OWL FARM
Providing knowledge.

St Peter's · Cambridge
NEW ZEALAND

LINCOLN UNIVERSITY
TE WHARE WĀNAKA O AORAKI

St Peter's School/Lincoln University
Demonstration Dairy Farm

Farm Focus Day

Wednesday, 23 September 2020

PROVIDING KNOWLEDGE

Reflections on Spring.
Production, feed management, managing lameness, auto-draft.

Review of the 2020 calving season.
How did the sexed semen/Wagyu mating stack up?

Edge-of-Field Actions to improve environmental outcomes.
Chris Tanner and James Sukias – NIWA
What are the options?
Capabilities of constructed wetlands.
How has the Owl Farm wetland been performing?

Disclaimer:

While every effort has been made to ensure information provided in this handout was true and correct and the time of going to print, Owl Farm takes no responsibility for the use of data outside of the purpose to inform readers of the current situation at Owl Farm for the purpose of the Focus Day.

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OWL FARM STRATEGY

OWL FARM

Providing knowledge.

ST PETER'S SCHOOL & LINCOLN UNIVERSITY DEMONSTRATION DAIRY FARM

St Peter's Cambridge NEW ZEALAND

LINCOLN UNIVERSITY TE WHARE WĀNAKA O AORAKI

1. **Vision**

   a. **Dairy Farm**

      - To apply proven research, utilising good on-farm practice and scientific monitoring for the farm to be an exemplar in dairy production, financial, environmental and people performance, while maintaining the highest standards of health and safety.

   b. **Students**

      - To encourage more young people into the dairy industry.

2. **Strategic Objectives**

   a. **Dairy Farm**

      - Providing leadership to dairy farmers and the wider community by demonstrating progressive practices that can be achieved on farm.
      - Optimising profit through identifying the appropriate dairy production system for Owl Farm.
      - Achieving a sustainable environmental footprint based on industry good management practice.
      - To attract, train and retain quality employees.

   b. **Students**

      - To provide educational opportunities and exposure to the dairy industry which demonstrates career opportunities to students.

3. **Farm Development Stages**

   a. **Stage 1 Objective (2015/16 – 2017/18)**

      Established credibility by addressing current issues and performance, whilst setting up the farm for future development. During this stage, the farm operated a pasture-based system, with tactical supplementation strategies, based largely on existing infrastructure, to optimise profit while developing a resilient farm system.

   b. **Stage 2 Objective (2018/19 – onwards)**

      Testing and investigating, in conjunction with partners, innovative strategies to lead sustainable profit. The farm system will be developed over years 1-3 and reflect demonstration requirements of industry that are relevant and appropriate at that time point.

HEALTH AND SAFETY

Welcome to Owl Farm. We are a fully operational, commercial dairy farm with a number of potential hazards to both visitors and staff. Many of these hazards cannot be eliminated while also providing access to visitors, therefore all staff and visitors MUST watch for potential hazards and act with caution.

St Peter's School / Owl Farm Hazard Notifications

- Children are the responsibility of their parent or guardian
- Normal hazards associated with a dairy farm
- Other vehicle traffic on farm roads and races
- Races may be slippery

ARE YOU TRAINED FOR WHAT YOU ARE ABOUT TO DO? If not, STOP.

Emergency Contact Information

In the event of an emergency, ensure the scene is safe and raise the alarm to get Owl Farm staff and emergency services to assist.

Emergency Services

- **Fire, Police and Ambulance** **111**
  1716 Cambridge Road, follow Hanlin Road through the school to the farm

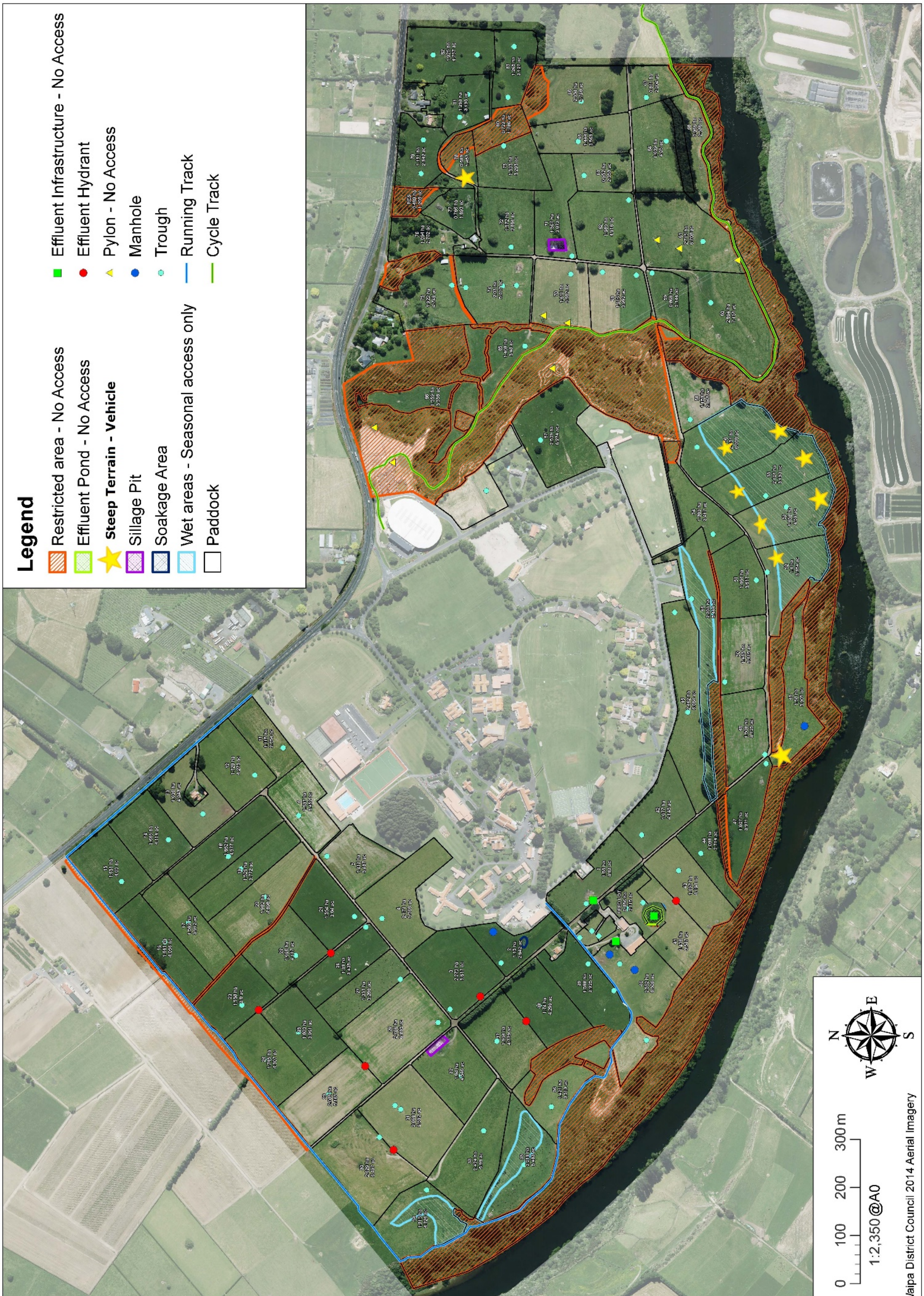
Farm Staff

- Jo Sheridan – Demonstration Manager 021 712 680
- Tom Buckley – Farm Manager 021 058 4916

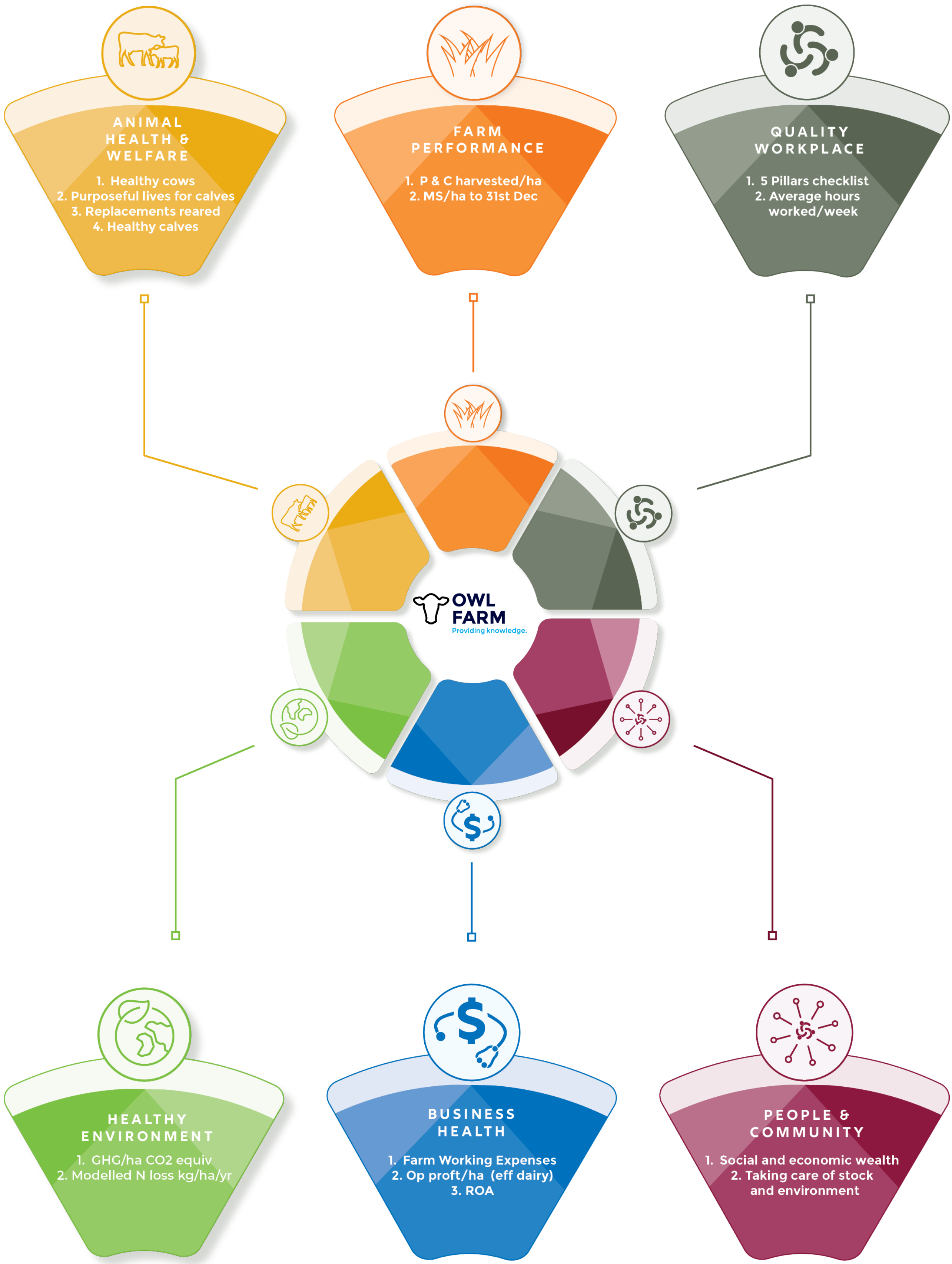
Safety Equipment Location

- First Aid Kits: Dairy Shed and Vehicles
- Fire Extinguishers: Dairy Shed and Tractor
- Defibrillator: Main Office and St Peter's Medical Centre

By entering Owl Farm and signing in at registration, you are acknowledging your understanding of any potential hazards and agree to take personal responsibility and act in such a manner as to protect yourselves and others also on-farm.


Legend
Restricted area - No Access
Effluent Pond - No Access
Steep Terrain - Vehicle
Sillage Pit
Soakage Area
Wet areas - Seasonal access only
Paddock
Effluent Infrastructure - No Access
Effluent Hydrant
Pylon - No Access
Manhole
Trough
Running Track
Cycle Track
0 100 200 300 m
1:2,350 @A0
Waipa District Council 2014 Aerial Imagery
N
E
S
W

OWL FARM WAGON WHEEL KPIS – STAGE 2



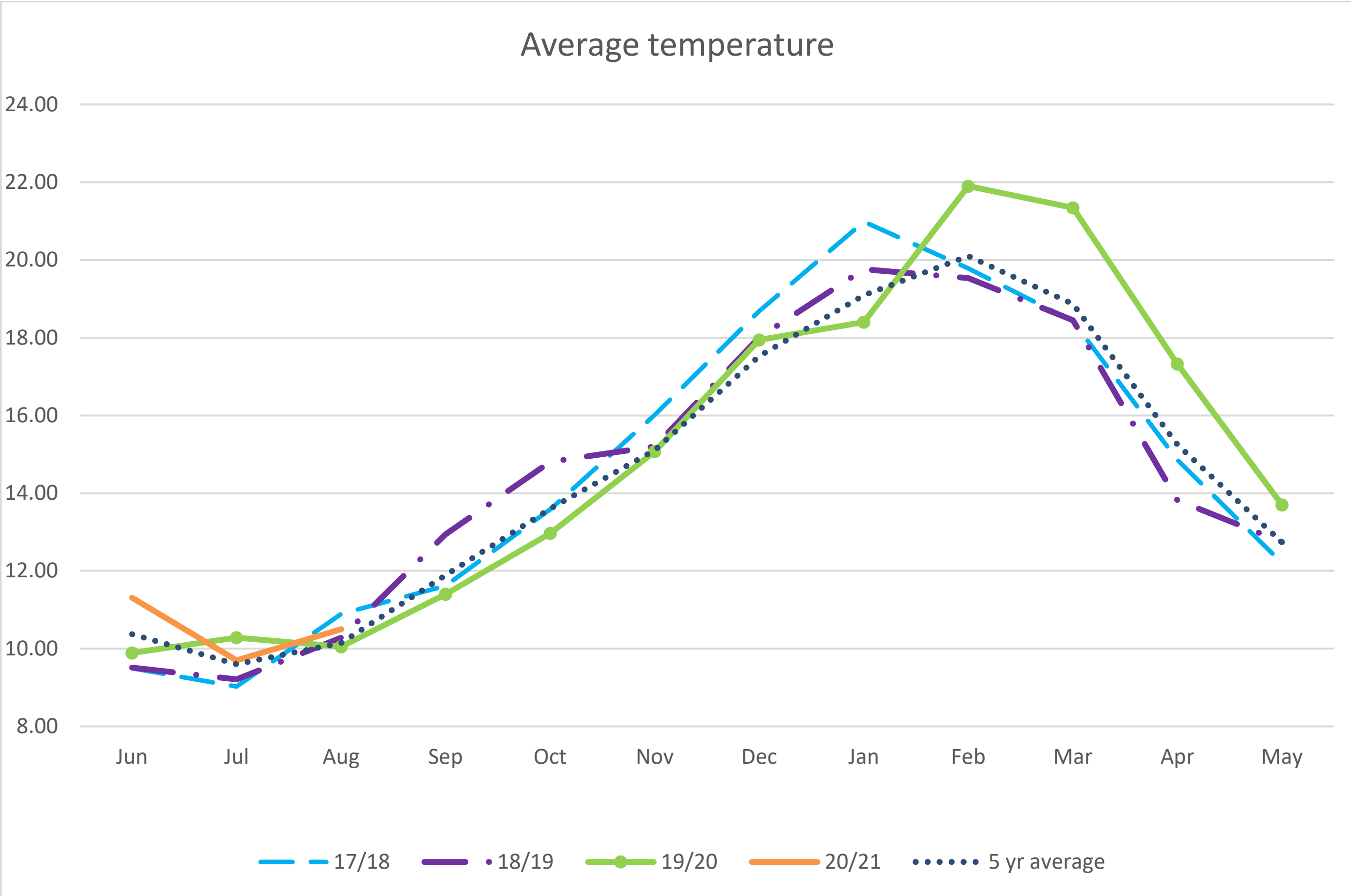
OWL FARM MULTI-YEAR SNAPSHOT

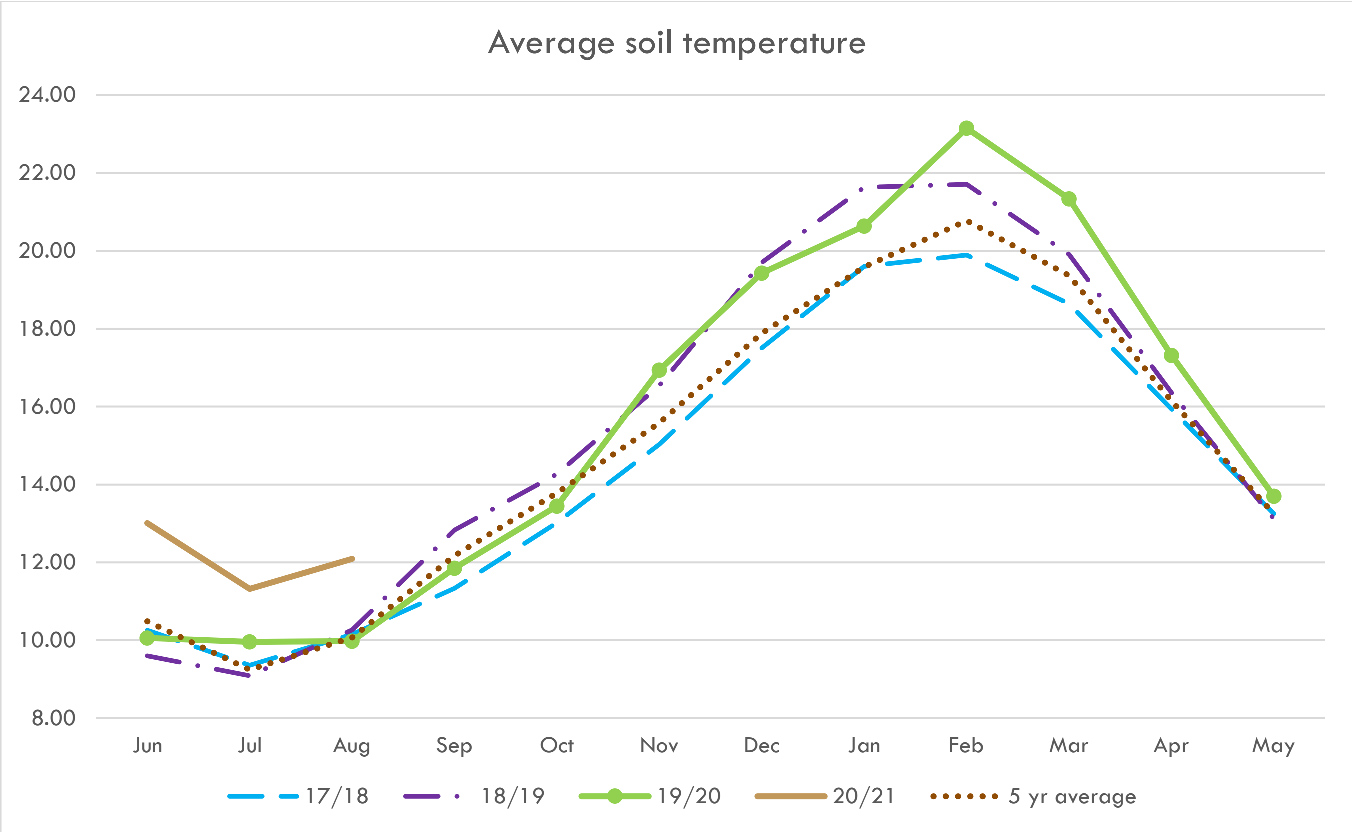
	Year	2017-2018	2018-2019	2019-20
Physical Info	Total farm area	164	164	164
	Effective area (ha)	148	147.3	147.5
	Effective area leased (ha)	18	18	22
	Leased run off (ha)	5	3+12	5+5
	Cows wintered	441	419	421
	Peak cows (1 Nov)	418	406	405
	Peak stocking rate cows/ha	2.82	2.76	2.75
Production	Total kg MS	168,169	169,359	167,185
	MS/cow	402	417	413
	MS/ha	1,136	1,150	1,133
	MS/ha from homegrown feed	978	1,013	931
	MS as % liveweight	86.5%	89.7%	86%
	Average SCC	146,000	172,000	162,000
Feed and Inputs	Feed grown T DM/ha	17.5	15.7	13.9
	Feed harvested T DM/ha (actual kg)	13.6	14.1	12.2
	Feed harvested T DM/ha (@11MJ ME/kg DM)	13.7	13.2	
	Supplements imported T DM/ha	2.3	2.1	3.0
	Supplements imported T DM	335	306	440
	% diet imported	11%	11.8%	25%
	% of farm cropped & harvested (silages)	33%	93%	45%
	Nitrogen applied/effective ha	150kg	150kg	139kg
Financials	Gross farm revenue/kg MS (including stock/dividend)	$7.56	$6.86	*$7.87*
	Cash farmgate milk price/kg MS (Dairybase)	$6.39	$6.43	*$7.51*
	Accrued farmgate milk pric /kg MS	$6.66		
	Stock sales/kg MS	$0.54	$0.43	*$0.36*
	Dividend/kg MS	$0.36	$0.00	*$0.00*
	FWE/kg MS	$4.28	$4.41	*$4.80*
	OPEX/kg MS (inc dep^n & feed inv)	$4.59	$4.72	$5.32
	EFS/ha actual payouts (cash milk rev) Dairybase	$3,096	$2,482	*$2,891*
	EFS/ha actual payouts (accrued milk rev)	$3,446	$2,395	
	EFS/ha @ $6.00 farmgate milk price (no div)	$2,102	$1,922	
	Opening debt/kg MS held	$21.23	$23.02	*$21.61*
Enviro	Estimated N loss kg/ha	35	35	33
	Estimated P loss kg/ha	0.8	0.9	0.8
	GHG loss/ha Overseer FM kgCO_2e/ha	11,900	11,740	11,264
	Biological GHG/ha (methane + nitrous oxide)	9,824	9,361	9,030
	N conversion efficiency	24%	24%	25%
	Cowshed	36 Rot	36 Rot	36 Rot
	Feed infrastructure	NIL	NIL	NIL
	Herd BW/PW	112/135	119/153	159/186
	Industry BW/PW	72/93	64/73	93/117
	Effluent storage	*New lined pond*		
	% farm effluent applied to	51 ha 34%	51 ha 34%	51 ha 34%

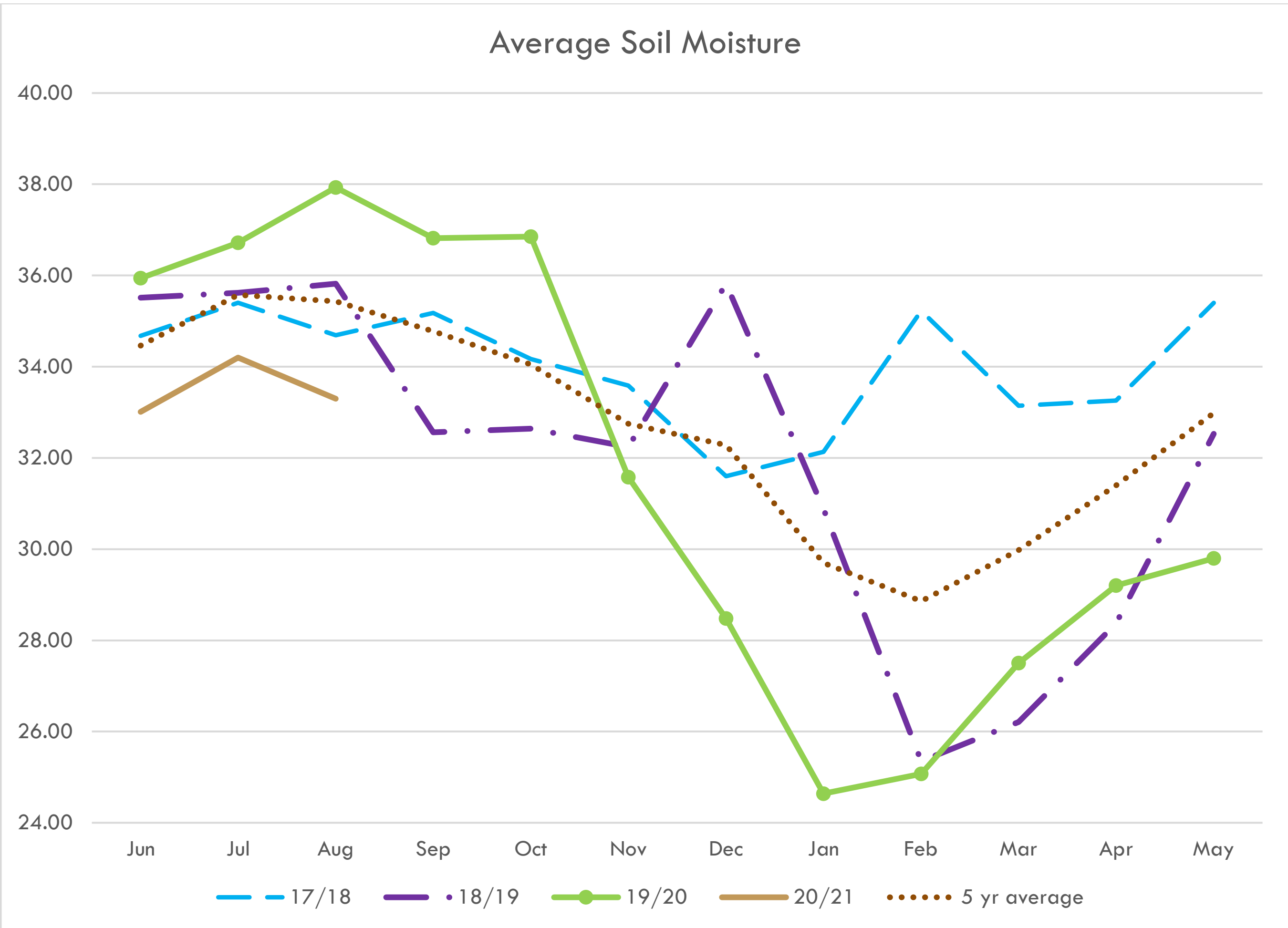
**Estimates in italics*

CLIMATE

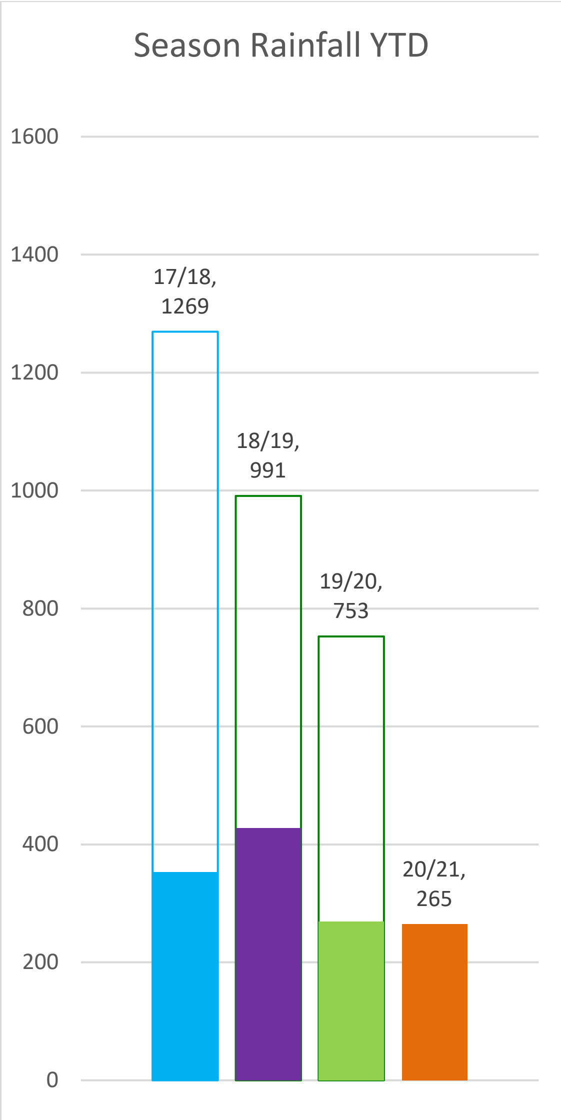
The start of the 2020 season has been blessed with warm dry winter weather. Recovery from the drought was rapid and we didn't need as much feed as we thought to get through the winter. Good grazing conditions have seen excellent feed utilisation, less pasture damage, less wear and tear on machinery and a more enjoyable calving for the team. Although average temperatures have normalised through July and August, the significant trend is much higher soil temperatures and lower soil moisture levels. These are indicating a benefit to getting our summer crops in earlier this year. The Met Service is also predicting a drier than usual September and warmer temperatures. Our response has been to secure extra silage from off farm and focus on getting crops in as our first surplus management tool, with silage second.



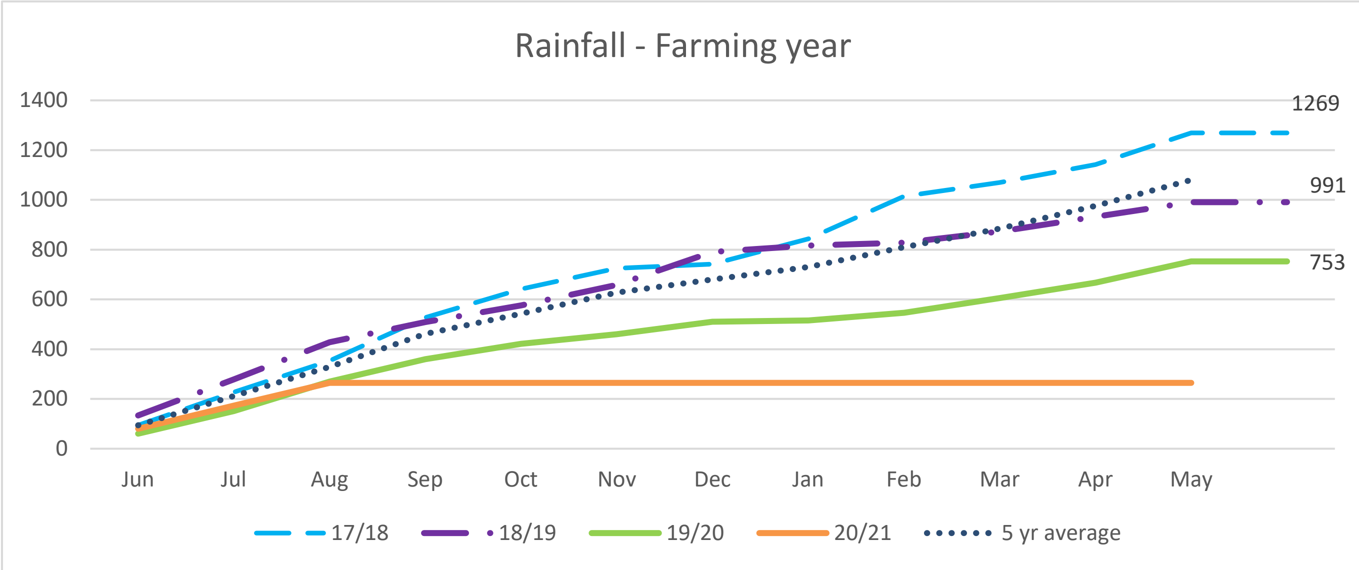

Average soil temperature
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
17/18
18/19
19/20
20/21
5 yr average


Average Soil Moisture
40.00
38.00
36.00
34.00
32.00
30.00
28.00
26.00
24.00
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
17/18
18/19
19/20
20/21
5 yr average

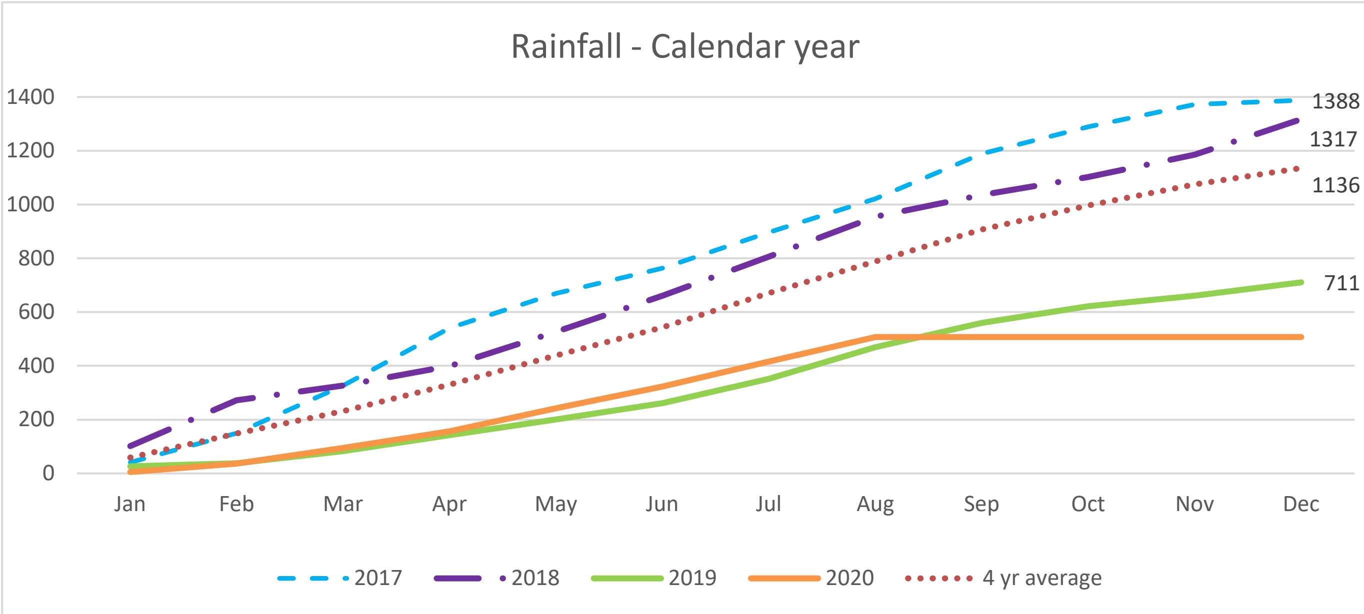
RAINFALL



Season Rainfall YTD
1600
1400
1200
1000
800
600
400
200
0
17/18, 1269
18/19, 991
19/20, 753
20/21, 265



Rainfall - Farming year
1400
1200
1000
800
600
400
200
0
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
1269
991
753
17/18
18/19
19/20
20/21
5 yr average

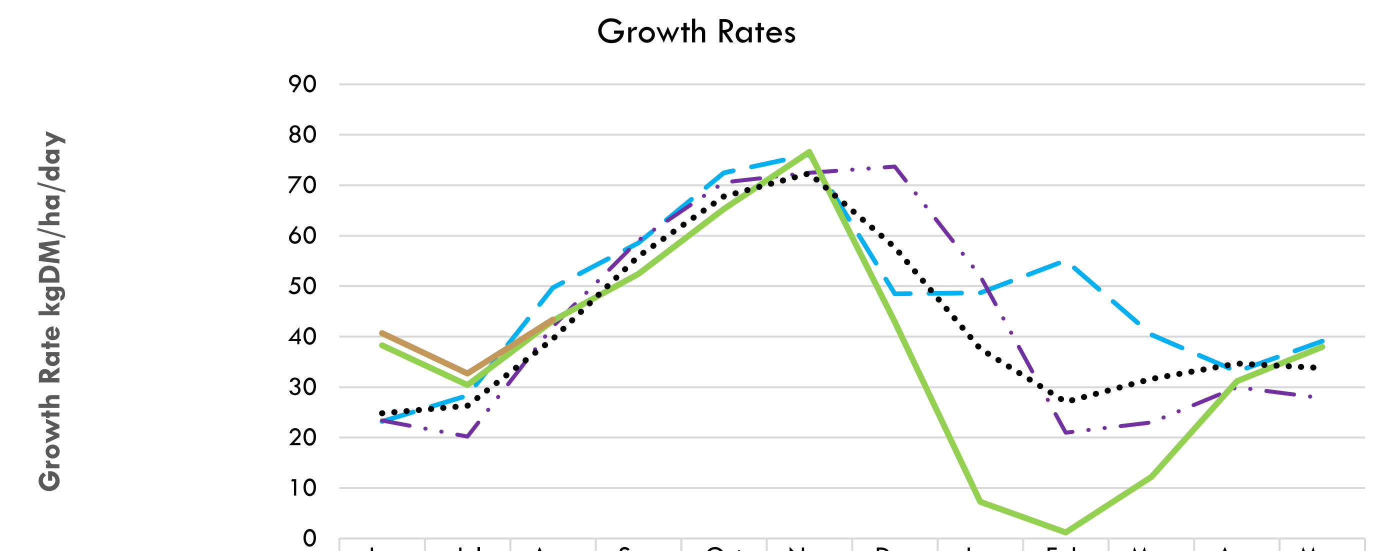


Rainfall - Calendar year
1400
1200
1000
800
600
400
200
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
1388
1317
1136
711
2017
2018
2019
2020
4 yr average

FARM PERFORMANCE

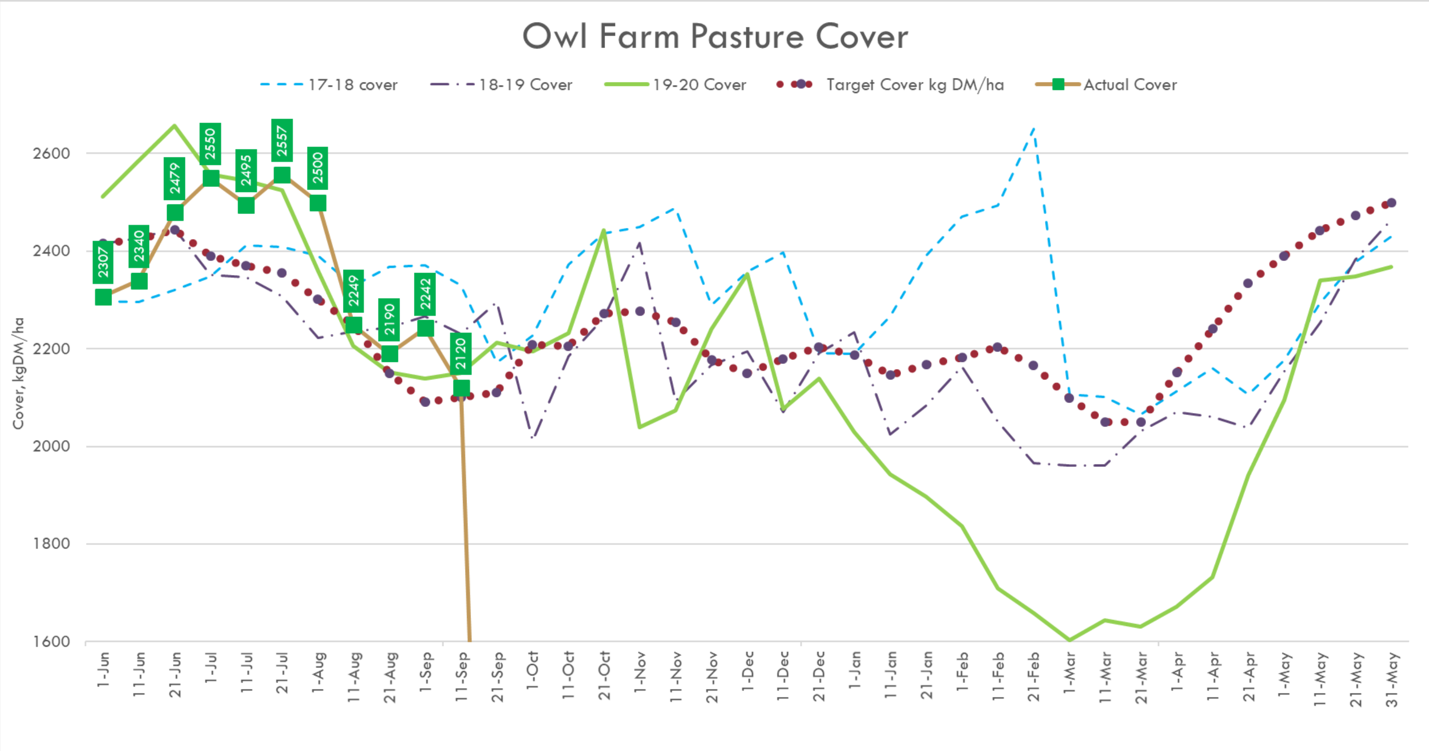
	Season to date 31/08/2020	2017-2018	2018-2019	2019-2020	2020-2021
Stock	Milking Platform	148	147	147	144
	Cows on farm	428	411	407	410
	Peak cows	418	406	405	405
	Cows calved	378	366	392	388
	Cows in vat today	372	346	383	377
	Peak stocking rate	2.82	2.76	2.75	2.81
Production	Total kgMS Season to date to factory	27,990	27,607	29,691	25,595
	MS/cow/day - last 10 days	2.04	2.22	2.16	2.19
	MS/ha/day - last 10 days	4.85	5.20	5.49	5.25
	MS/cow Season to date	67	68	73	63
	MS/ha Season to date	189	187	201	178
	MS/ha from homegrown feed to date	138	153	186	168
Feed and Inputs	Average Pasture Cover 1 June	2,256	2,430	2,516	2,517
	Pasture growth rates total TDM/ha	3.1	2.6	3.4	3.6
	Actual pasture grown to graze and harvest as silage excl area sprayed out in crop	2.8	2.5	3.0	3.0
	Total pasture supply TDM/ha	2.8	2.5	3.0	3.0
	Yield of Crop grown per total farm /ha	0.0	0.0	0.0	0.0
	Winter homemade silage on hand fed	0.2	0.8	0.6	0.1
	Imported Supplements fed/ha	1.2	0.7	0.3	0.2
	Total Feed supply TDM/ha	4.2	4.1	3.9	3.3
	Homegrown grass eaten TDM/Ha (grown this year)	2.4	2.0	2.7	2.5
	Homegrown silage grown and eaten this year	0.0	0.0	0.0	0.0
	Crop eaten per total farm/ha	0.0	0.0	0.0	0.0
	Homegrown feed EatenTDM/ha (grown this year)	2.4	2.0	2.7	2.5
	Silage harvested TDM/ha Season to date	0.0	0.0	0.0	0.0
	Total Homegrown feed Harvested TDM/ha	2.4	2.0	2.7	2.5
	Winter homemade silage on hand eaten	0.2	0.6	0.5	0.1
	Imported Supplements Eaten TDM/ha	0.9	0.6	0.3	0.2
	Total Feead eaten this year (includes only silage fed) TDM/ha	3.4	3.3	3.4	2.7
	% Feed eaten grown on farm	73%	82%	92%	94%
	Feed conversion Eff (kgDM/kgMS eaten)	18.3	17.4	16.9	15.2
	Nitrogen Applied/effective ha	37	38	38	28

GROWTH RATES



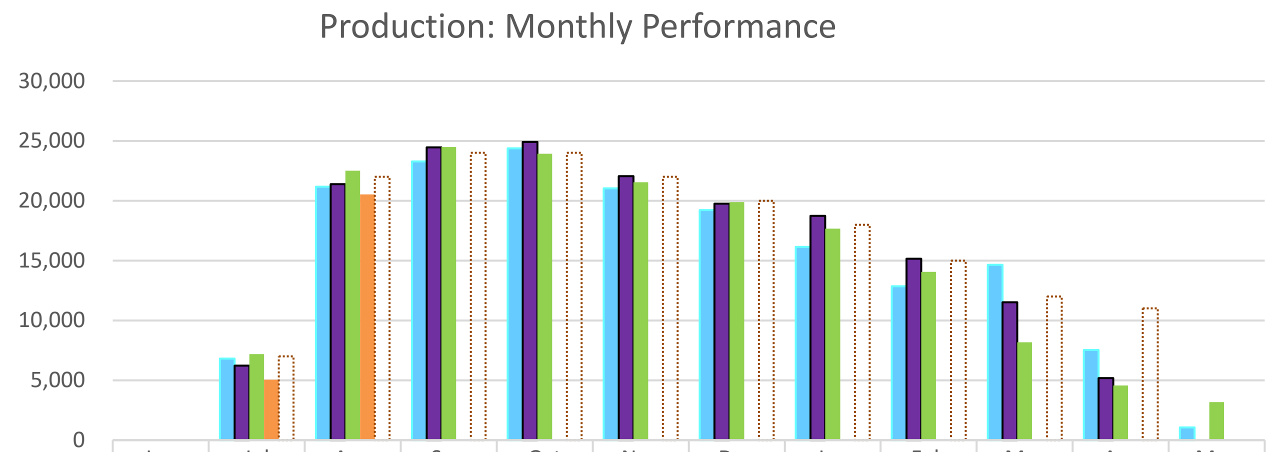
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
2017-18	23	28	50	59	73	76	49	49	55	40	33	39
2018-19	23	20	42	59	71	73	74	52	21	23	30	28
2019-20	38	30	43	52	65	77	43	7	1	12	31	38
2020-21	41	33	43									
Long term average	25	26	40	56	68	72	58	38	27	32	35	34

PASTURE COVER



PRODUCTION

As at 18/9/2020 the herd had produced 39,681 kg MS, which is 8.7% behind last season's production. For the month of September, we are tracking 2.2% ahead.



	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
17/18 Production		6,807	21,183	23,287	24,376	21,030	19,213	16,158	12,856	14,641	7,549	1,070
18/19 Production		6,216	21,391	24,460	24,906	22,042	19,744	18,745	15,165	11,509	5,181	
19/20 Production		7,184	22,507	24,485	23,924	21,544	19,879	17,675	14,070	8,179	4,564	3,173
20/21 Production		5,052	20,543									
Budgeted 20/21		7,000	22,000	24,000	24,000	22,000	20,000	18,000	15,000	12,000	11,000	0

17/18 Production   18/19 Production   19/20 Production   20/21 Production   Budgeted 20/21

Herd test data below showed that heifers' production levels were 77% of their mixed-age herd mates.

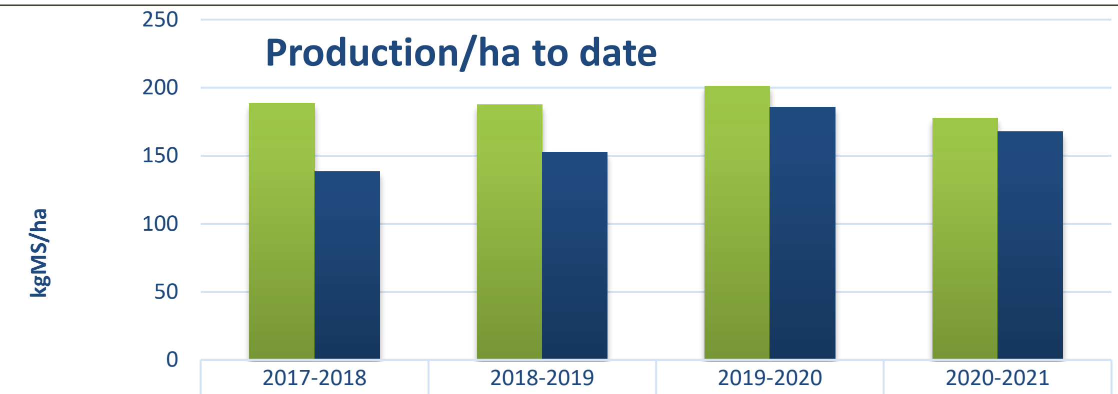
Test day production averages for 02/09/2020

Print

Age group	No. of animals	Milk (l)	Fat (%)	Fat (kg)	Protein (%)	Protein (kg)	Milksolids (kg)	SCC (000)
2 Years	64	20.40	5.04	1.03	3.73	0.76	1.79	47
3 Years	67	27.40	4.66	1.28	3.72	1.02	2.29	59
4-8 Years	194	28.00	4.93	1.38	3.79	1.06	2.44	128
9+ Years	33	25.90	4.97	1.29	3.77	0.98	2.27	454
Animals Excluded								
Whole Herd	358	26.30	4.90	1.29	3.76	0.99	2.28	131

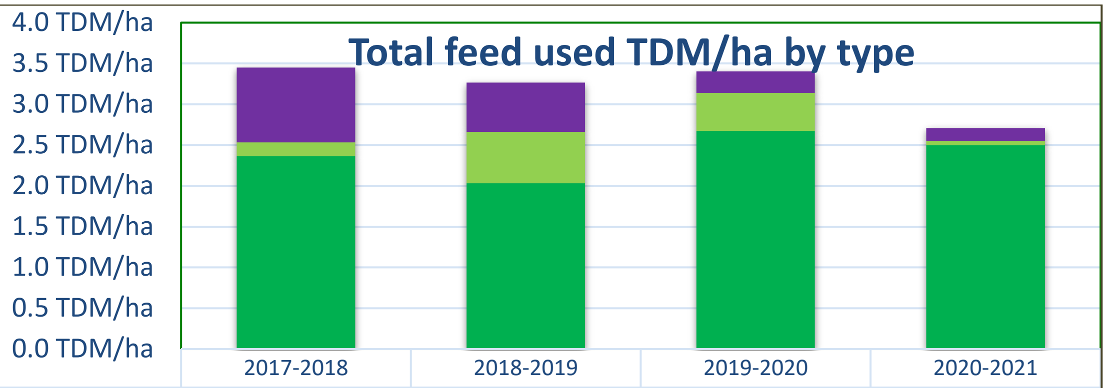
MS/HA FROM HOME-GROWN FEED

Even though production/ha season to date is lower than last season, we have once again produced more of it from our home-grown feed. This year we have used approx. 11 t sorghum silage and 8 t DM hay for the springer cows to manage energy intake. We have fed 10 t wet weight of Calcimol Molasses and 25 t DM of PK to the Colostrum and Milkers.



	2017-2018	2018-2019	2019-2020	2020-2021
MS/ha Season to date	189	187	201	178
MS/ha from homegrown feed to date	138	153	186	168

FEED SUPPLY AND DEMAND GRAPH



	2017-2018	2018-2019	2019-2020	2020-2021
Imported Supplements Eaten TDM/ha	0.9	0.6	0.3	0.2
Crop eaten per total farm/ha	0.0	0.0	0.0	0.0
Homegrown silage grown and eaten this year	0.0	0.0	0.0	0.0
Winter homemade silage on hand eaten	0.2	0.6	0.5	0.1
Homegrown grass eaten TDM/Ha (grown this year)	2.4	2.0	2.7	2.5
Total Feed eaten this year (includes only silage fed) TDM/ha	3.4	3.3	3.4	2.7
% Feed eaten grown on farm	73%	82%	92%	94%

CROP PLAN

Changes to this season's crop plan include growing an extra 1 ha of kale, because it fits well with our system and will cover any expected shortfall in summer feed. We have also opted to grow 4.7 ha of chicory to graze weaners on at our runoff lease block.

Ha	Variety	Sow date
4.71 (runoff)	Puna II Chicory	25th September
4.47	Firefly cleancrop Kale	1st October
6.55	Turnips	15-20th October

BUSINESS HEALTH

Early season cashflow monitoring shows that income is on track with variances created due to lower than expected milksolids production, and now featuring income from land leased that was not included in the original budget. The income from the Wagyu calves has not been included yet.

Total expenses for season to date are lower than expected, primarily due to less PK being needed and less feeding out expenses including staff time. There are still some expenses that have not yet been processed which include N fertilizer in August. Grass silage purchased and race maintenance expenses will feature in September.

Owl Farm - For Year Ended: May 2021

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St Peter's Cambridge

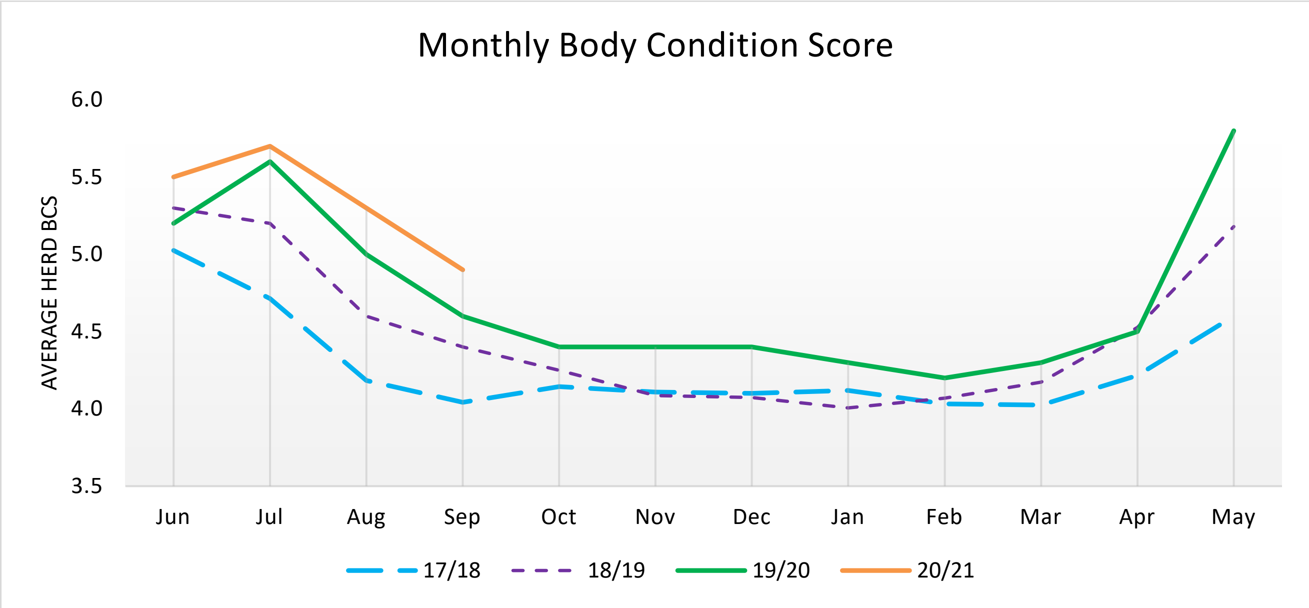
LINCOLN UNIVERSITY

INCOME	Jun-20	Jul-20	Aug-20	Total	Budget YTD	Variance YTD	Budget Full Year
Milk Solids KG	-	5,052	20,543	25,595	29,000	(3,405)	175,000
Milk	67,990	71,112	75,431	**214,534**	204,596	9,938	1,210,382
Dividends	-	-	-	**-**	-	-	-
Cattle	-	1,187	12,942	**14,129**	22,700	(8,571)	70,770
Other Income	-	3,930	3,930	**7,859**	-	7,859	-
Total Income	**67,990**	**76,229**	**92,303**	**236,522**	**227,296**	**9,226**	**1,281,152**
EXPENSES	**Jun-20**	**Jul-20**	**Aug-20**	**Total**	**Budget YTD**	**Variance YTD**	**Budget Full Year**
Wages	10,940	10,163	18,406	**39,510**	44,877	(5,367)	182,508
Animal Health	7,933	9,770	1,068	**18,771**	16,000	2,771	57,000
Breeding	315	225	535	**1,075**	715	360	39,851
Dairy Shed and Electricity	219	1,537	960	**2,716**	7,510	(4,794)	24,040
Purchased Feed	4,446	9,227	557	**14,230**	30,419	(16,189)	85,075
Grazing - Replacement Heifers & Calves	-	5,226	5,226	**10,452**	12,600	(2,148)	70,600
Fertiliser	(981)	-	152	**(829)**	8,421	(9,250)	65,053
Gibberellic Acid	-	-	-	**-**	-	-	-
Fertiliser Spreading	-	-	677	**677**	-	677	5,984
Freight	-	606	119	**725**	155	570	3,619
Cartage	48	-	-	**48**	905	(857)	8,855
Weeds and Pests	-	335	-	**335**	1,322	(987)	2,500
Consultancy	-	-	-	**-**	-	-	4,000
Silage	-	-	-	**-**	-	-	47,450
Cropping	-	-	-	**-**	-	-	10,750
Regrassing	2,700	-	-	**2,700**	-	2,700	22,800
R&M	3,448	6,008	1,001	**10,457**	13,500	(3,043)	103,850
Vehicle Expenses	2,226	1,972	2,574	**6,772**	7,377	(605)	12,708
General	3,230	2,614	2,628	**8,473**	13,130	(4,657)	50,359
Overheads	1,719	1,719	1,719	**5,157**	7,194	(2,037)	47,557
Total Farm Working Expenses	**36,243**	**49,402**	**35,622**	**121,267**	**164,125**	**(42,858)**	**844,559**
Net Surplus before Financial Charges	**31,747**	**26,828**	**56,681**	**115,255**	**63,171**	**52,085**	**436,593**
Financial Charges	**Jun-20**	**Jul-20**	**Aug-20**	**Total**	**Budget YTD**	**Variance YTD**	**Budget Full Year**
Interest Cost	14,106	14,106	14,106	**42,318**	33,999	8,319	135,996
Lease Land	3,103	3,103	3,103	**9,310**	12,204	(2,894)	48,816
Depreciation	8,000	8,000	8,000	**24,000**	24,000	-	96,000
Total Financial Charges	**25,209**	**25,209**	**25,209**	**75,628**	**70,203**	**5,425**	**280,812**
Surplus (Deficit) after Financial Charges	**6,538**	**1,618**	**31,471**	**39,627**	**(7,032)**	**46,659**	**155,781**

ANIMAL HEALTH AND WELFARE

BODY CONDITION SCORE

Dry-off decisions made through last summer have ensured that we started the season exceeding BCS targets. Even though BCS has been higher than ever all winter/spring, the cows have still dropped 0.8 BCS from Planned Start of Calving to Planned Start of Mating.



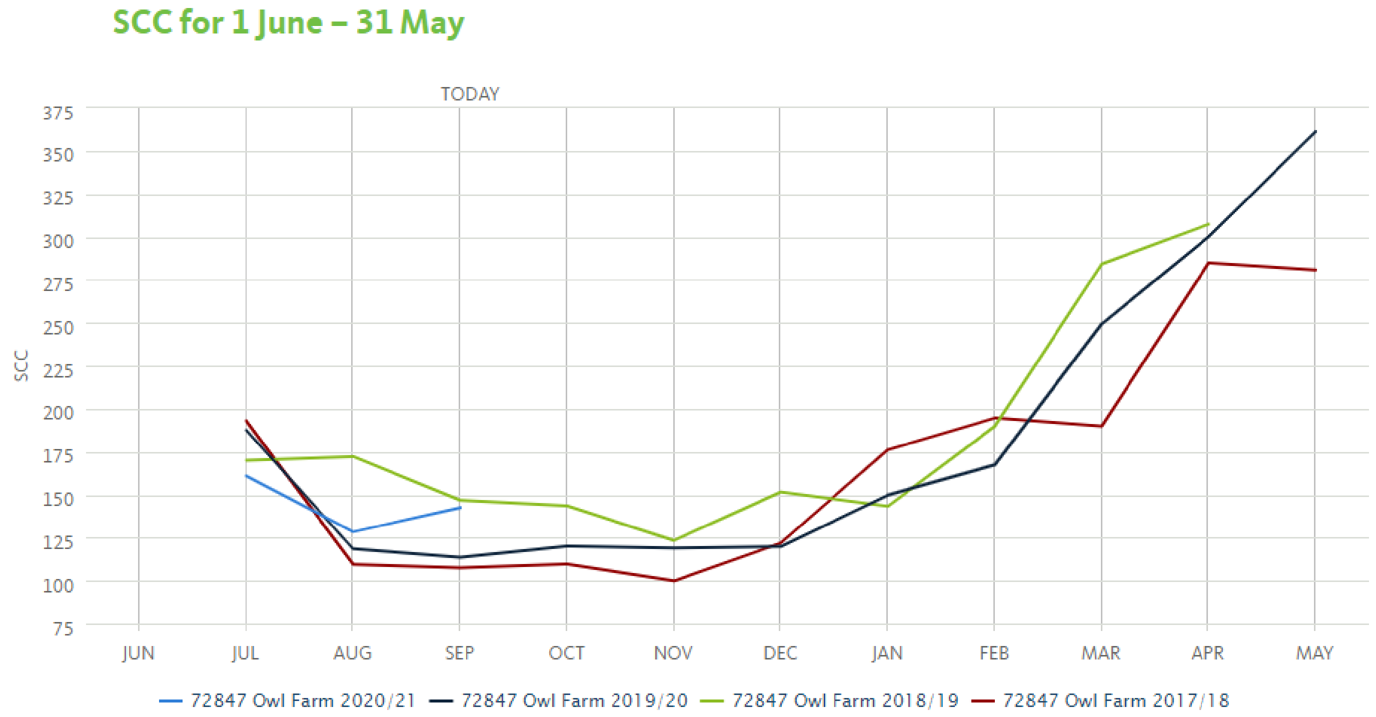
TAIL SCORING

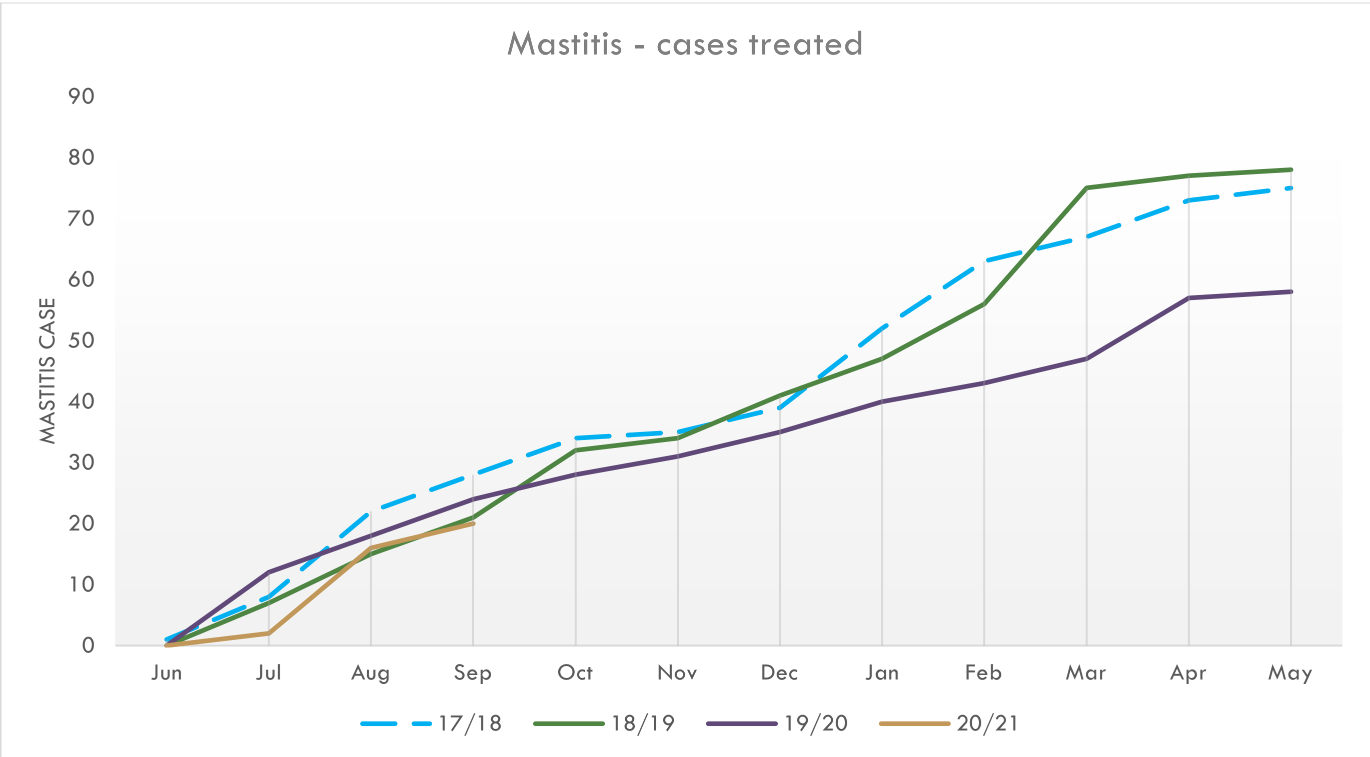
This season we carried our first-ever tail score assessment during our standard BCS process with Pete Briston from Cambridge Vets.

The first assessment is to gain an understanding of the current state of the herd. Subsequent assessments then allow you to assess stock handling practices and/or infrastructure that may be causing damage. On 6th July, seven MA cows and heifers were identified with an existing tail dislocation or break (1.7%). On 17th August another assessment was undertaken, with only one status change. This was a great result and reflection of the care taken with stock handling and movement through the yards and platform and during calving. We will continue to monitor before and after calving each year as standard practice. We link it into our BCS assessment so it only costs a small amount of extra time to capture this data.

SCC (SOMATIC CELL COUNT)

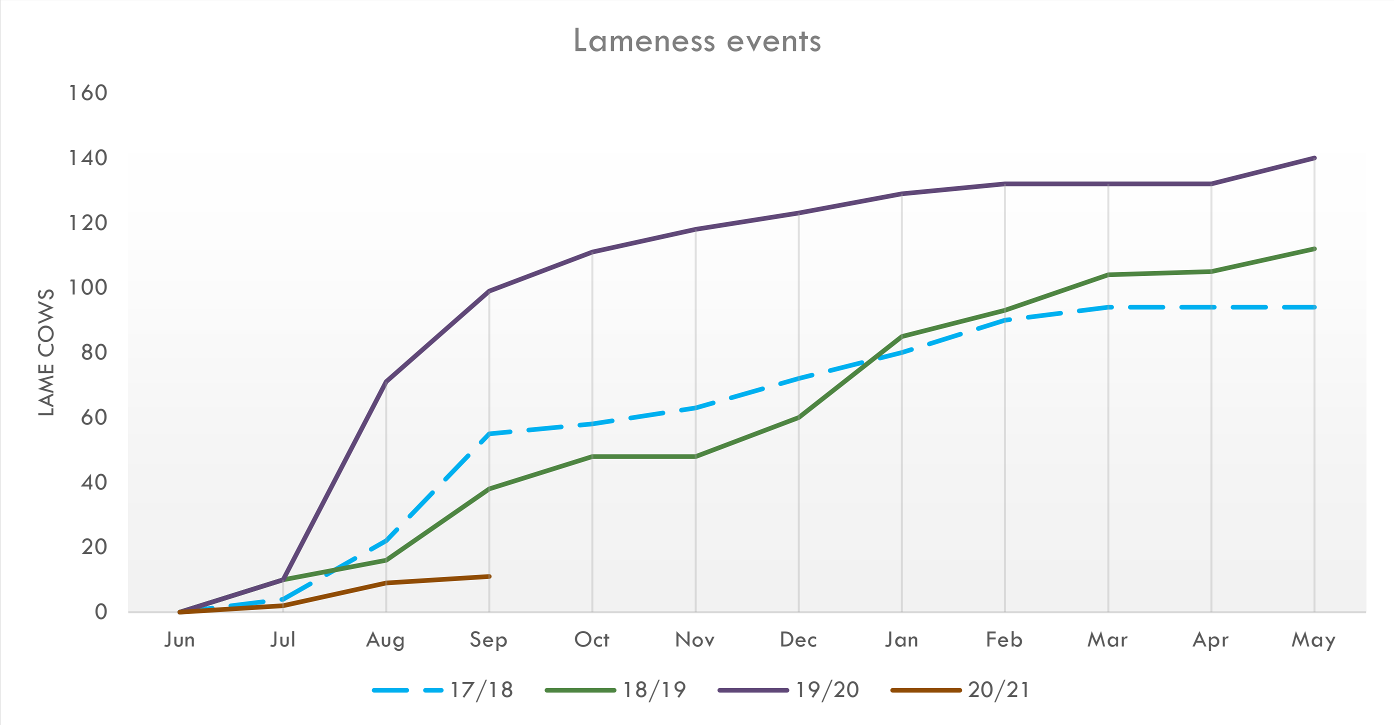
Keeping cows in the colostrum herd for an extra few days this season has enabled more time to be spent on checking milk and udder quality prior to entering the main herd. Cows are always stripped and paddle-tested before entering the main herd, with any marginal cows staying in the colostrum mob a little longer until they are clear. We have used whole herd stripping on occasion when needed. Cell count has started tracking higher but without the associated numbers of clinical cases.





LAMENESS

More cows were identified as lame last year compared with previous years, partially due to our lower tolerance levels to draft out a cow and check feet or rest them. A lame case is recorded if a cow is drafted out of her herd regardless of the treatment. The number of cows treated with antibiotics for lameness last season was 26, or 6.5%.



This is a critical area for animal welfare and performance, so we enlisted the help of our Healthy Hoof provider, Bill Hancock from Cambridge Vets, and recorded film footage of cow movement on the yard to contribute to our review.

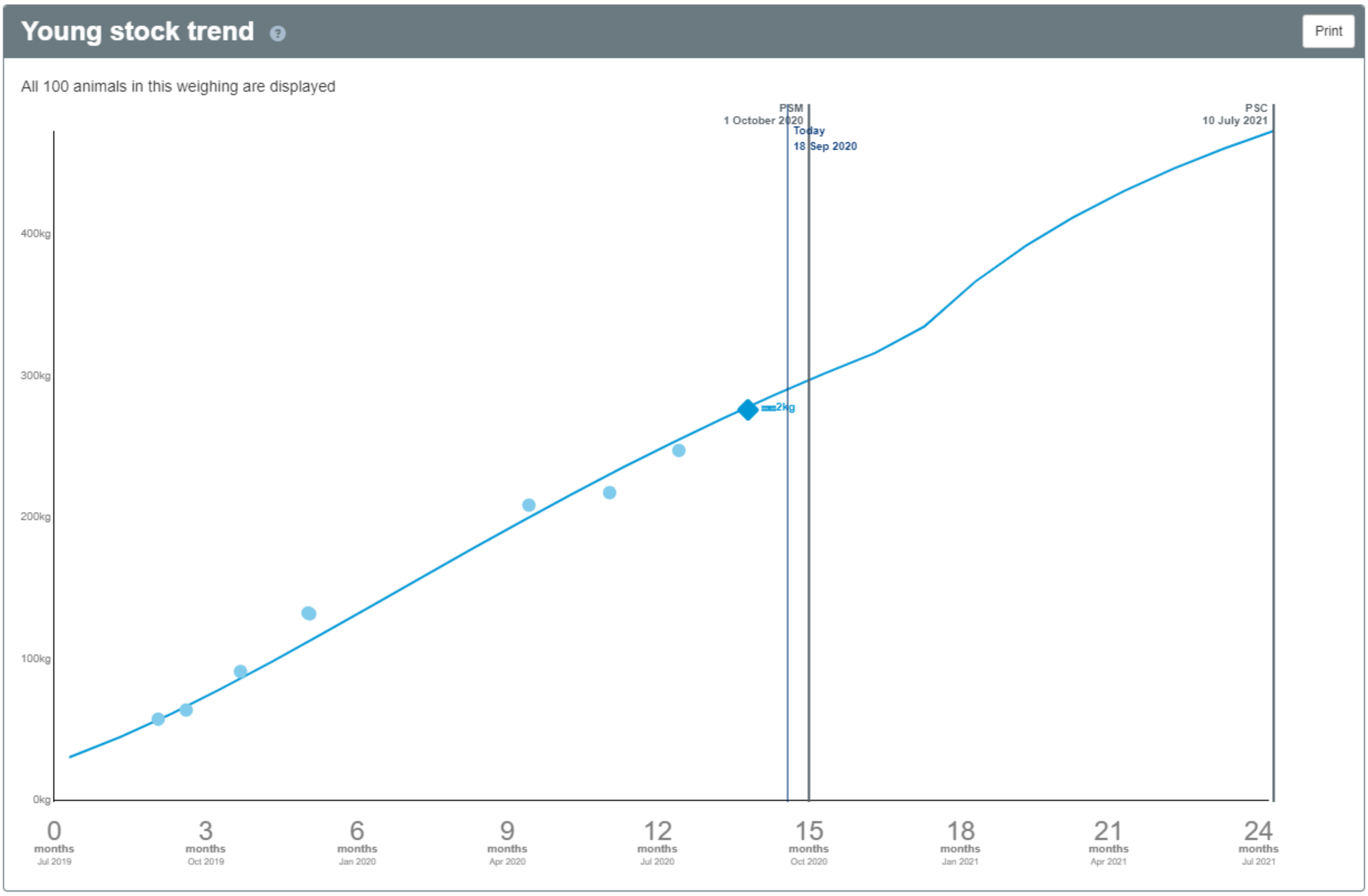
Key actions undertaken so far for the 2020-21 season include:

- Install mirror for backing gate operator
- Only use the backing gate to take the space behind half the herd that is already facing the entry to the platform. This allows the remaining cows to turn around (in their own time after entry to the yard) before the backing gate takes the space behind them.
- Update recording board at lameness treatment area to align with DairyNZ Healthy Hoof app, including which hoof and potential issues
- Trial Batt-latch time release gate openers to reduce pressure on movement to the shed.
- Investment of over $30,000 on race work last autumn to remedy some sharp stony race surfaces

We have significantly reduced the incidences of lameness this season, with only 2.6% of cows recorded as lame so far compared with 17% last season. So far this season only two cows have been treated with antibiotics for lameness.

LIVESTOCK GROWTH

Last season was challenging for graziers to achieve heifer replacement targets. We made the decision on 17th April to bring our 2018-born heifers home from grazing after they lost weight in March. They managed to put on 39kg and weighed 455 kg, on average, on 3rd June. The calves also came home on 11th May as they transitioned to their new grazier. A team effort including investing in extra supplements has got the R2s back on track weighing an average of 276 kg on 25th August. We still have 27% under target weight; these are being managed carefully to support improved reproductive performance.



REVIEW OF SEXED SEMEN/WAGYU MATING PLAN

KEY PERFORMANCE INDICATORS

1. Maintaining or improving current reproduction performance

- 74% 6-week in-calf rate ✓ 74%
- 13% Not-In-Calf rate ✓ 10%
- 84 day mating duration ✓
- 70 day calving period ✓

2. Maintain heifer replacement rate of 25% ✓
3. Accelerated genetic gain through generating replacements from the top 75% of the herd ✓
4. Creating a marketable, value-add product through the Wagyu/Hereford Dairy cross programme ✓
5. Make a shift towards A2A2 semen

MATING & CONCEPTION RATES 2019

Product	Number of straws	Cows conceived	Conception rate
Conventional Semen	252	126	50%
Liquid Sexed Semen	172	88	51%
SGL Dairy	112	48	43%
Wagyu/SGL Hereford	182	96	53%
TOTAL	718	358	50%

* SGL Dairy was used from weeks 7 to 12 of mating. We anticipate reduced conception rates during this period as the inseminations are conducted on generally less fertile cows; this decline is recorded nationally as mating weeks progress in line with the SGL Dairy result above.

SEXED SEMEN MATING CRITERIA

- Top 75% selected on BW
- Health status (SCC, Mastitis, Lameness etc)
- Age 2-8 years
- Had a pre-mating heat

Mate the best cows on the day that matched the above criteria

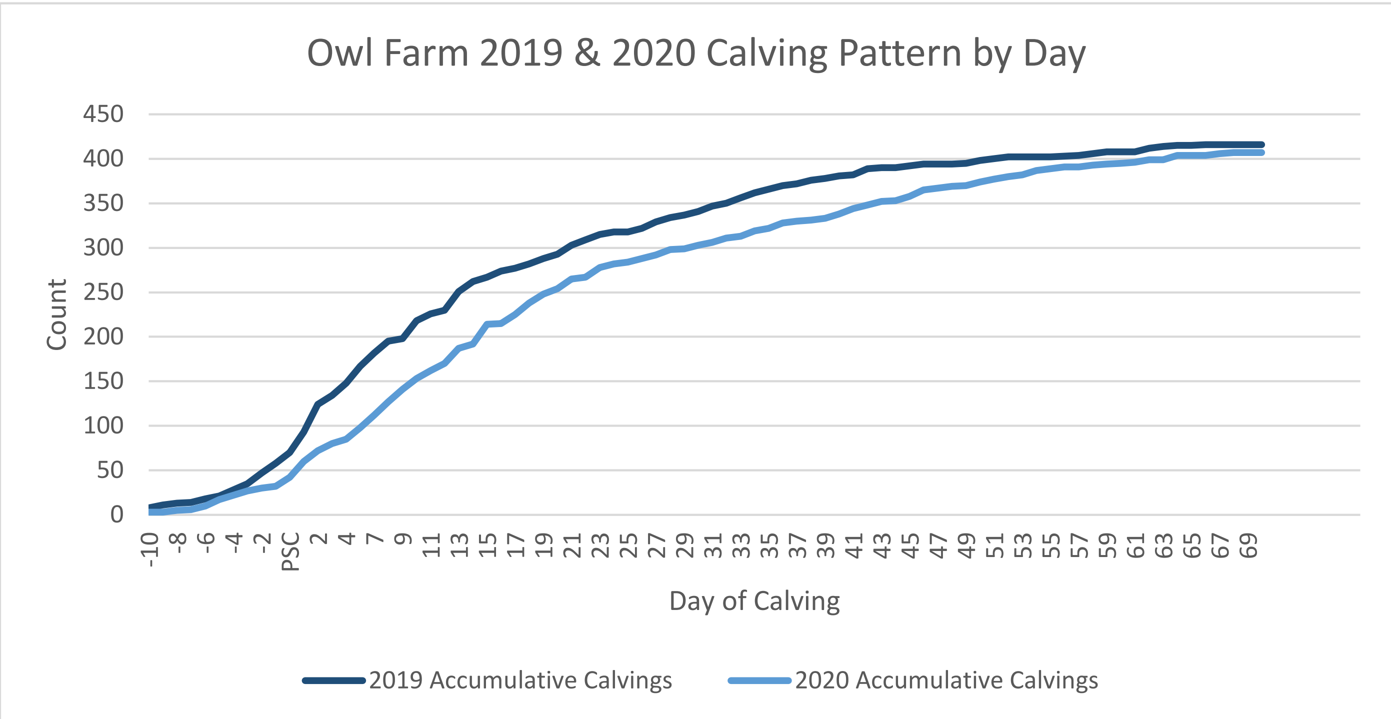
MATING PROGRAMME COSTS

Prices standardised to LIC 2019 pricing schedule

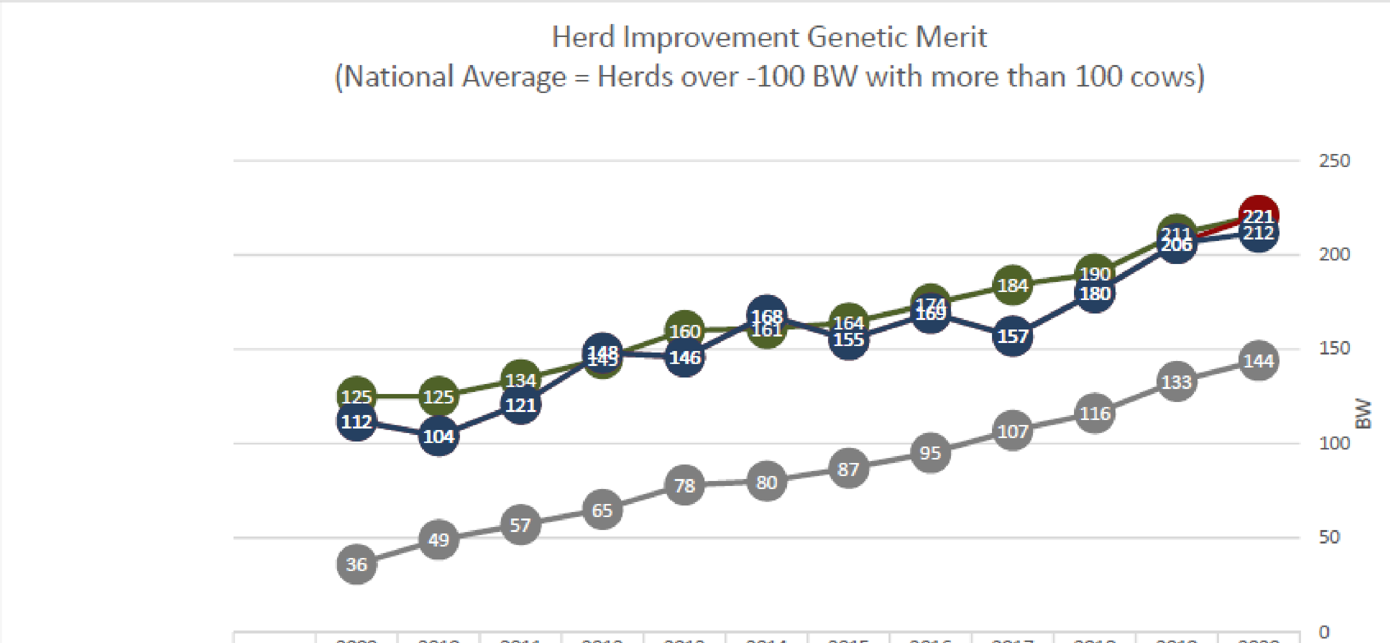
	2019		2018	
Products	Quantity	Costs	Quantity	Costs
A2A2 Premier Sires	252	$ 5,846.40	-	-
Nominated Tech Service	354	$ 2,391.00	90	$ 612.00
PS Forward Pack Tech	-	-	476	$ 11,043.20
Sexed Semen Straw	172	$ 9,632.00	-	-
PS Kiwicross SGL	112	$ 2,296.00	170	$ 3,485.00
Wagyu	161	$ 2,392.73	-	-
SGL Hereford Pak	20	$ 224.10	50	$ 560.25
SGL Kiwicross Pak	-	-	10	$ 146.25
Classic Pak 3	-	-	30	$ 734.40
TOTALS	717	$ 22,782.23	736	$ 16,581.10

CALVING PATTERN

Although CIDR levels remained similar, we did not make use of Why-Wait programmes. This has potentially cost us around 1000 days in milk (2.4 days/cow) compared to last year, due to a later start to calving and a greater spread. We also had a delayed start to mating (1st October 2019 vs 25th October 2018) to fit with the availability of sexed semen for 2019.

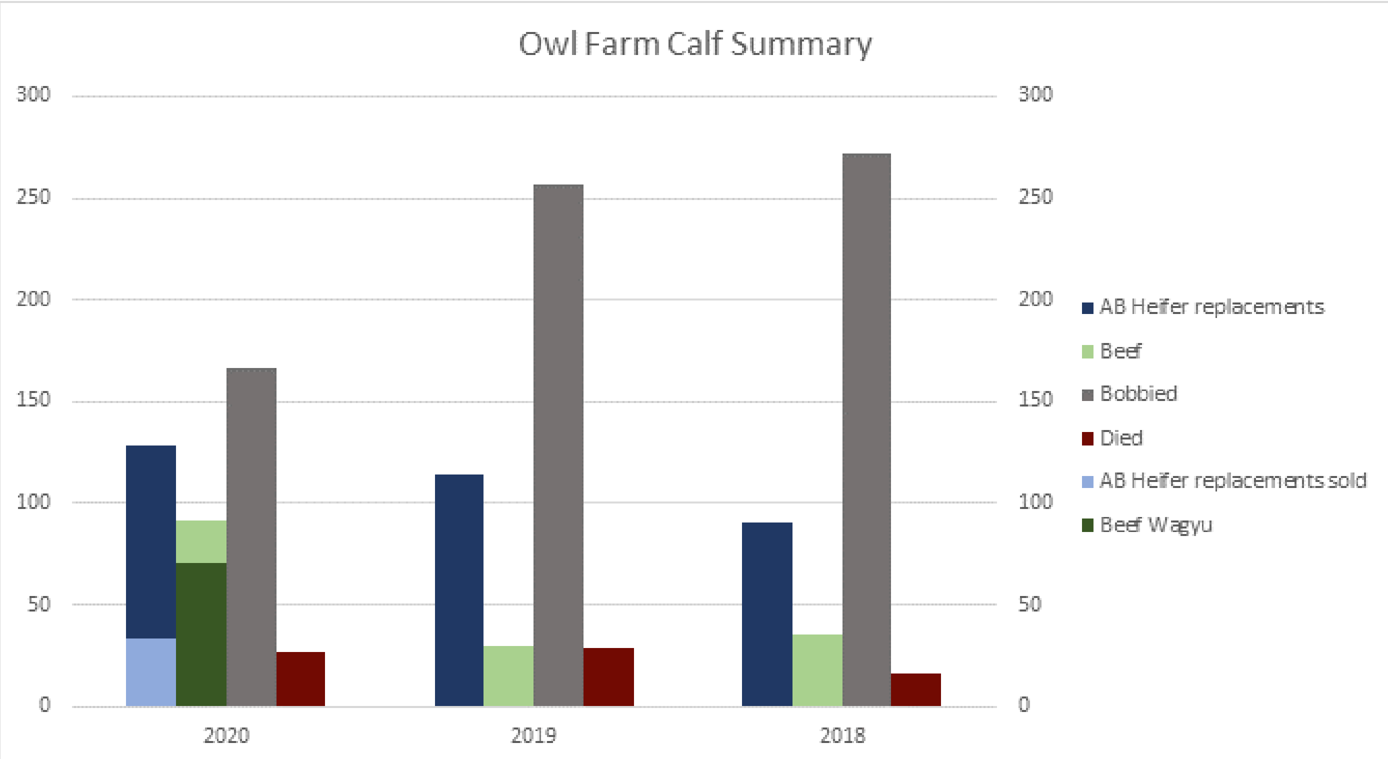


HERD IMPROVEMENT



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
National Average	36	49	57	65	78	80	87	95	107	116	133	144
Top 5%	125	125	134	145	160	161	164	174	184	190	211	221
Potential	112	104	121	148	146	168	155	169	157	180	206	221
St Peters	112	104	121	148	146	168	155	169	157	180	206	212

CALF FATE FOR THE LAST THREE YEARS



INCOME AND EXPENSES ASSOCIATED WITH PROGRAMME

	2020	2019
AB replacements	$4265.40	$0
Bull beef	$1756.03	$4652.48
Wagyu	$14490	$0
Bobbies	$3985.82	$6277.70
Total	**$24497.25**	**$10930.18**

Time

Analysis of the time and task study carried out again in late July and August 2020 compared with the same time period in 2019 showed no significant extra time was spent rearing the calves. We attribute this to a couple of things, including the efficiencies that LaArni has developed as head calf rearer. We purchased an extra calf feeder for $360 and set up a system to transport buckets of milk from the shed to the calves, which saved time and was less fatiguing for the calf rearer.

Time spent calf rearing

	2020	**2019**
Team	2.5 FTE	3 FTE
Total hours calf rearing from 21st July to 31 August	102	110

Extra milk feed to calves

After 66 days of lactation we were 2,207 kg MS behind last season's production for the same days since start of calving. Approximately 1,771 kg MS can be explained by the slower calving rate (2.4 days or 984 cow days in milk). To date we have not taken any more milk out of the vat than last season, but we have held cows in the colostrum mob longer this season. Cows were drafted out every third day which also provided health benefits to the herd in the form of mastitis management and diet transition management. This would indicate that an extra 436 kg MS was fed to the calves via the colostrum milk. We estimate approximately 280 kg MS was used to keep the Wagyu calves on farm for an extra 11 days longer than a bobby calf (4L/calf/day).

Other considerations

Our infrastructure proved adequate for the numbers in the shed this season. We were vigilant with weekly Virkon disinfectant spraying and topped up the bedding once during the season (which was already on hand). Next season we will be able to start the programme at our desired PSM (25th September), and it is likely the Wagyu calves will be picked up more frequently which reduces time spent feeding calves but will mean less income per calf due to less weight gain.

SUMMARY

Result $4,240 profit and 31% reduction in bobby calf numbers.

So, will we do it again?

Extra Income	**$13,567**
Less extra semen expenses	-$6,177
Lost milk revenue	-$2,790
Equipment purchased	-$360
Result	**$4,240**
Reduction in bobby calf numbers	**31%**

2020 MATING PROGRAMME

Based on the success of last season's mating and calving programme, we have decided to continue with the sexed semen/Wagyu programme. With the reduced replacement numbers (90) needed to rear, we have decided to synchronise the R2 to ensure we strive towards our goal of the herd being in the top 5% national BW.

We have 350 Wagyu straws available to use until we switch to Short Gestation Length (SGL) semen.

Yearling mating synchronised blanket insemination commencing 23/09/2020

- Sexed semen KiwiCross®: 30 straws
- Premier Sires® A2/A2 KiwiCross®: 71 straws
- Run bulls introduced 10 days after AB mating

Milking herd mating commencing 25/09/2020 – 15/12/2020

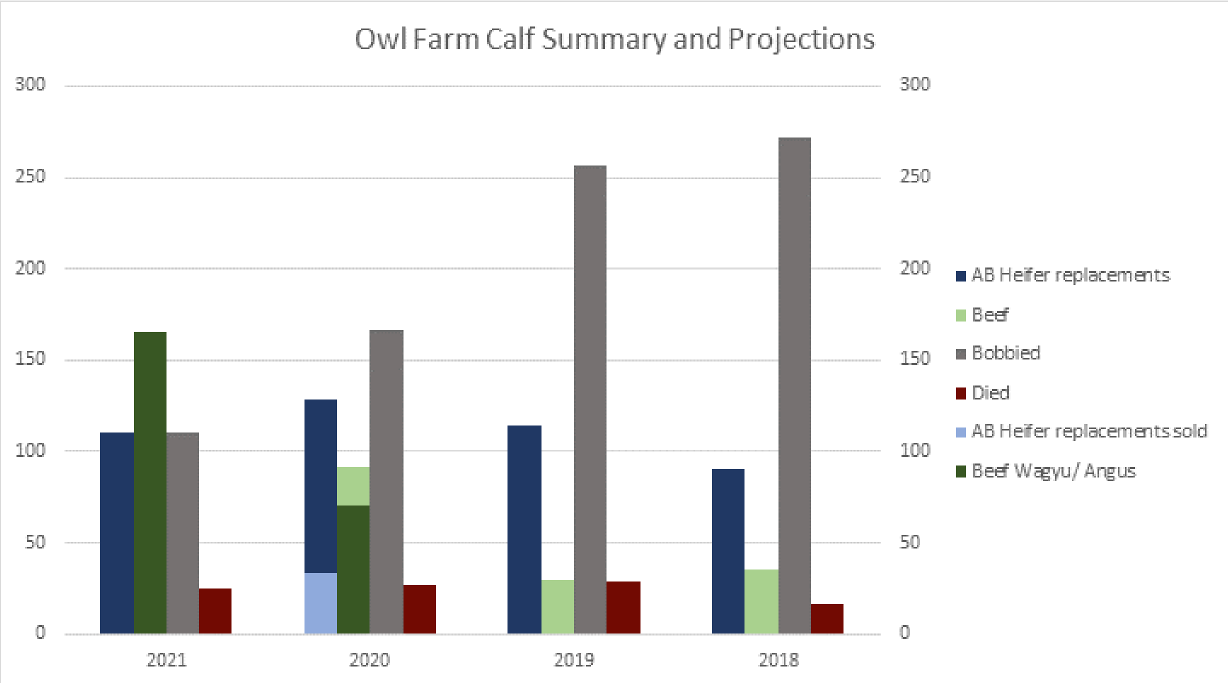
Period 25/09/2020 – 14/10/2020

- Sexed semen KiwiCross® 8 straws per day commencing 26/09/2020
- PSS A2/A2 KiwiCross®: Matings on first day, top 50% who are either unable to be mated to sexed semen or synchronised as non-cyclers.
- Either Wagyu or Angus for the balance of the herd

Period 15/10/2020 – 15/12/2020

- Wagyu or Angus until all straws are used
- Short Gestation Length KiwiCross® until mating end date

CALF FATE PREDICTION FOR 2020



Fertility Focus 2019: Seasonal

Owl Farm
Tom Buckley

Report date:	12/03/20
PTPT:	HPTT
Herd Code:	2/1884
No of cows included:	408
These cows calved between:	23/05/19 and 28/11/19
Mating start & end date: (based on AB or pregnancy test data)	30/09/19 - 21/12/19
Next planned start of calving:	08/07/20
Duration of mating:	83 days
Duration of AB period:	83 days

incalf FERTILITY FOCUS
Version 3.01

1 Overall herd reproductive performance

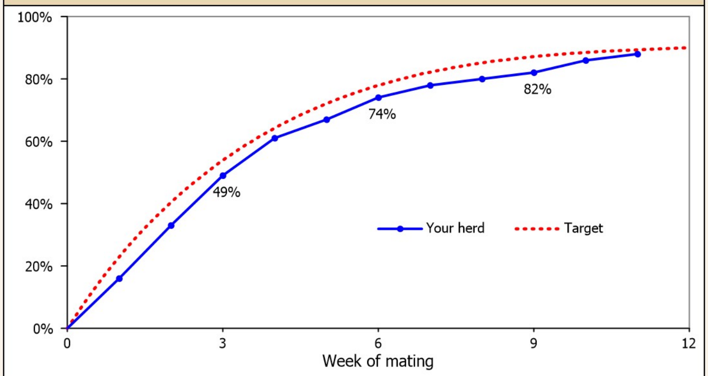
6-week in-calf rate
Percentage of cows pregnant in the first 6 weeks of mating

Your herd	74%	☆☆☆☆☆
Aim above	78%	

Not-in-calf rate
Percentage of cows not pregnant after 83 days of mating

Your herd	10% (8-10%)	☆☆☆☆☆
Aim for	10%	

% of herd in calf
Cumulative by week of mating



2 Drivers of the 6-week in-calf rate

3-week submission rate
% of cows that were inseminated in the first 3 weeks of mating

Your herd	91%	☆☆☆☆☆
Aim above	90%	

Non-return rate
% of inseminations that were not followed by a return to heat

Your herd		
Aim above		

Conception rate
% of inseminations that resulted in a confirmed pregnancy

Your herd	50%	☆
Aim above	60%	

3 Key indicators to areas for improvement

Calving pattern of first calvers
Well managed heifers get in calf quickly and calve early.

Calved by	Week 3	Week 6
Your herd	89%	98%
Aim above	80%	95%
	☆☆☆☆☆	☆☆☆☆☆

Calving pattern of whole herd
Did late calvers reduce in-calf rates?

Calved by	Week 3	Week 6	Week 9
Your herd	75%	93%	99%
Aim above	67%	88%	98%
	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆

Pre-mating heats
A high % of well managed cows will cycle before the start of mating.

Your herd	71%	☆☆☆
Aim above	85%	

3-week submission rate of first calvers
Well managed heifers cycle early

Your herd	94%	☆☆☆☆☆
Aim above	90%	

Heat detection
A high % of early-calved mature cows should be inseminated in the first 3 weeks of mating.

Your herd	91%	☆☆☆
Aim above	95%	

Non-cycling cows
Treated non-cyclers get in calf earlier.

Treated	By MSD	Wks 1-3	Wks 4-6
Your herd	16%	0%	0%

Rating	What does it tell me?	What should I do?
☆☆☆☆☆	Top result	Ideal - keep up the good work!
☆☆☆	Above average	Getting there - focus on getting the details right.
☆	Below average	Plenty of room to improve - seek professional advice.
	No result	Not enough information provided - seek help with records.

Performance after week 6
Expected not-in-calf rate helps assess management affecting performance after week 6 (including bull management and herd nutrition).

Not-in-calf rate

Your herd	10%	OK
Expected	13%	

Owl Farm constructed wetland

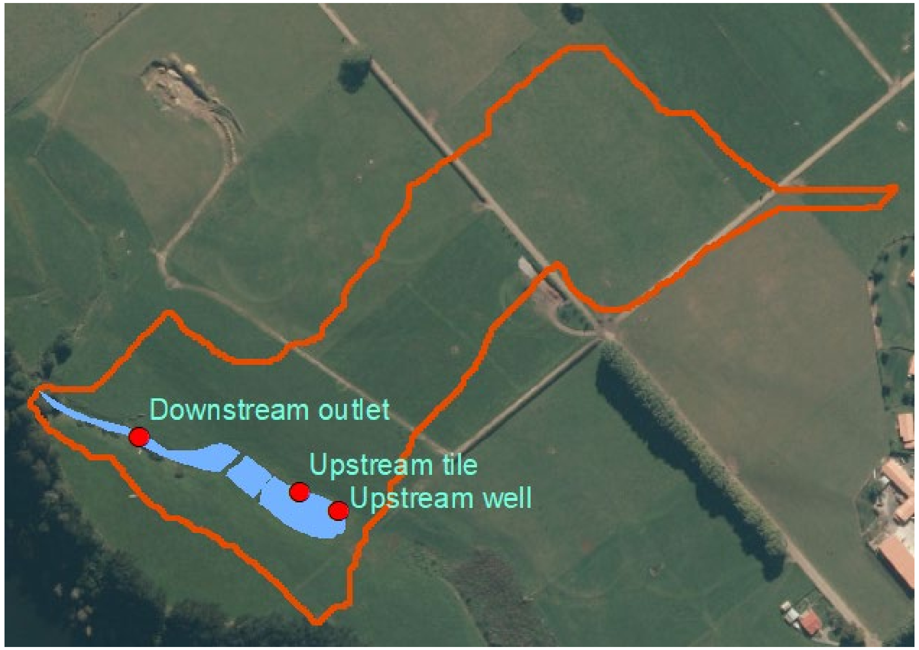
Cambridge, New Zealand

Wetland area: 3400 m^2 (4.5% of catchment)

Catchment area 7.6 ha.

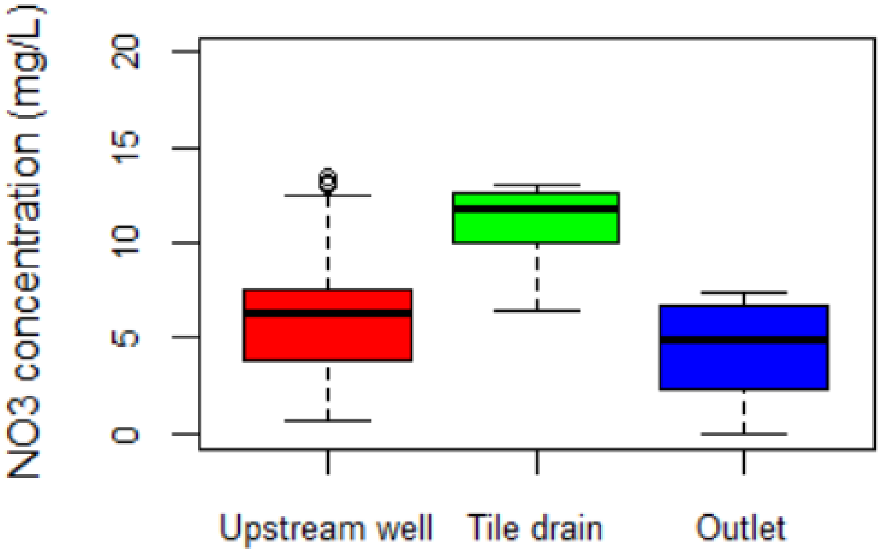
Wetland constructed in 2016

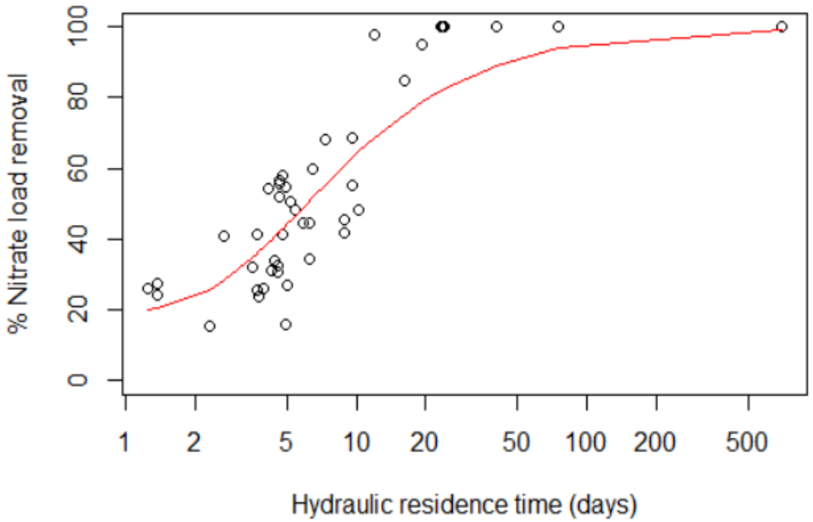
Planted with a range of native wetland species



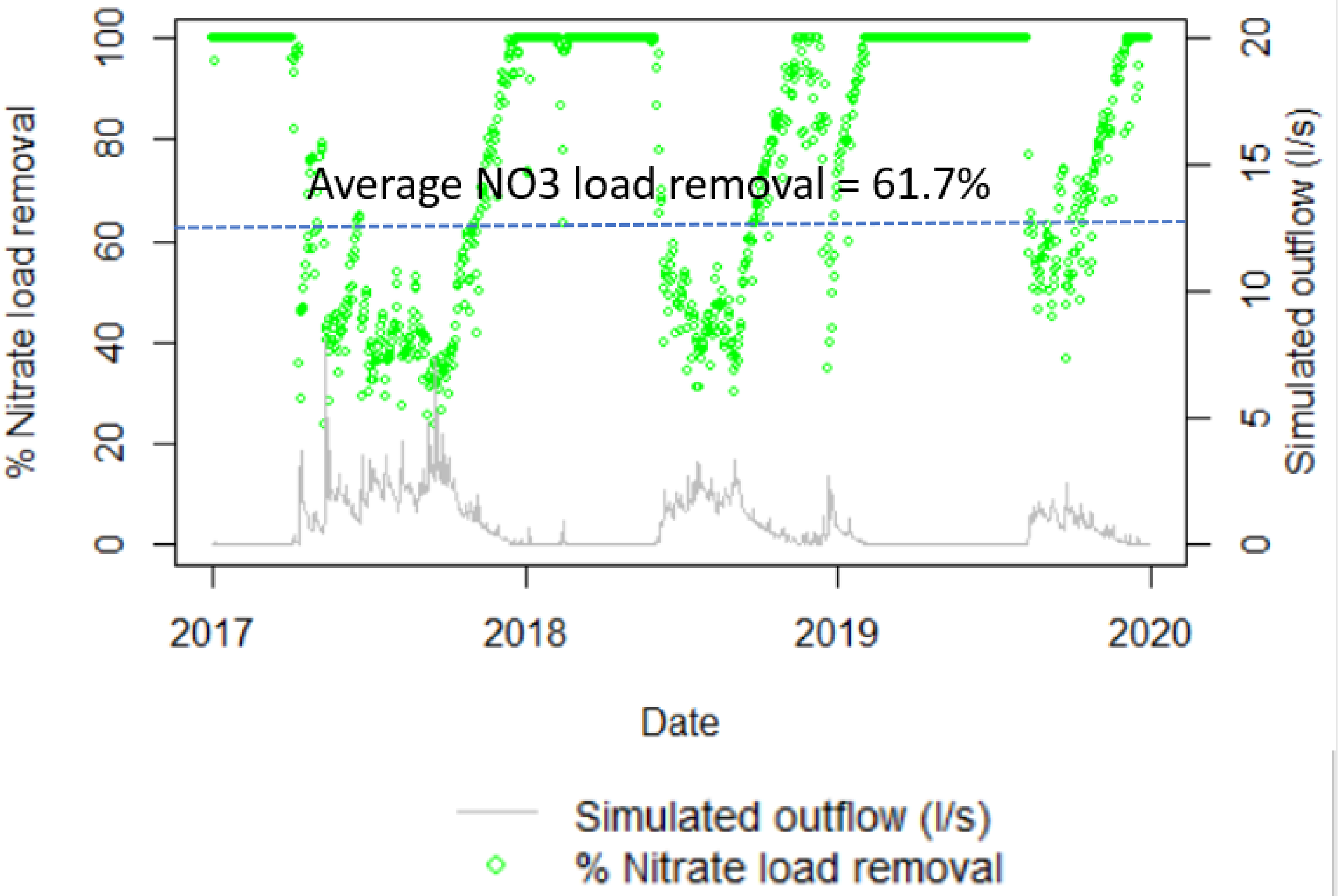
The wetland receives farm drainage water from a single tile drain plus natural groundwater seepage and occasional localised surface run-off. Left: Orange line delineates catchment area. Red points show water quality sampling sites. Photo on right shows vegetation establishment in 2019.

The wetland is constructed as four cells in series.



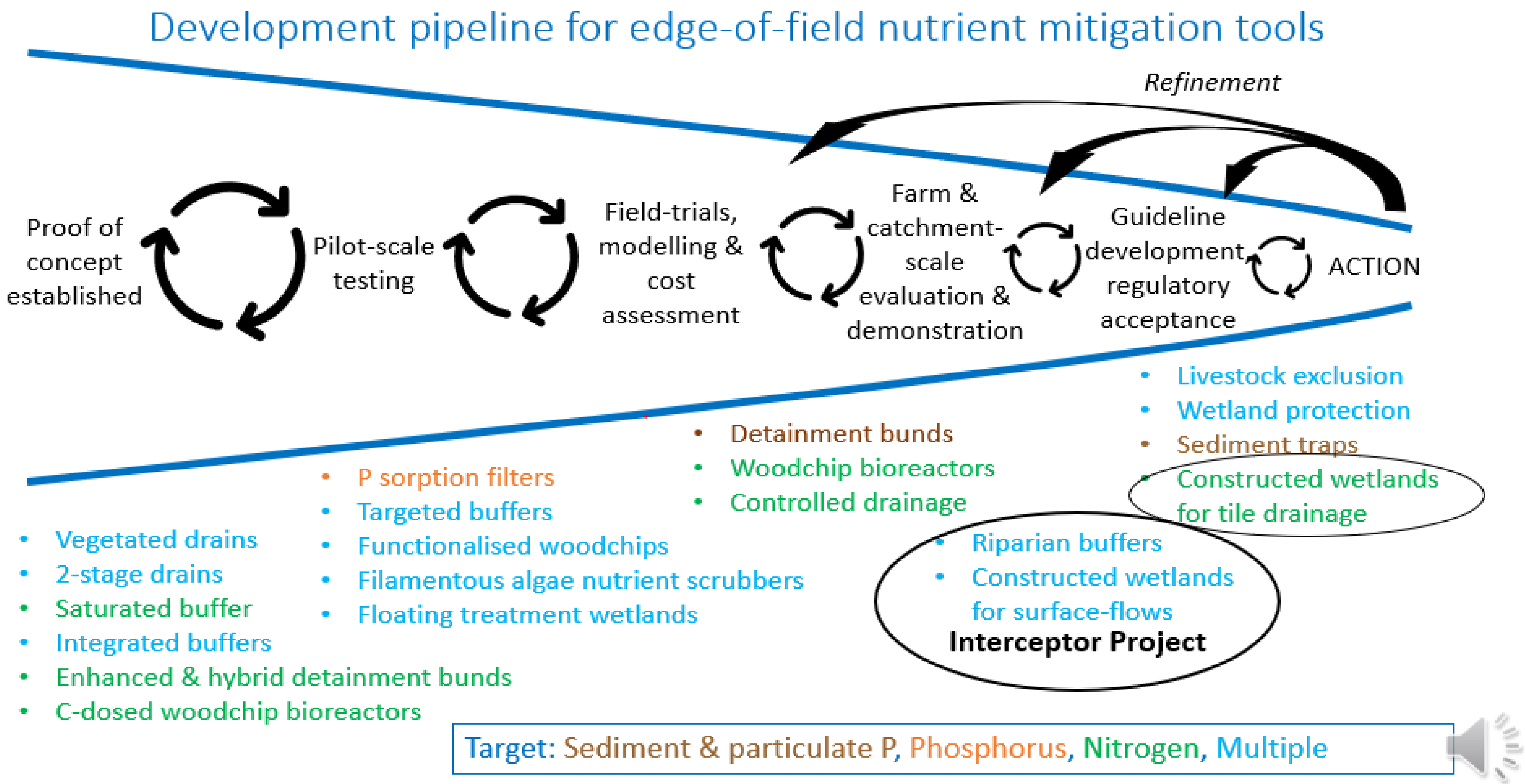


Nitrogen enters mainly as nitrate in groundwater seepage and tile drainage, with around double the concentration in the latter. There is a significant relationship between how long water stays in the wetland (hydraulic residence time) and how effective nitrate removal is in the wetland. Best removal occurs when the water is retained in the wetland for a week or more.



Nitrate removal rates vary with inflow rates and concentrations (influent load) and seasonal temperature. During higher flow periods the residence time of water in the wetland reduces and so does the nitrate removal. Overall nitrate load removal over the three years monitored is estimated to be around 62%.

Comparison of Owl Farm constructed wetland performance (red star) against long-term annual performance expectations for constructed wetlands receiving run-off and drainage from pastoral farmland for warm (median temperature >12˚C) and cool (median temperature 8-12˚C) climatic zones across New Zealand (from NIWA provisional constructed wetland guidelines 2020). Red star shows where Owl Farm wetland sites relative to expected constructed wetland performance



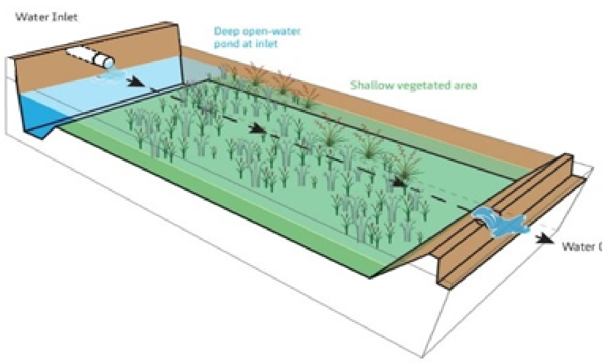
Constructed wetlands are just one option for edge-of-field nutrient loss mitigation. Above are some of the options being evaluated. Different tools target different contaminants and flow pathways. They have different cost:benefit ratios and suitability for different farm types and management systems. Some options have only been tested at proof of concept stage, while others such as livestock exclusion, sediment traps, constructed wetlands and riparian buffers, are further along the development pathway. NIWA and DairyNZ are working together on the Interceptor programme to develop guidelines for the effective use of these tools. We are looking to quantify their performance, evaluate where they are likely to be most appropriate, and provide information to assist their regulatory acceptance.

More Information at: https://www.dairynz.co.nz/environment/waterways/wetlands/ OR https://niwa.co.nz/freshwater-and-estuaries/management-tools/restoration-tools/constructed-wetland-guidelines

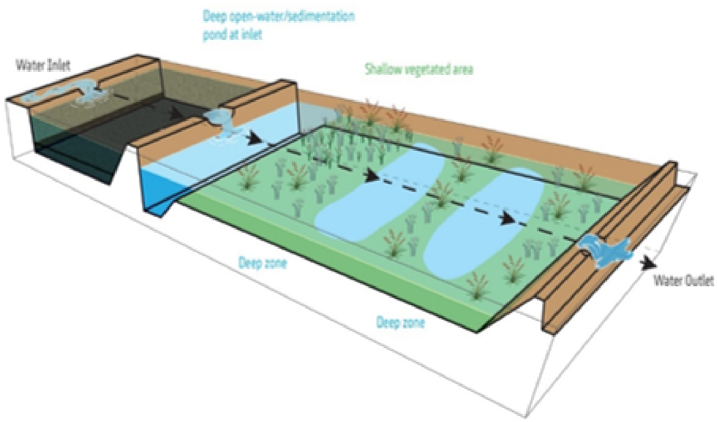
BASIC WETLAND DESIGNS

Low gradient sites (<3° slope)

Option 1a: Sub-surface drainage
(negligible sediment input; focus is on N reduction)

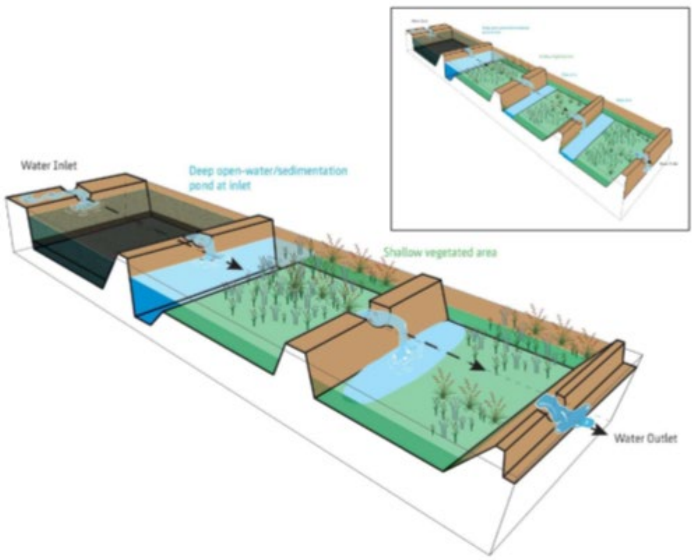


Option 2a Surface and mixed flows
(including significant sediment and associated nutrients)

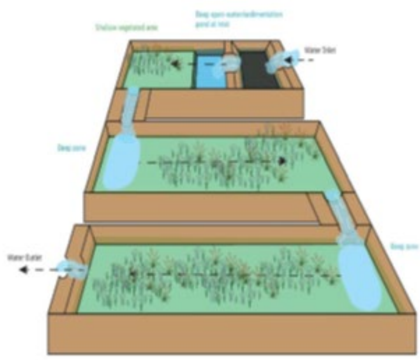


Moderate gradient site (4-7° slope)

Option 3a: Longitudinally stepped multi-stage wetland



Option 3b: Transversely stepped multi-stage wetland



Constructed wetlands to reduce contaminant loss from pastoral farms

Key design guidelines and performance estimates.

The following summary is drawn from the NIWA guidelines provided in Tanner et al. (2020) and a companion review of available New Zealand and international performance data (Woodward et al. 2020).

Design guidelines

Flows of diffuse agricultural run-off are highly variable from day-to-day, season-to-season and year-to-year, and wetland treatment performance will vary according to the distribution, intensity and duration of rainfall and how this interacts with soils, slopes and vegetation across landscapes.

To function effectively, wetlands intercepting agricultural runoff and drainage flows normally need to comprise **between 1-5% of their contributing catchment** (i.e. 100 - 500 m2 of wetland per hectare). The performance of constructed wetlands depends to a large extent on the residence time of water within them, so larger relative wetland areas will show higher contaminant removal. Graphs of estimated long-term median annual performance in relation to relative wetland size, and expected range of variability, are provided for sediment, nitrogen and phosphorus. The basis for their derivation is detailed in the companion review (Woodward et al. 2020).

Contaminant removal performance is also influenced by how evenly water flows through the wetland. This means the best shape for a constructed wetland is elongated or with multiple cells to avoid short-circuiting between the inlet and the outlet. Even flow distribution across the full width of a wetland, and consequent wetland treatment effectiveness is improved where the **overall length to width ratio of the wetland channel is between 5:1 and 10:1 (minimum 3:1).**

Constructed wetlands can either be constructed directly in an existing flow path (e.g. by modifying open drains to convert them into wetlands), or alongside the flow path (e.g. placed adjacent to a stream or river). **An off-line wetland provides additional benefits** as it can be engineered to accept the majority of flow during normal flow conditions, while allowing a larger proportion of the water to bypass the wetland during higher flow periods, passing along the existing stream channel. This approach provides more consistent flows to the wetland, allows partial fish passage along the existing stream channel, and minimises damage to the wetland during flood flows.

The three key components of constructed wetlands: **1) sedimentation ponds, 2) shallow vegetated and 3) deep open water zones**, need to be integrated into a treatment train.

Surface runoff tends to contain more particulate matter, whereas subsurface flows generally contain more dissolved nutrients (e.g. N and P). Larger particles will settle more quickly than smaller particles like fine silts and clays. Removal of dissolved contaminants usually requires chemical or biological processes like binding to minerals or organic matter, microbial transformation or uptake by plants. These processes take longer and are dependent on temperature, so performance will vary seasonally and for different climatic regions. They are also influenced by factors like pH, and oxygen and carbon availability.

Including a **sedimentation pond** as the first stage of a wetland complex helps capture the coarse sediment fractions. Accumulated sediment will need to be be mechanically removed from the sedimentation pond periodically. General principles for construction of a sedimentation pond are based on the MAF coarse sediment trap guidelines (Hudson 2002). Sizing of sedimentation ponds depends on peak flows that the pond is likely to experience during a storm event and is further detailed in Appendix A of the NIWA guidelines (Tanner et al. 2020).

Plants are very important in the overall functioning of wetlands, particularly through their support for microbial processes, for example by providing carbon-rich organic matter, and helping disperse flows within wetlands. It is recommended that **70% of the wetland is shallow water** (0.2-0.4 m deep) to support dense growths of emergent plants (e.g. sedges and bulrushes). The rich carbon supply from decomposing plant litter, and high surface area for growth of biofilms in these planted zones promotes nitrogen removal by conversion of nitrate to nitrogen gases (i.e. denitrification) which is supplemented by plant uptake during the growing season.

Having some **deep open water areas** (0.50-0.75 m) at the inlets and at intermediate stages within the wetland (~30% total coverage) can help settle sediment, slow the flow, and disperse it evenly through shallower, densely planted zones. These open water zones can provide habitat for waterfowl and increase wetland biodiversity. However, because feeding activities can disturb bottom sediments and generate faecal contamination, open water zones should not be located near the final outlet of the wetland.

Phosphorus can be removed in deposited sediments, by adsorption to sediments and organic matter, and through uptake by algae and plants. However, when the algae die or plant leaves fall and degrade in the wetland, a proportion can be released again. This means that as wetlands mature, net uptake of P by plants drops off and most of the P removal occurs through retention of particles. For this reason, it is important to **periodically remove the sediments** that accumulate in the deep water zones of the wetland, primarily in the sedimentation pond, to ensure P isn't remobilised during high flows or through decomposition and release of soluble P.

A well-functioning wetland will have:

- Low sediment accumulation rates in the main vegetated wetland
- Well-established, flourishing and evenly distributed wetland plants
- Evenly distributed flow, with no signs of channelization or short-circuiting
- Appropriate water levels for plant survival and treatment function
- Minimal invasion by weedy plants
- Well-maintained embankments and margins – negligible erosion/bank collapse, low incidence of weeds, fencing to exclude livestock.
- Outflow water is generally clear, with low odour.

Constructed wetland design basics

Size	1-5% of contributing catchment area - larger areas provide greater contaminant reduction
Wetland type	Surface-flow, also known as free-water surface constructed wetland
Shape	Elongated or multi-stage systems with inlet and outlet at opposite ends and overall length:width ratio 5:1-10:1 (minimum 3:1).
Wetland components	
Initial deep sedimentation pond (≥1.5 m depth).	Wherever there is potential for sediment transport into the wetland. Size according to expected peak flows, based on local rainfall intensity. Clean out accumulated sediment periodically to maintain at least half depth.
Shallow (average 0.3 m depth) densely vegetated zone.	~70% of wetland area, including the final 20% of wetland closest to the outlet.
Deep (>0.5 m) open water zones aligned transversely across the wetland.	~30% of wetland area including inlet dispersion zone and intermittently within the wetland, excluding the final 20% of the wetland area.
Planting	
Shallow zones	≥70% cover of native wetland sedges and bulrushes. Plant in spring, early summer at 3-4 plants/m2.
Embankments	Hardy riparian plants. Plant in winter, early spring at ~1-2 plants/m2
Protection	Control weeds mechanically or with an approved herbicide before planting. Protect new plantings from grazing by pukeko and Canada geese. Fence to exclude livestock.

Performance estimates

The performance of different sized constructed wetlands relative to the size of their contributing catchments was assessed by Woodward et al. (2020) using information derived from local and international field-scale monitoring and modelling studies. This information was integrated with expert opinion to derive contaminant reduction estimates for constructed wetlands. These estimates were further refined to generate conservative guidelines of long-term performance for appropriately designed, constructed, vegetated and maintained constructed wetlands.

These performance estimates are relevant to small-scale, edge-of-field and sub-catchment situations, discharge from streams of first-order or less, involving water-ways generally smaller than one metre wide and 30 cm deep at base-flow which receive flow from catchments no larger than about 50 ha in extent. They assume normal New Zealand pastoral farming conditions and management practices on flat to rolling landscapes only (average slopes of 15 degrees or less)[1], and to annual rainfall of 800-1600 mm. They do not apply to areas with highly permeable soils where groundwater is the dominant flow pathway[2]. Some additional limitations are noted below for specific contaminants and flow pathways.

Performance estimates for sediment

Figure 1 shows the expected long-term performance estimates for removal of suspended sediments by a constructed wetland built according to the above recommendations. The solid line defines the 'most likely' performance of well-constructed and maintained wetlands of different sizes. Wetlands occupying 1% and 5% of the catchment area should, typically remove between 50% and 90% respectively of the long-term sediment input. The shaded areas show the potential inter-annual and inter-site range of performance expected.

Sediments which might be transported in surface drains or overland flows (e.g. off raceways) will comprise a range of size fractions from fine clays, to sands to larger aggregates of soil and potentially clumps of dung. High intensity rain events will transport larger particles, while low intensity events will only transport medium to fine particles. The estimates for removal are based on annual performance of wetlands, thus during high intensity events when lots of large particles are mobilised, high removal rates will occur, but predominantly for the coarse particles. In contrast, during less intense events, less sediment will be mobilised, but greater capture of finer particles will occur. Because of insufficient performance information relevant to catchments dominated by clay soils these performance estimates are only applicable to catchments with soils having < 35% clay content.

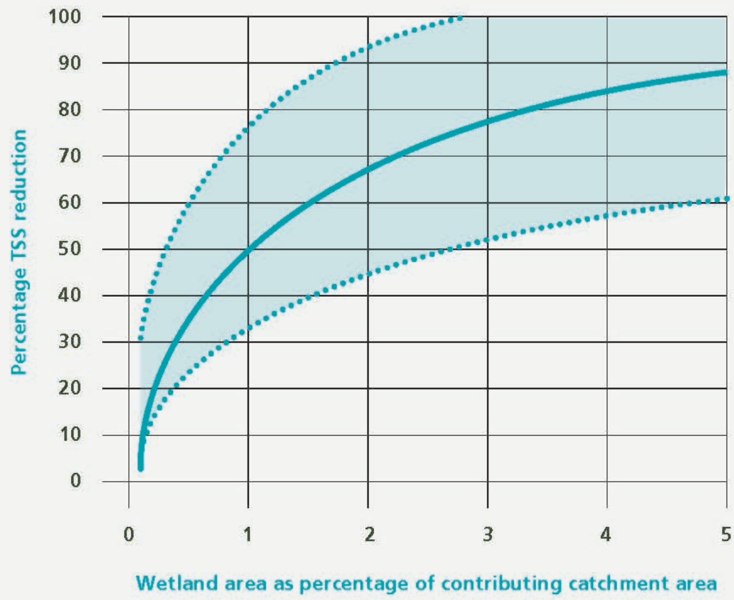


Figure 1: Long-term median annual performance expectations for reduction of Total Suspended Solids (TSS). Performance is for appropriately constructed wetlands receiving surface run-off and drainage from pastoral farmland in New Zealand. Not applicable to areas with clay soils (≥35% clay content) or catchment rainfall outside NZ norms as noted in the text. Solid line shows expected median. Shaded area shows expected inter-annual and inter-site range of performance.

Performance estimates for nitrogen

Nitrogen in agricultural drainage water is normally present in dissolved nitrate-N form. This is primarily removed in constructed wetlands via biological processes (microbial denitrification and plant uptake). Removal generally decreases as temperature decreases. Different performance estimates are therefore provided for warmer (median annual air temperatures ≥12°C) and cooler regions (median annual air temperature 8 - 12°C) of New Zealand). Median annual temperatures for New Zealand (1981-2010) are provided in Tanner et al. (2020) for guidance.

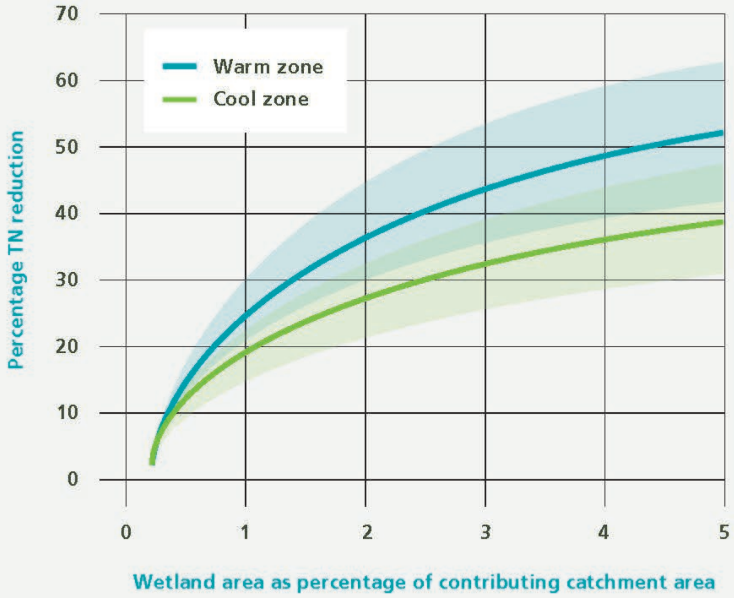


Figure 2: Long-term median annual Total Nitrogen (TN) reduction performance expectations. Performance is for appropriately constructed wetlands receiving surface run-off and drainage from pastoral farmland for warm (median annual temperature >12°C) and cool (median annual temperature 8-12°C) climatic zones in New Zealand and with catchment rainfall within NZ norms. Solid lines show expected medians for each zone, shaded areas show inter-annual and inter-site range of performance expected.

Performance estimates for phosphorus

Performance estimates for removal of Total Phosphorus are applicable to constructed wetlands receiving surface run-off and drainage flows where P is predominantly associated with particulates only (sediments), and in catchments not dominated by clay soils (i.e. < 35% clay content). Phosphorus mobilised in subsurface drainage is mainly in dissolved forms and its removal is not covered by these guidelines. Some studies have shown the potential for dissolved P release from within a constructed wetland when P-rich agricultural soils are used as growth media for the wetland plants; therefore soils with low potential for P release should be selected for use in the wetland.

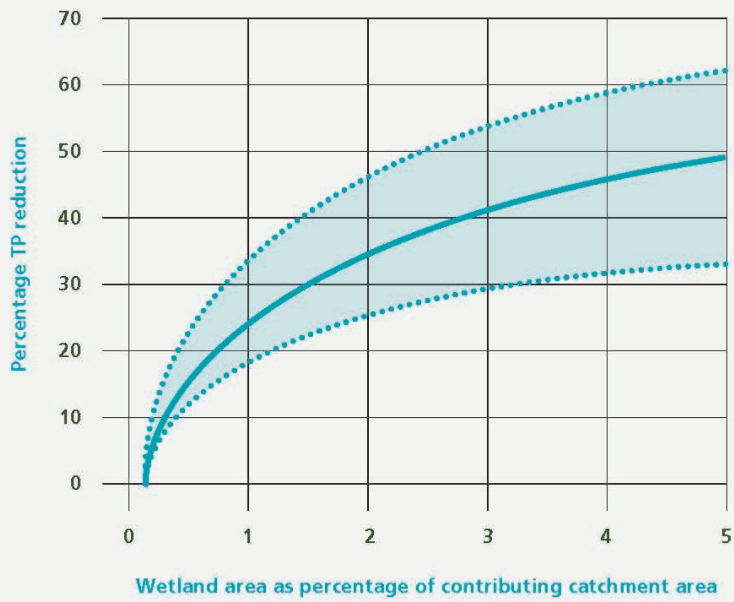


Figure 3: Long-term median annual Total Phosphorus (TP) reduction performance expectations. Performance is for appropriately constructed wetlands receiving surface run-off and drainage from pastoral farmland in New Zealand with catchment rainfall within NZ norms. Solid line shows expected median; shaded area shows inter-annual and inter-site range of performance expected. These predictions do not apply for constructed wetlands whose main source is subsurface drainage containing predominantly dissolved forms of phosphorus.

References:

Hudson, H.R. (2002) Development of an in-channel coarse sediment trap best management practice. Environmental Management Associates Limited, Report FRM500. Prepared for Ministry of Agriculture and Forestry.

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Woodward, B., Tanner, C.C., McKergow, L., Sukias, J.P.S. and Matheson, F.E. (2020) Diffuse-source agricultural sediment and nutrient attenuation by constructed wetlands: A systematic literature review to support development of guidelines. NIWA Client Report to DairyNZ, January 2020.

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