinga kai (food gathering areas) - as a source of plants for medicines and dyes - is well recognised.

Fencing keeps stock out, stops pugging of wetland margins and enrichment from animal wastes. Appropriate planting around the edges of the wetland reduces pollution from surrounding farmland, provides cover for wildlife, reduces bank erosion and reduces the temperature of water through shading.

Onetai Station is undertaking to fence off wetlands for sound environmental reasons and farm management. Reduction in stock loss, easier stock management, improved animal health and water quality are all very good reasons to fence off your wetlands.

Waikato Regional Council can offer free advice to landowners on managing wetlands, including information on fencing, planting of suitable riparian margins and weed control.

Pelts

Crusader Meats

The initial contact happened when Rafa was introduced by his agent to our Livestock Manager. They were looking to process lambs from Onetai through the Crusader Meats plant in Benneydale.

Through that arrangement, in mid-2017 discussions commenced between Rafa and Mike Ramsey as to Crusader Meats supplying new season lamb, salted woolly skins to Argentina. In past years Crusader Meats had sold a small number of woolly new season lamb skins to a South Island processor. This channel was changing due to that processor being sold and ownership moving from a majority Japanese shareholder to Chinese ownership. So, the approach from Rafa was timely.

The partnership is a good fit for both parties and with both being family owned businesses has a nice “feel” about the relationship.

For Crusaders it is a beneficial relationship. We are not a large processor of pelts but we have followed the pelt market. The pelt market has been in a state of depression for the past three years. Selling the skins to Rafa helps Crusader in removing a number of pickled pelts to sell on a depressed market.

For Rafa it gives him stable supply of woolly pelts. Another example of the value of a good relationship!

Fertiliser trial—Onetai Station

Low soil fertility over large areas of Onetai are a barrier to farm performance. A phosphate fertiliser response trial has been set-up to measure the change in pasture growth over time from the application of various rates of single super phosphate (SSP) and DAP.

Site 1: North facing Easy
Average slope: 17 degrees
Average olsen P: 5

Site 2: South facing steep
Average Slope: 22 degrees
Average olsen P: 3

Treatments:

A	Control (0 kg SSP/ha)	= No fertiliser
B	300 kg SSP/ha	= 27 kg P/ha
C	600 kg SSP/ha	= 54 kg P/ha
D	1200 kg SSP/ha	= 108 kg P/ha
E	1700 kg SSP/ha	= 153 kg P/ha
F	150 kg DAP/ha	= 30 kg P/ha 26 kg N/ha
G	250 kg DAP/ha	= 50 kg P/ha 44 kg N/ha

An overview of the results will be presented at the field day.

Greenhouse gas emissions & environmental modelling at Onetai Station

Grant Rennie, AgResearch

The NZ Agricultural Greenhouse Gas Research Centre and the Pastoral Greenhouse Gas Research Consortium (NZAGRC/PGgRc) provided funding for AgResearch to monitor the greenhouse gas (GHG) emissions from Onetai station.

The farm has been monitored for 2015/16 and 2016/17 seasons and compared to a benchmark year of 2014/15 using Farmax Pro® and OVERSEER®® models. This allowed assessment of progress towards adoptable changes, developed by the farm management team, to increase animal production, farm profitability and to reduce GHG emissions intensity and nutrient emissions from the farm.

Over the monitoring period Onetai reduced total GHG emissions by 6% and GHG emissions intensity (the amount of CO2 equivalents that are emitted to produce meat or wool) from 24.9 to 21.0 kg CO2-e/kg product. Drivers of the differences in GHG emissions between years included: fertiliser use, breeding efficiency, sheep to cattle ratio, proportion of trading or finishing stock to maternal stock and total stocking rate.

Although not an explicit focus of the NZAGRC project, nutrient loss from each farm was also reported from the OVERSEER®® files developed for GHG emissions. In many regions of New Zealand, farms are, or soon will be, under some form of nitrogen (N) loss regulation. It is important to understand how the objectives and practice change of one focus area (e.g. the reduction of GHG emissions) affects other parts of the farm (specifically profitability and N loss). The farm systems models used are key to understanding these complex relationships.

Environmental modelling

Total GHG emissions in 2015/16 season were lower than the benchmark year in 2014/15 (Table 1). The additional GHG emissions in 2014/15 were predominantly due to non-biological CO2 emissions from fertiliser production. In this first season, capital fertiliser was applied to around 80% of the pastoral area and was not repeated in subsequent years. The capital fertiliser application also resulted in higher nitrous oxide emissions in 2014/15 as the fertiliser used (DAP) included substantial N inputs. An increase in methane emissions was due to an increase in stocking rate in 2015/16. Further increases in stocking rate occurred in 2016/17, however, finishing stock replaced breeding units and additional increase in methane emissions were limited. In the 2016/17 season, total GHG emissions remained similar to 2015/16, but on farm production increased, improving production efficiency and reducing GHG emissions intensity.

Nitrogen loss to water and atmosphere was similar for 2014/15 and 2015/16 but increased for 2016/17. Summer finishing crops (16 ha) introduced to the farm system in 2016/17 were significant contributors to the annual increase in N loss. It was estimated that around 15% of the total N loss was from the cropping area which was 1% of the total farm area. The use of lamb finishing crops in the farm system added an N loss hotspot but improved N and GHG efficiencies per weight of product.

GHG emissions summary

On Onetai, increases in stocking rate have been made without large increases in methane production due to more efficient animal production systems. Significant capital fertiliser applications are still required to optimise productivity but these will come with increases in non-biological CO_2 emissions due to fertiliser manufacture. If further fertiliser use includes nitrogen fertilisers then nitrous oxide emissions would be expected to increase. However, following the benchmark year capital expenditure on fertiliser has been limited and total GHG emissions has reduced. As finishing animals became a greater proportion of stock units, product output increased and the GHG emissions intensity reduced. Scenario modelling has suggested that once a higher performing, well managed farm system has been reached, total GHG emissions will be higher, but GHG emissions intensity will be lower.

Table 7: Nitrogen (N) and phosphorus (P) losses and greenhouse gas (GHG) emissions at Onetai Station, coastal King Country in 2014/15, 2015/16 and 2016/17

	2014/15	2015/16	2016/17
Methane (kg CO2-e/ha)	1,324	1,350	1,341
N2O (kg CO2-e/ha)	417	378	385
CO2 (kg/ha)	128	33	32
Total CO2 equivalents (kg/ha)	1,869	1,761	1,758
GHG emissions intensity (kg CO2-e/kg product)	24.9	24.8	21.2
N leaching losses (kg N)	18,137	17,509	19,929
N leaching losses (kg N/ha)	11.5	11.1	12.7
N leaching losses (kg N/kg product)	0.153	0.155	0.152
P loss to water (kg P/ha)	0.08	0.50	0.51

Water quality monitoring

Bala Tikkisetty

Water Quality Monitoring at several Waikato River sites began in the 1980's, with other sites being added later. Waikato Regional Council (WRC) measures water quality every month at 115 river and stream sites throughout the region. These include the Waikato, Waipā, Waihou and Piako rivers, the Taupo Lake, and the many streams that flow into them.

Water quality in rivers and streams is influenced by the surrounding land uses and land management practices. In the Waikato region, we find that water quality is generally good in the upland bush areas, but it deteriorates markedly in the lowland farming areas. Water quality is measured by either taking measurements on site or taking samples of water to the laboratory for analysis.

How the quality is measured?

How water quality is assessed depends on its use. Water suitable for some uses may be unacceptable for others. For example, water contaminated with treated sewage may be unsafe for swimming but still suitable for industrial cooling.

The water quality measures are divided into two groups:

- Ecological health—those measuring whether water quality is suitable for plants and animals living in a river
- Human use—those that measure whether water quality is suitable for human use and activities such as swimming. This is also called swimmability.

WRC measures various indicators such as dissolved oxygen, pH, turbidity, total ammonia, temperature, total phosphorus, total nitrogen, base flow water clarity and *E.coli* etc. WRC also monitors stream habitat and invertebrate communities (such as insects, crustaceans and worms) at more than 341 river and stream sites in the Waikato region since 1994.

A wide variety of native and exotic fish, invertebrates, aquatic plants and algae are found in Waikato rivers and streams. The number and type of species found at each site provides an indication of stream health. Over 130 different types of invertebrates have been identified in Waikato Regional Council's ecological monitoring of streams programme.

Studies show that invertebrates differ in their tolerance to pollution and habitat quality. Habitat quality can vary naturally, for example through differences in channel gradient and streambed substrate size, as well as through people-induced factors such as clearance of riparian vegetation. Plants and animals living in the stream may also accumulate contaminants over time.

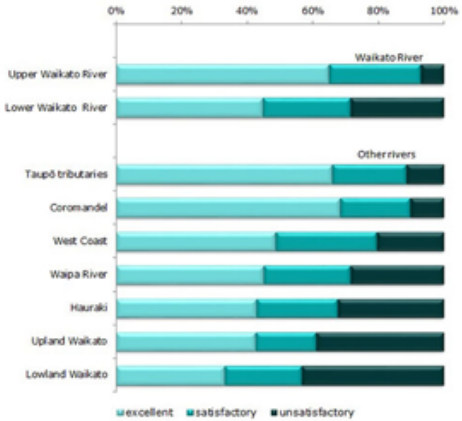
The types of invertebrates that are present in a sample enable us to calculate biological indicators that reflect overall stream health.

The graph below shows the percent of samples from rivers around the region that met or exceeded WRC guidelines for excellent, satisfactory or unsatisfactory water quality for ecological health (2012-2016).

We measure a range of factors, such as water clarity, temperature, oxygen levels and levels of contaminants and chemicals. We use these to provide an overall picture as to whether a site is excellent, satisfactory or unsatisfactory for:

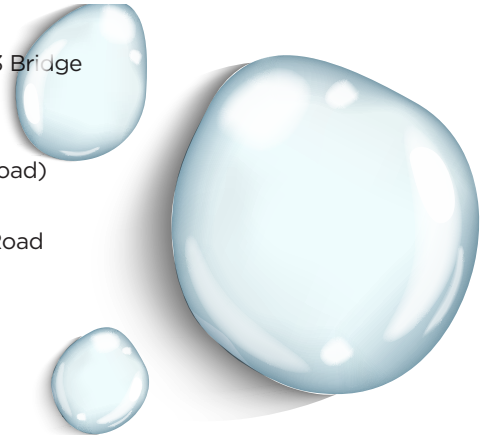
- Swimming (people can fully immerse themselves in the water)
- Ecology (supporting plants and animals that live in water).

Remember there are many other factors that affect safety for swimming, including access and flow rates. Our monitoring reports do not include or provide advice on these.



WRC is monitoring water quality in the following 13 sites in the West Coast of the Waikato Region. The monitoring results show that some of the sites are not meeting the guidelines for swimmability. These are:

- Mokau River at Awakau Road
- Awakino River at Awakau Road
- Manganui River near Manganui Road
- Awakino River at Gribbon Road
- Mokau River at Totoro Road
- Mokauiti Stream at Aria
- Mangaotaki River at State Highway 3 Bridge
- Tawarau River near Speedies Road
- Marokopa River at Te Anga
- Oparau River at Oparau (Langdon Road)
- Waitetuna River at Te Uku
- Ohautira River at Te Uku-Waingaro Road
- Waingaro River at Ruakiwi Road.



Waikato Regional Council—A resource to help you

Onetai Station have been working with Waikato Regional Council to help them achieve their environmental goals. The Council are always keen to work with landowners and have a range of support available, including funding. Farmers are encouraged to talk to their local Catchment Management Officers, or Land Management Advisors.

Funding support

Hill Country Erosion Fund— Environmental works the funding covers:

- Tree planting, including poplar poles and native plants
- Fencing out marginal land or bush from active use
- Riparian management (fencing/planting/stock water)
- Farm plans to identify soils, land use capability and potential projects on your farm
- Other environmental projects.

Funding for the Lower Mokau, Awakino and Mangaotaki catchments—environmental works can be funded with up to 70% subsidy available from Waikato Regional Council.

Funding for all other catchments—environmental works can be funded with up to 35% subsidy available from Waikato Regional Council.

Onetai Station—What has happened and what's planned?

Manganui Catchment: An area of subsiding and mass moving soil was identified above the house and yards. This area has been managed by planting 40 poplar poles to assist with stabilising the soil movement. This area drains into the Manganui River which falls into the Awakino River. Any soil conservation works in the Awakino catchment can be funded at a rate of up to 70%.

Tasman Sea: An area of subsiding and mass moving soil, a wetland, and steep eroding areas above a stream were identified in the Land and Environment Plan as areas Onetai wanted to manage.

Waihi Stream: An area of mass moving and subsiding soil has been treated by planting 60 poplar poles. This area has had some poplar poles planted in the past but required more poplars to help manage this area. This area has the farms main access road above it which makes soil conservation more critical for the farm.

A wetland that was unfenced was prone to pugging and contributing to sediment loss via the Waihi Stream and out to sea. The Northern side of this wetland has now been fenced. A plan is in place to fence the southern side and plant native plants throughout the wetland.

Waioroko Stream: Where the Waioroko Stream enters the Tasman Sea there are areas of steep eroding hillsides. A plan is in place to fence and plant this area in native plants.

Other resources

Menu of Practices to Improve Water Quality:
www.farmmenus.org.nz

Poplar and Willow Trust:
www.poplarandwillow.org.nz (information on poplars and willows including useful factsheets for farmers).

Beef + Lamb New Zealand:
www.beeflambnz.com/compliance/environment
(a range of research and resources related to environmental management on drystock farms).

Who to contact at WRC for soil conservation works in the West Coast Catchment.

South of Te Anga
Adrian Jepson
Ph 0800 800 401
adrian.jepson@waikatoregion.govt.nz

North of Te Anga
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Callum.bourke@waikatoregion.govt.nz

Waikato Regional Council
Te Kaunihera ā Rohe o Waikato

Ministry for Primary Industries
Manatū Ahu Matua

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