

STANDARD BEST PRACTICE

TYPICAL STORAGE PONDS



STORAGE PONDS BEST PRACTICE

1. Liquid is anaerobic (DEAD)
2. 40% to 60% of volume is rain water catchment (1.1 to 3m of rainfall per year)
3. High methane generation (3x fart tax)
4. No sediment extraction without stirring (solids settle out on a plastic liner)
5. High application rates to remove liquid volume (100lt/cow x 310 milking days x herd size divided by 120 suitable application days) $100 \times 310 \times 780 = 24\text{million litres divided by } 120 \text{ days} = 201,500\text{lt/day}$



SOLIDS REMOVAL FROM TANKS

BEST PRACTICE

- 1 Solids create crusting (Extraction difficult)
- 2 Storage reduction (Crust up to 1mtr thick)
- 3 Liquid becomes sludge (Crust fragments)
- 4 Irrigator stoppages (Crust lumps block nozzles)
- 5 high emissions levels (anaerobic crust rotting)

DISTRIBUTION SYSTEM TRAVELLING IRRIGATORS BEST PRACTICE



TRAVELLING IRRIGATORS

BEST PRACTICE

1. High application rates and depths (90mm/hr application rate at 8 to 30mm application depth, industrial dumping)
2. Pasture pollution (bacteria, odour and soiling)
3. High odour output (anaerobic product)
4. Short application season (dry months only)
5. Prone to stoppages (stalling and hose breakages)

SLURRY TANKERS & UMBILICAL CORDS

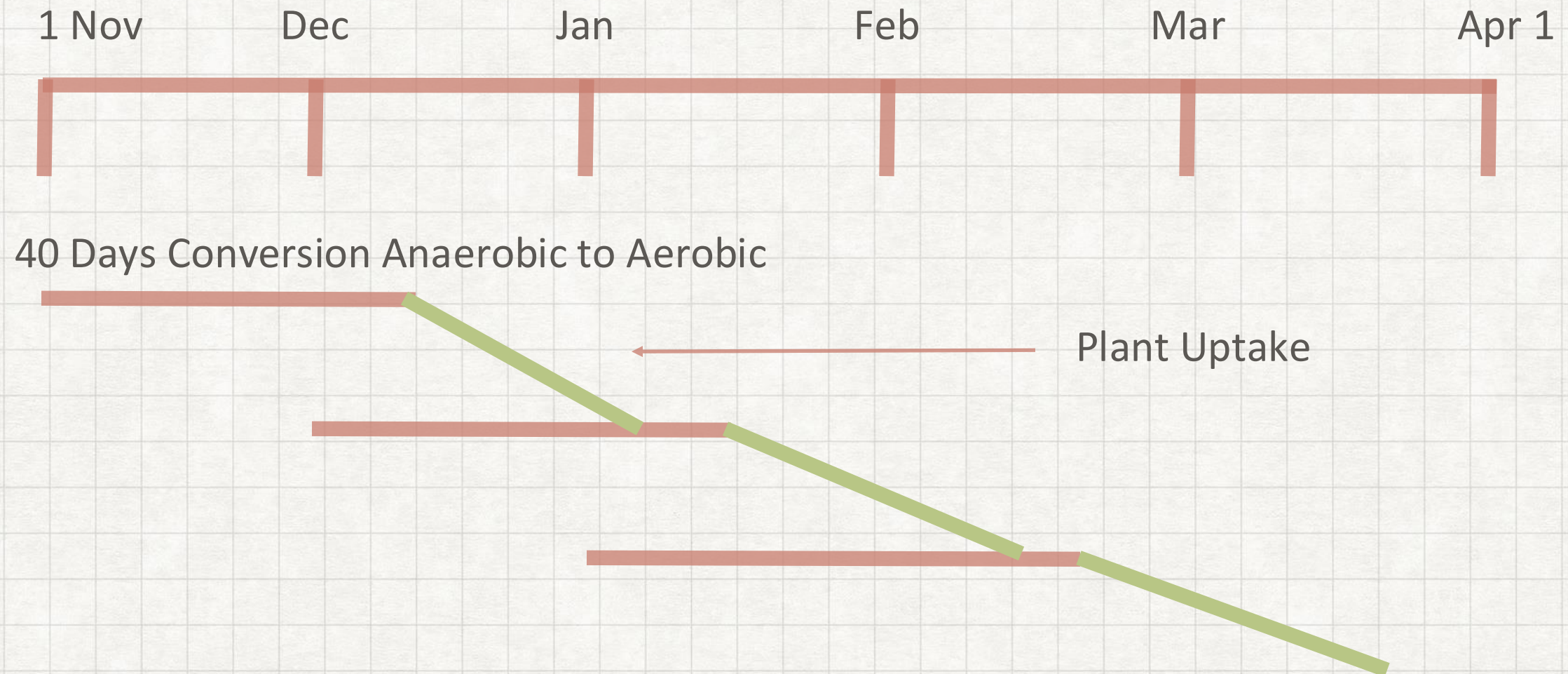


SLURRY TANKER AND UMBILICAL CORDS BEST PRACTICE

1. Large volumes in one application (7million litres in one day)
2. Pasture pollution (E-coli and soiling)
3. Anaerobic product (dead, not plant acceptable)
4. High application depths (6 to 20mm)
5. Often used as a last resort (applied when conditions are not suitable)

EFFLUENT DISPOSAL AND PLANT UPTAKE

Best practice



50 Kg of Nitrogen applied 1st November 1st December & 1st January

Any rain event between 1st Nov to the 1st Apr will cause nitrate leaching

EFFLUENT DISTRIBUTION VERSUS PLANT UPTAKE

1. Anaerobic (dead product, not plant acceptable)
2. Large quantities of NPK (slow uptake by pasture)
3. High nitrate leaching (high rain events wash nitrates into aquifers)
4. Poor nutrient uptake (dormant effluent on pastures)
5. High emissions (effluent on soil surface)

MONTHLY PASTURE NITROGEN UPTAKES

BOB LONGHURST PAGE 7

Pasture Growth and Nitrogen Uptake

For calculating the daily pasture growth rates and nitrogen (N) uptake data has been sourced from published material from Dalley & Geddes (2012). The average monthly pasture growth rates recorded at the Southland Demonstration Farm (SDF) between 2007-2012 have been used (Table 3). This paper reported on the pasture growth from six dairying sites across Southland and West & South Otago. Feed quality data including crude protein (CP) was also reported from four monitor dairy farms but not from the SDF. The N content in pastures can be derived from the CP values. Therefore, the monthly CP values for Eastern and Coastal Southland were used and averaged to derive the %N content of pastures throughout the year (Table 3). Nitrogen uptake (kg N/ha) was then calculated from pasture growth (DM yields) and N content of pastures (%N in DM) (Table 3).

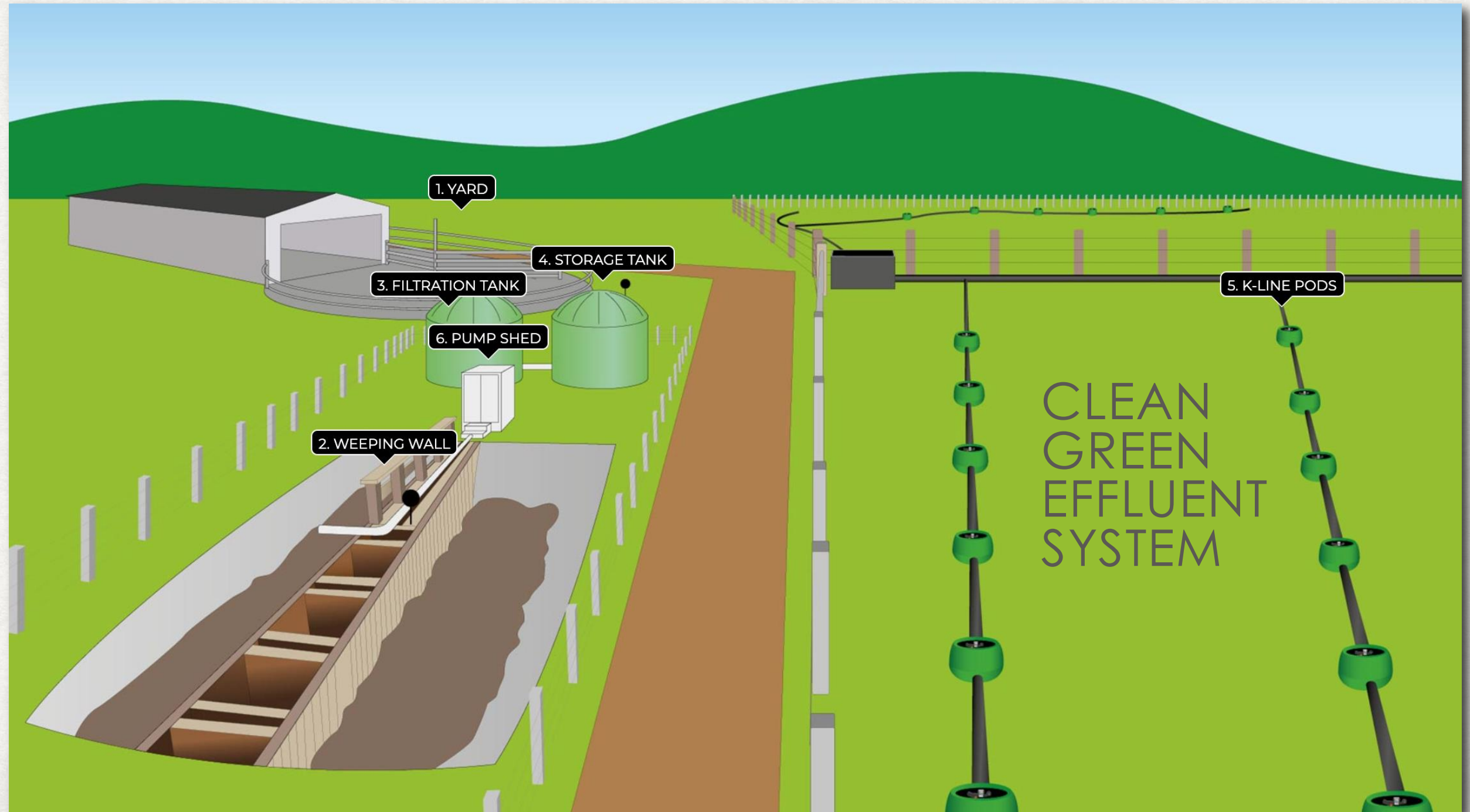
Table 3: Daily and monthly pasture growth rates (kg DM/ha), pasture N concentrations (%N in DM), and N uptake (kg N/ha/month).

Pasture	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
DM - day	7	17	41	60	68	55	51	50	50	42	21	9
DM - month	217	527	1230	1860	2040	1650	1581	1400	1550	1260	651	270
%N in DM	4.16	4.16	4.16	4.08	3.92	3.68	4.32	4.48	4.48	4.72	4.72	4.16
N uptake	9.0	21.9	51.2	75.9	80.0	60.7	68.3	62.7	69.4	59.5	30.7	11.2

Key points:

1. Pasture growth rates for June & July are below 10 kg DM/ha/day and above 50 kg DM/ha/day from October to March.
2. Nitrogen concentrations increase from December to May, presumably because of increasing clover component in pasture.
3. N uptake is driven by DM yield in October & November (spring growth) and by increasing N content from December to May.
4. Annual pasture production is 14.2 t DM/ha and total N uptake is 600 kg/ha.

THE SOLUTION - ENVIRONMENTALLY FRIENDLY



THE SOLUTION



PATENTED WEEPING WALL

1. Removes 35% more solids (conventional wall)
2. Removes 1264% more solids (press)
3. Removes 330% more dissolved solids (press)
4. Removes 410% more Kjeldahl Nitrogen (press)
5. Removes 625% more potassium (press)

WEEPING WALL FILTRATION

Watercare Laboratory Services

Auckland
52 Aintree Ave,
PO Box 107028,
Auckland Airport,
Auckland, 2150
Tel: (09) 539 7614
Fax: (09) 539 7601

Invercargill
142 Esk Street,
PO Box 747,
Invercargill, 9840
(03) 214 4040
(03) 214 4041

Queenstown
74 Glenda Drive,
PO Box 2614,
Wakatipu,
Queenstown, 9349
(03) 409 0559

www.watercarelabs.co.nz

clientsupport@water.co.nz

Certificate of Analysis Laboratory Reference: 170825-132

Attention:
Client: **CLEAN GREEN**
Address: **PO Box 1530, Invercargill, 9840**
Client Reference: **Effluent**
Purchase Order: **Not Available**

Final Report: **240013-0**
Report Issue Date: **04-Sep-2017**
Received Date: **25-Aug-2017**
Sampled By: **G. Broad**
Quote Reference : **4885**

Sample Details		WATERS	WATERS	WATERS
Lab Sample ID:		170825-132-1	170825-132-2	170825-132-3
Client Sample ID:				
Sample Date/Time:		25/08/2017	25/08/2017	25/08/2017
Description:		Fresh Pressed Effluent	Filtered New Wall	Biomass Filtered
General Testing				
Total Dissolved Solids	mg/L	9400	5600	2100
Total Kjeldahl Nitrogen (as N)	mg/L	2400	1400	470
Total Suspended Solids	mg/L	30000	11000	2200
Metals				
Total Metals by ICP-MS—Screen (Default Digest)				
Potassium (Total)	mg/L	2900	2300	400

GREEN WASH EXTERNAL YARDS



THE SOLUTION



Green Wash External Yarding

1. Reduced fresh water usage to 20 litres/cow (50 to 70 litres industry standard)
2. 80% reduction in effluent generated for disposal (including rain catchment)
3. 60% reduction in fresh water extraction (water for shed only)
4. Fresh water reduction equates to 8 months water usage for Auckland City (if every cow shed in NZ installed green wash)
5. Fully automated system, reduction in man hours hosing yards (up to 2 hrs/day)

LOW RATE LOW DEPTH DISTRIBUTION



THE SOLUTION

Distribution - K-Line



1. Nil soil or pasture pollution with anaerobic liquid (application less than dew)
2. Low rate low depth application (0.25mm)
3. Application depth deeming safe effluent dispersal almost every day of the year (evapotranspiration minimum 0.6mm/day)
4. Application rate of nitrogen is less than plant uptake (0.6 to 0.8kg/ha/day)
5. Application rate eliminates nitrogen leaching and emissions (plant uptake is in excess of NPK applied)

WATER HYDRAULICS VERSUS PLANT UPTAKE

1. Soil saturation (12mm AD = 12mm leaching)
2. Soil saturation (50kg Nitrogen applied = 50kg Nitrogen leaching)
3. Soil deficit (12mm dry soil + 12mm AD = 0 leaching)
4. CGE- soil saturation (0.8kg Nitrogen applied minus plant uptake of 2.5kg = 0 leaching)
5. CGE- soil saturation + 50mm rain (0.8kg applied Nitrogen minus plant uptake of 2.5kg = 0 leaching)

SOLIDS DISTRIBUTION CHUCK WAGON



THE SOLUTION

Solids Distribution



1. Dry Humus (No smell, No Emissions)
2. Manageable product (Solids spread when conditions are suitable)
3. Low moisture content (85% organic 15% liquid Nitrogen)
4. Organic humus fertiliser (Perfect worm food)
5. Slow breakdown of distributed materials (18 months)

ANIMAL HEALTH



THE SOLUTION

Animal Health -



1. UV on low rate application eliminates E-coli (Sun kills bacteria)
2. Balanced fertilizer plant uptake (NPK)
3. No potassium build up in pasture (All elements are readily available to the plant)
4. No pasture pollution (Application less than dew)
5. Reduced Somatic cell count (No pollutants or bacteria left on pasture)

THE SOLUTION

Nitrogen Uptake & Emissions



1. Anaerobic effluent (Plant acceptable material)
2. Low rate low depth liquids (less than the plant can eat)
3. Reduce liquid strength (NPK retained in the solids)
4. Dry solids storage (15% moisture)
5. Dry solids distribution (dry humus spread over large area)

THE SOLUTION

Soil Health



1. Good worm base (Worms create Humus and Fertilizer)
2. Good microbial action (Assist worms to create humus)
3. Increase in soil depths (Achieved by worms and microbial)
4. Increase carbon levels (Increase soil, increase carbon)
5. Greater fertilizer retention (1% increase in carbon equates to 30,000 litres of water retention)

Metabolic Effects on Lactating Cows

The dispersal of high rate applications of anaerobic mega pond effluent is the main contributor of excess build-up of potassium in pasture.

When anaerobic effluent is dispersed to land at high volumes, the only mineral that is immediately plant accessible is potassium.

The plant uptakes potassium until it reaches saturation point, at which time the plant shuts down and locks up the supply of nutrients from its stem. The plant achieves this by drying off the pasture stems between the soil surface and the first grass stem knot, locking the stored potassium between the first and second knot on the stem.

The plant is now no longer able to uptake any nutrients provided from the root base and must live off the stored potassium. This makes the plant poisonous and stock will only graze the tips of the plant and leave the remaining potassium saturated stem behind.

The only way to regenerate the plant is to cut the stem off at near soil level to allow the plant to start growing again.

During this period of potassium saturation the nitrates are becoming aerobic and plant accessible. However due to the plant being overloaded with potassium it is unable to uptake any nutrients and all the valuable effluent is being lost to our aquifers and creating large amounts of nitrate leaching.

On average a plant can uptake 2.5kg nitrogen/ha/day. Effluent should only be applied at a rate less than the plant can uptake.

Dispersing anaerobic effluent through a low rate low depth system allows the plant to instantly uptake a balance of nutrients and therefore eliminates the metabolic problems and reducing nitrate leaching to considerably less effect than a cow standing in a paddock.

Applying Effluent at Low Rate Low Depth has eliminated metabolic issues in pasture to a level where farmers are able to use Effluent paddocks for calving.

AGRISEA

I began working with a farm 4 years ago in Atiamuri and have been sampling the 6 sites 3x per annum for soil fertility and herbage (rye only and clover only) , I have attached a draft document that we handed out at an on-farm day last year for the background info, what we were up to and why.

In a nutshell the work has been inspired and overseen by Dr Christine Jones and we wanted to see what would happen to soil and plant fertility if we removed synthetic fertilisers from the system initially and then increased regenerative principles such as grazing management and diverse pasture swards.

In Spring 2017 the farmers also added a great diverse pasture sward to one of the biostimulant treated paddocks - this has been hugely successful and we have run a number of on-farm days and farmers in the area are also starting to make transformations.

Out of interest a few weeks ago I wanted to take some soil Carbon measurements at different depths in this diverse paddock and compare that to the “Conventional paddock” . I have also attached these results:

For your understanding:

Conventional Paddock measurements

53 0-15cm to compare fertility to neighbouring 54 AgriSea only treated paddock (I have these potted through time)

53 15-30cm Soil Carbon

53 30-15cm Soil Carbon

54= Neighbouring AgriSea paddock 0-15cm only test in this paddock as per long term monitoring of soil fertility. These were a paired site in my 6 site 4 year experiment.

Salad Paddock is the diverse pasture paddock

0-15 Soil C

15-30 Soil C

30-45 Soil C

These results at 15-30cm in the “salad paddock” look incredible next to the Conventional measurements at the same depth. Id really love some help on interpreting them, and also to see if they do actually signify a large benefit to soil health and indeed the climate. I have read your papers with interest over the years and I am really keen to understand the potential effects of regenerative Ag on soil Carbon.

Warm regards,

Nga mihi,

Clare Bradley



AgriSea New Zealand Ltd
7446 State Highway 2
Paeroa 3600
T 0800 SMART FARM (762 783)
T +64 7 682 8424
E info@agrisea.co.nz
W www.agrisea.co.nz
F www.facebook.com/AgriSea



Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Page 11 of 17

Client:	Wilith Farm Limited	Lab No:	2178808	shvpv1
Address:	2212 State Highway 30 RD 1 Atiamuri 3078	Date Received:	20-May-2019	
		Date Reported:	29-May-2019	
		Quote No:	68991	
		Order No:		
		Client Reference:	Tests as per Quote	
		Add. Client Ref:	Nutritional Tests	
		Submitted By:	Clare Bradley	

Soil Analysis Results

Sample Name:	Salad Soil 30-45	Salad Soil 15-30	15cm Salad	53 Soil 15-30	53 Soil 30-45	54 15cm	
Lab Number:	2178808.1	2178808.2	2178808.3	2178808.4	2178808.5	2178808.6	
Sample Type:	SOIL General, Sub-Soil	SOIL General, Sub-Soil	SOIL Mixed Pasture, Dairy (Ash)	SOIL General, Sub-Soil	SOIL General, Sub-Soil	SOIL Mixed Pasture, Dairy (Ash)	
Sample Type Code:	S147	S147	S180	S147	S147	S180	
Total Carbon*	%	1.8	3.9	7.7	1.9	1.0	6.7
Hot Water Extractable Carbon*	mg/kg	361	1,176	2,816	381	311	2,315
Total Nitrogen*	%	0.15	0.29	0.55	0.15	0.12	0.51
C/N Ratio*		11.8	13.4	13.8	12.7	8.7	13.3
Anaerobically Mineralisable N/Total% N Ratio*		1.7	1.8	2.4	1.7	1.6	2.4
Phosphorus (Mehlich 3)*	mg/L	-	-	-	-	-	140
Potassium (Mehlich 3)*	mg/L	-	-	-	-	-	132
Calcium (Mehlich 3)*	mg/L	-	-	-	-	-	1,064
Magnesium (Mehlich 3)*	mg/L	-	-	-	-	-	135.0
Sodium (Mehlich 3)*	mg/L	-	-	-	-	-	22
Iron (Mehlich 3)*	mg/L	-	-	-	-	-	98
Manganese (Mehlich 3)*	mg/L	-	-	-	-	-	11.3
Zinc (Mehlich 3)*	mg/L	-	-	-	-	-	7.26
Copper (Mehlich 3)*	mg/L	-	-	-	-	-	1.3
Boron (Mehlich 3)*	mg/L	-	-	-	-	-	0.18
Cobalt (Mehlich 3)*	mg/L	-	-	-	-	-	< 0.1
Aluminium (Mehlich 3)*	mg/L	-	-	-	-	-	1,729
'Total' Phosphorus	mg/kg	-	-	-	-	-	1,430
'Total' Sulphur*	mg/kg	-	-	-	-	-	702
Soil Sample Depth*	mm	300-600	150-300	0-150	150-300	300-600	0-150
Soil Type*		Ash	Ash	Ash	Ash	Ash	Ash



AgriSea New Zealand Ltd
7446 State Highway 2
Paeroa 3600
T 0800 SMART FARM (762 783)
T +64 7 682 8424
E info@agrisea.co.nz
W www.agrisea.co.nz
F www.facebook.com/AgriSea



Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Page 10 of 17

Client:	Wolith Farm Limited	Lab No:	2178808	shvpv1
Address:	2212 State Highway 30 RD 1 Atiamuri 3078	Date Received:	20-May-2019	
		Date Reported:	29-May-2019	
		Quote No:	68991	
		Order No:		
		Client Reference:	Tests as per Quote	
		Add. Client Ref:	Nutritional Tests	
		Submitted By:	Clare Bradley	

Soil Analysis Results

Sample Name:	Salad Soil 30-45	Salad Soil 15-30	15cm Salad	53 Soil 15-30	53 Soil 30-45	54 15cm
Lab Number:	2178808.1	2178808.2	2178808.3	2178808.4	2178808.5	2178808.6
Sample Type:	SOIL General, Sub-Soil	SOIL General, Sub-Soil	SOIL Mixed Pasture, Dairy (Ash)	SOIL General, Sub-Soil	SOIL General, Sub-Soil	SOIL Mixed Pasture, Dairy (Ash)
Sample Type Code:	S147	S147	S180	S147	S147	S180
pH	pH Units	-	-	-	-	6.0
Resin P	mg/kg	-	-	-	-	136
Olsen Phosphorus	mg/L	-	-	-	-	61
Anion Storage Capacity*	%	-	-	-	-	60
Potassium	me/100g	-	-	-	-	0.61
Potassium	%BS	-	-	-	-	2.5
Potassium	MAF units	-	-	-	-	8
Calcium	me/100g	-	-	-	-	9.0
Calcium	%BS	-	-	-	-	37
Calcium	MAF units	-	-	-	-	7
Magnesium	me/100g	-	-	-	-	1.92
Magnesium	%BS	-	-	-	-	8.0
Magnesium	MAF units	-	-	-	-	26
Sodium	me/100g	-	-	-	-	0.17
Sodium	%BS	-	-	-	-	0.7
Sodium	MAF units	-	-	-	-	5
CEC	me/100g	-	-	-	-	24
Total Base Saturation	%	-	-	-	-	49
Volume Weight	g/mL	0.66	0.64	0.63	0.68	0.73
Sulphate Sulphur	mg/kg	-	-	-	-	9
Extractable Organic Sulphur*	mg/kg	-	-	-	-	8
Aluminium (CaCl ₂ Extractable)	mg/kg	-	-	-	-	1.3
Boron	mg/kg	-	-	-	-	0.6
Potentially Available Nitrogen (15cm Depth)*	kg/ha	25	51	123	27	20
Anaerobically Mineralisable N*	µg/g	25	53	131	26	19
Organic Matter*	%	3.1	6.7	13.2	3.3	1.8

PASTURE UPTAKE OF NITROGEN

PLANT UPTAKE RATE
IS DIRECTLY PROPORTIONAL
TO AIR & SOIL TEMPERATURE

NO STUDIES HAVE BEEN DONE TO DETERMINE THIS RATIO.

NITROGEN FROM ANIMAL WAIST OR FROM FERTILIZER
COMPANIES CAN BE APPLIED TO SUIT THE PLANT UPTAKE, BY
SIMPLY TESTING SOIL TEMPERATURES.

TWO PROBLEMS WITH EFFLUENT DISTRIBUTION

1. Nitrate leaching

2. Overland runoff

- **COMMON DENOMINATOR**

- Application rates and application depths are too great

- **SOLUTION**

- Low Rate Low Depth application rates



