HS Jansen and Sons Ltd Nutrient Management Plan

2017

1. Introduction

This is a Nutrient Management Plan (NMP) for HS Jansen and sons, Hullcar Road, Spallumcheen BC for the 2017 cropping year (see Figure 1 for farm location). It contains information on all nitrogen sources on the farm, and nitrogen requirements for crops in 2017 based on estimated crop uptake and residual soil nitrate levels. It has been developed with the goal of a zero or negative nitrogen balance on all fields. This means that the supply of crop-available nitrogen in manure and other nitrogen inputs will be equal to or less than the estimated crop requirement for nitrogen.

A summary of 2017 planned nitrogen applications is found in Table 1.

This plan considers the agronomic balance of nitrogen only. The combination of residual levels of phosphorus and potassium in the soil and the amount in the planned manure applications will meet crop needs for these nutrients for 2017. Many of the fields farmed by HS Jansen currently have high to very high levels of plant-available phosphorus. Elevated soil phosphorus is a concern where there is hydraulic conductivity between fields and surface water such as where fields are located next to surface water or where ditches or tile drainage connects to surface water. Deep Creek runs adjacent to sections of three fields at HS Jansen, 103A Hullcar, 103C Island and 103B Doug's. There is potential for movement of phosphorus from these fields into Deep Creek during snowmelt if there is runoff and during freshet in Deep Creek when it can flood part of the fields. The farm's crop advisor is actively working with the operation to reduce residual soil phosphorus levels by increasing the acreage planted to alfalfa and by rotating alfalfa with corn silage.

This plan was prepared with the assistance of Doug Macfarlane, Certified Crop Advisor. He calculated nitrogen application rates based on crop requirements. His proposed application rates have been reviewed as part of preparation of this plan.

All calculated values used in this plan are derived from the Ministry of Agriculture's Nutrient Management Planner calculator Excel spreadsheet.

This Nutrient Management Plan describes cropping planned to be undertaken by HS Jansen and Sons in 2017. However, weather and other factors can result in changes to the cropping plan after this plan is submitted.

Disclaimer

This plan has been developed based on a combination of research and industry-standard estimates from BC Ministry of Agriculture nutrient management materials, and farm-specific information where available. It is understood that even when industry-standard estimates are used to calculate application rates of manure, there is considerable imprecision in the process. This plan has been prepared with the goal of a zero nitrogen balance in all fields, and to ensure that the level of residual nitrate-N in soil in fall 2017 is low. However, no guarantee is made that this will be achieved in 2017. Results of post-harvest soil nitrate testing in fall 2017 will be used to further fine-tune manure application rates in 2018 as required.

Table 1. Summary of 2017 Planned Manure Nitrogen Applications

Field ID	Crop N requirement (Table 7)	Planned manure application rate		Crop-available N supplied in manure (Table 9)	N balance* (difference between crop requirement and supply) (Table 10)
	Lb/A	Liquid manure Imp. Gal/A	Solid manure Tons/A	Lb/A	N requirement less N supply
Corn fields (2017)					
104 Harold's	16	6,000	0	22	-6
105 Dixon Back	76	14,950	0	55	21
106 Dixon Front	80	14,950	0	55	25
109 Sylvia	11	5,000	0	18	-7
202 Reimer	68	17,960	0	37	146
401/2/3 Pivots Lavington	150	0	10	19	131
Alfalfa fields (2017)					
101 B,C Yard	0	0	0	0	0
101 Barns	313	23,950	0	88	225
103 A Hullcar Hall	305	29,950	0	110	195
103 B Doug's	294	29,950	0	110	184
103 C Island	68	18,359	0	68	0
201 Skelton	346	29,950	0	110	236
203 Hoekstra	261	0	0	0	261
205 Jessie	325	39,900	0	147	178
206 Ferguson	182	0	0	0	182
102 Sorensen	118	9,980	0	37	81

In 2017 all fields will receive nitrogen close to or less than crop requirements. The supply of nitrogen in 2017 will be less than or very close to crop requirements.

2. Livestock on site 2017

HS Jansen and Sons is a dairy farm located in the Hullcar valley in Spallumcheen BC. As of the time of writing, they have 960 milking cows on site as well as 120 dry cows and 100 calves less than 3 months of age. The remainder of the operation's livestock (dry cows and heifers) are housed at the operation's second farm in Enderby. All manure from the Enderby farm is utilized on the land base of that farm. No manure effluent from the Hullcar operation is used at the Enderby farm.

3. Acreage report - 2017

HS Jansen will farm 1183 acres (479 hectares) of land in 2017. The fields are listed with areas and 2017 cropping information in Table 2 below. Fields are identified on Figure 2.

Cropping is summarized as follows:

- 510 acres (206 hectares) in corn silage.
- 672.8 acres (272 hectares) in alfalfa and alfalfa:grass, 100.6 acres (40.7 hectares) to be planted in spring 2017, remainder are 2 to 4 year old stands.

Table 2. 2017 Acreage Report

Field ID	Area		2016 Crop	2017 Crop
	ha	acres		
Home farm (Hullcar)				
101 B,C Yard	3.7	9.3	Alfalfa-grass	Alfalfa-grass
101 Barns	18.7	46.8	Alfalfa/grass	Alfalfa/grass
102 Sorensen	40.2	100.6	Corn silage	Alfalfa (new seeding)
103 A Hullcar Hall	40.6	101.5	Alfalfa/grass	Alfalfa/grass
103 B Doug's	38.4	96	Alfalfa/grass	Alfalfa/grass
103 C Island	5	12.4	Corn silage	Grass
104 Harold's	44.1	110.3	Corn silage	Corn silage
105 Dixon Back	40.4	101	Alfalfa/grass	Corn silage
106 Dixon Front	6	15	Corn silage	Corn silage
109 Sylvia	29.4	73.5	Corn silage	Corn silage
202 Reimer	14.6	36.6	Corn silage	Corn silage
Total – home farm	**284.5**	**703**		
Rented land – Armstrong area				
201 Skelton	29.1	72	Alfalfa	Alfalfa
203 Hoekstra	12	30	Alfalfa	Alfalfa
205 Jessie	12	30	Alfalfa	Alfalfa
206 Ferguson	16	39.7	Alfalfa	Alfalfa
Total –rented land Armstrong area	**69.5**	**171.7**		
Lavington property				
401/2/3 Pivots Lavington	124.6	308	Corn silage	Corn silage
Total - Lavington	**124.6**	**308**		
Total acreage 2017	**479**	**1183**		

4. Results of Ministry of Agriculture 2016 Post-harvest Soil Nitrate Study

Table 3 contains the results of the fall 2016 post-harvest nitrate soil testing at HS Jansen and Sons for the fields that will be farmed in 2017 (lab data in Appendix 1). Fifteen fields farmed by Jansen in 2016 were included in the fall 2016 study. All fields had residual soil nitrate-N in fall 2016 in the medium to very high category of environmental risk based on the BC Ministry of Agriculture (AGRI) scale that was

used to assess residual soil nitrate-N levels in the Hullcar area in fall 2016. Residual soil nitrate-N was measured to 90 cm in the soil.

Eight alfalfa fields were included in the study. All but one field had residual soil nitrate-N in the medium environmental risk range; the remaining field was in the high range. The management recommendation for fields within the medium risk range is to 'consider changes to nitrogen management'.

Seven fields that had been planted to corn silage in 2016 were included in the study. All but one field had residual soil nitrate-N in the high to very high environmental risk range; the remaining field was in the medium range. The management recommendation for fields in the high to very high range is to 'change nitrogen management' to reduce residual nitrate-N and environmental risk.

Bulk density conversions: Residual soil nitrate-N was converted from mg/kg to kg/ha assuming a soil bulk density of 1470 kg/m^3 to reflect the sandy texture of the soils in and around the HS Jansen property. The original conversions from mg/kg to kg/ha of soil residual nitrate-N made by Ministry of Agriculture staff in fall 2016 following the 2016 post-harvest soil nitrate survey assumed a soil bulk density of 1150 kg/m^3 to allow comparison to the data from the 2007 Ministry of Agriculture Okanagan soil survey. The higher bulk density used in this NMP has resulted in slightly higher total residual nitrate-N levels which resulted in a higher environmental risk rating for several fields.

These residual soil nitrate-N levels have been included when calculating manure application rates for 2017 in all fields.

Residual soil ammonium-N data has not been included in residual soil nitrogen levels. Soil residual levels of ammonium-N were low in fall 2016 in all but two fields, and there is currently no Ministry of Agriculture interpretation for residual soil ammonium-N.

Table 3. Soil residual nitrate-N levels from PHNT program – fall 2016 – Alfalfa Fields

Field ID	2016 Crop	Sampling depth	Nitrate-N (NO_3-N)	NO_3-N by depth and total to 90 cm (assuming BD of 1470 kg/m^3)	BC Ministry of Agriculture Environmental Risk Rating
		cm	mg/kg	kg/ha	
ALFALFA FIELDS					
101 Barns	Alfalfa	0-15	20	44.1	Medium
		15-30	8	17.6	
		30-60	3	13.2	
		60-90	3	13.2	
Total				**88.2**	
103A (north)	Alfalfa	0-15	14	30.9	Medium
		15-30	5	11.0	
		30-60	3	13.2	
		60-90	2	8.8	
Total				**63.9**	
103A (south)	Alfalfa	0-15	18	39.7	Medium
		15-30	4	8.8	
		30-60	3	13.2	
		60-90	1	4.4	
Total				**66.2**	
103B (west)	Alfalfa	0-15	17	37.5	Medium
		15-30	6	13.2	
		30-60	3	13.2	
		60-90	3	13.2	
Total				**77.2**	
103B (east)	Alfalfa	0-15	13	28.7	Medium
		15-30	10	22.1	
		30-60	3	13.2	
		60-90	2	8.8	
Total				**72.8**	
105 Dixon Back	Alfalfa	0-15	10	22.1	Medium
		15-30	4	8.8	
		30-60	3	13.2	
		60-90	2	8.8	
Total				**52.9**	
201 Skelton	Alfalfa	0-15	14	30.9	Medium
		15-30	7	15.4	
		30-60	4	17.6	
		60-90	3	13.2	
Total				**77.2**	
205 Jessie	Alfalfa	0-15	22	48.5	High
		15-30	12	26.5	
		30-60	5	22.1	
		60-90	1	4.4	
Total				**101.4**	

Table 3. Soil residual nitrate-N levels from PHNT program – fall 2016 – Corn Fields

Field ID	2016 Crop	Sampling depth	Nitrate-N (NO_3-N)	NO_3-N by depth and total to 90 cm (assuming BD of 1470 kg/m^3)	BC Ministry of Agriculture Environmental Risk Rating
		cm	mg/kg	kg/ha	
SILAGE CORN FIELDS					
102 Sorensen	Silage corn	0-15	18	39.7	High
		15-30	17	37.5	
		30-60	11	48.5	
		60-90	9	39.7	
Total				**165.4**	
103C Island	Silage corn	0-15	30	66.2	Very high
		15-30	18	39.7	
		30-60	9	39.7	
		60-90	14	61.7	
Total				**207.3**	
104 Harold's lower	Silage corn	0-15	14	30.9	Very high
		15-30	21	46.3	
		30-60	15	66.2	
		60-90	13	57.3	
Total				**200.7**	
104 Harold's upper	Silage corn	0-15	13	28.7	High
		15-30	13	28.7	
		30-60	10	44.1	
		60-90	9	39.7	
Total				**141.1**	
106 Dixon Front	Silage corn	0-15	10	22.1	Medium
		15-30	12	26.5	
		30-60	6	26.5	
		60-90	4	17.6	
Total				**92.6**	
109 Sylvia	Silage corn	0-15	23	50.7	High
		15-30	15	33.1	
		30-60	13	57.3	
		60-90	10	44.1	
Total				**185.2**	
202 Reimers	Silage corn	0-15	13	28.7	High
		15-30	14	30.9	
		30-60	10	44.1	
		60-90	12	52.9	
Total				**156.6**	

**Ministry of Agriculture (AGRI) Environmental Risk Rating: 0-49 kg/ha low, 50-99 kg/ha medium, 100-199 kg/ha high, 200+ kg/ha very high. Note: Residual nitrate-N in soil was calculated at a soil BD of 1470 kg/m^3.*

5. Nitrogen from all sources in 2017

Manure production – October 2016 to September 2017

All manure from the milking herd and dry cows at HS Jansen and Sons is put through a manure separator. The effluent from the separator is stored in the effluent storage lagoons. The solids separated out are stockpiled in a concrete storage area. Solids are transported to the operation's Lavington fields and applied as a nutrient source to those fields.

Liquid manure (effluent): Total liquid manure production during the October 2016 to September 2017 period including all runoff from roofs and areas around the barns and precipitation in manure storages (Table 4): **99,941.6 tons (approx. 19.9 million Imperial gallons).**

Solid manure: Total solid manure production October 2016 to September 2017 (Table 4): **2654 tons**.

Table 4. Calculation of manure production October 2016 to September 2017

Worksheet 7.1. Annual Manure Production for Dairy Cattle

Manure and Waste Generation

Type of Milk Cow: [illegible] | Number of Cows Milking: 960 | Average milk production per milked cow (lb/day): 72.3 | Days Grazing: (if unknown, use the default value provided)

Type of Animal	Typical Number	Your Number	Slurry	Primary Manure Type	Using Solid/Liq. Separation	% Slurry Separated to Solid fraction	Total Manure Generation Slurry (ft^3/day)	Solid (ft^3/day)
Milk Cow	960	960	☑	Slurry	☑	6	2,390	263
Dry Cow	192	120	☑	Slurry	☑	6	279	31
Heifers (16 to 26 months)	317	0	☐	Slurry	☐	10	0	0
Heifers (7 to 15 months)	269	0	☑	Slurry	☐	15	0	0
Calves (4 to 6 months)	96	0	☑	Slurry	☑	20	0	0
Calves (0 to 3 months)	96	100	☑	Slurry	☑	20	20	9
Total	1,930	1,180			**Total Daily Manure Production**		2,689	302

Milk House Effluent (typically 0.75 to 1.5 ft^3/day/milk cow): 4 ft^3/day/milk cow → 3,840 (ft^3/day)

1000 L = 35.3 ft^3

PLUS Other **Liquid** Wastes (silage effluent,etc.): 100 (ft^3/day)

PLUS Other **Solid** Wastes (spoiled feed, etc.): 100 (ft^3/day)

6629 402 (ft^3/day)

Assumed bulk density of solids: 580 (kg/m^3) OR 0.488 ($tons/yd^3$)

Manure and Waste Production: 89610 5438 (yd^3/year); 75522 2654 (tons/year)

Rainwater Collection

This applies only to rainwater that *enters* liquid manure handling systems.

Size of Yard Areas That Runoff Needs to be Collected From	696000	(ft^2)
Size of Roof Area That Discharge to Yard Areas Listed Above or That Discharge Directly Into the Manure Storage	323000	(ft^2)
Unroofed Surface Area of Manure Storage Facilities	257500	(ft^2)
Floating crust on manure surface	☐	No
Weather Data Site to be used	[illegible]	

How is this calculated? **Total Rainwater Collection**: 28975.5 (yd^3/year); 24419.9 (tons/year)

Total Weight of Manure

Total Weight of Manure Produced: Slurry 99941.6; Solid 2654 (tons/year)

Nitrogen content in manure: samples of liquid and solid manure were collected in March and May 2017 from the effluent storage lagoon and stockpiled solid manure. The liquid manure contained on average 0.063% total nitrogen and 425 ppm of ammonium-N (average of March and May samples). The solid manure contained 0.35% total nitrogen and 204 ppm of ammonium-N. This lab data was entered into the NMP calculator and used to calculate the amount of nitrogen in the manure for 2017 (Table 5). Original lab data is found in Appendix 2.

Table 5. Calculation of Nitrogen Content of Manure

Worksheet 4. Calculate Crop Nutrients in the Manure Sources													
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Manure Source and Application Method	Manure Nitrogen (N) Availability Calculation									Manure P_2O_5 and K_2O			
	Total nitrogen content (lab report) (%)[a]	Ammonium content (NH_4-N) (lab report) (ppm)[a]	Organic nitrogen content (col. B – C / 10^4) x 20 (lb N/ton)	N Mineralization factor (Table 6) (select from drop-down list)	Organic nitrogen mineralized this cropping year (col. D x E) (lb N/ton)	Ammonia (NH_4-N) retention factor (Table 7)	Ammonia (NH_4-N) remaining after volatilization (col. C / 10^4 x 20) x col. G (lb N/ton)	Nitrate (NO3-N) content of manure (lab report) (ppm)[a,b]	First-year plant available nitrogen (col. F + H) + (col. I / 10^4) (lb N/ton)	Total P (lab report) (%)[a]	Total P_2O_5 (col. K x 20 x 2.3) (lb P_2O_5/ton)	Total K (lab report) (%)[a]	Total K_2O (col. M x 20 x 1.2) (lb K_2O/ton)
Flush Lagoon	*0.06*	*425*	*0.4*	*0.35*	*0.14*	*0.7*	*0.60*		*0.74*	*0.009*	*0.4*	*0.07*	*1.6*
Dairy Solids	*0.35*	*204*	*6.7*	*0.25*	*1.66*	*0.58*	*0.24*		*1.90*	*0.071*	*3.3*	*0.05*	*1.3*
Settling Lagoon	*0.14*	*682*	*1.4*	*0.35*	*0.50*	*0.7*	*0.95*		*1.46*	*0.030*	*1.4*	*0.08*	*1.9*
			0.0		*0.00*		*0.00*		*0.00*		*0.0*		*0.0*
			0.0		*0.00*		*0.00*		*0.00*		*0.0*		*0.0*
			0.0		*0.00*		*0.00*		*0.00*		*0.0*		*0.0*
			0.0		*0.00*		*0.00*		*0.00*		*0.0*		*0.0*
			0.0		*0.00*		*0.00*		*0.00*		*0.0*		*0.0*

Other sources of nitrogen on farm

Fertilizer nitrogen: No nitrogen fertilizer is planned to be used at HS Jansen and Sons in 2017 unless results of pre-sidedress nitrogen soil testing on silage corn fields how that there is insufficient nitrogen in the soil to provide the nitrogen required by the corn crop till harvest. If there is insufficient nitrogen in June when pre-sidedress samples are taken (if soil available N level is below 25-30 ppm), either manure effluent or nitrogen fertilizer will be applied at the rate required to meet corn requirements for the remainder of the growing season. This decision will be made by the crop advisor who does the soil testing and provides advice to HS Jansen and Sons.

Irrigation water: The farm irrigates with more than 10 wells located around the property. Six of these wells had nitrates above 1 mg/L when last sampled in 2015 (Table 6) (2015 data, not sampled in 2016)(Associated Environmental 2017).

The remainder of the farm's irrigation wells had below 1 mg/L of nitrate at the time of last sampling in 2015 and thus would be expected to contribute less than 2 kg per hectare of nitrate over the growing season.

Only project wells #7 and #8 are expected to contribute a measurable amount of nitrate to the soil and only on Field 109 Sylvia because this field is adjacent to these wells. On this field, it is expected that irrigation water will contribute approx. 23 lb/A (25.5 kg/ha) nitrate-N during each growing season (based on 12" or 30 cm of water irrigated on the field over the growing season). There is some dilution of the water from these two wells during irrigation because all of the farm's wells are linked together and typically several are operated at once. Therefore, this amount is half of the nitrate-N that would be contributed if the field was irrigated only with water from these two wells.

All other fields on the farm are irrigated with a blend of water from all the wells. Several of the farm's high volume wells draw from the deeper aquifer and this water has non-detectable levels of nitrate-N. This water will dilute the level of nitrate from wells with detectable levels. Therefore, it is expected that irrigation water will contribute less than 5 lbs/A on all other fields. This amount has not been considered when calculating nitrogen requirements.

Table 6. Nitrate-N contribution from irrigation wells

Project well #	Well log or ID #	Nitrate-N concentration in irrigation water
		mg/L
Project well #7	na	21.5
Project well #8	na	12
Project well #12	WP25852	4.51
Project well #3	WP28038	3.27
Project well #13	WP25853	2.53
Project well #17	ID# 29867	2.34

Composted mortalities: The operation composts mortalities on site in a separate composting area near the solids storage area. Mortalities, once composted, become part of the solid manure stream and are hauled with the manure solids to the farm's Lavington fields. The nutrients in the mortalities do not contribute any nitrogen to the Hullcar-area fields.

6. Cropping and nitrogen requirements of crops in 2017

2017 Crops: 2017 cropping information is found in columns B, C and D of Table 7. Crop, estimated dry yield and protein content of crop as well as 2017 nitrogen application rates have been provided by Doug Macfarlane, CCA for HS Jansen.

Table 8 summarizes 2016 and 2017 crops and nitrogen recommendations for comparison between the two years.

Crop nitrogen requirements for 2017: Table 7, Column H contains the nitrogen application rate recommendations for 2017. This number is the estimated crop nitrogen uptake (column E) less the amount of residual nitrate in the 0 to 60 cm depth of the soil (column F, from fall 2016 PHNT results) and less the amount of nitrogen that is estimated to be released from soil organic matter in 2017 for each field (column G).

Column E contains the estimated crop nitrogen uptake values by field for 2017. These values are the product of crop dry yield by crop protein corrected for %N in protein (16% of protein is nitrogen).

Column F contains the residual soil nitrate from fall 2017 soil test results to 60 cm depth. Even though the new seedings of alfalfa:grass may not root deeper than 30 cm in 2017, it was felt that this was a conservative assessment of available nitrogen in soil.

Column G contains the nitrogen fertility factors by field which are an estimate of the amount of nitrogen which will be released from soil organic matter over the 2017 growing season. All fields farmed by HS Jansen have high fertility due to longterm application of manure to the land base. Several fields were given a higher fertility factor (estimated release of 90 lb/A) because they have been amended with manure at or higher than the agronomic rate for many years. One field (105, Dixon Back) was given the higher fertility factor because the alfalfa crop will be ploughed down in 2017 which is expected to release a significant amount of nitrogen.

Table 7. Crop nitrogen requirement calculations

Worksheet 1. Calculate the Crop Nitrogen Application Recommendations							
A	B	C	D	E	F	G	H
Field Description	Crop Information			Crop Nitrogen (N) Applicator Calculations			Crop Nitrogen Application Recommend'n
(name or number)	Crop type to be fertilized	Crop dry yield (estimated) (tons/ac)[a]	Protein content of crop[b] (estimated) (%)	Crop Nitrogen (N) Uptake (col. C x D x 1.6 x 2) (lb N/ac)	Available soil nitrogen (nitrate plus ammonia)[c] (lab report) (lb N/ac)	Nitrogen fertility factor (Table 1) (lb N/ac)	(col. E – F - G) (lb N/ac)
101 Barns Yard	Alf/Gra	7.0	21.0	470	67	90.0	313
102 Sorenson	Alf/Gra	5.0	20.0	320	112	90.0	118
103A Hullcar Hall	Alf/Gra	7.0	20.0	448	53	90.0	305
103B Dougs	Alf/Gra	7.0	20.0	448	64	90.0	294
103C Island	Grass	5.0	18.0	288	130	90.0	68
104 Harolds	corn sil	8.0	8.0	205	109	80.0	16
105 Dixon Back	corn sil	8.0	8.0	205	39	90.0	76
106 Dixon Front	corn sil	7.5	8.0	192	67	45.0	80
109 Sylvia	corn sil	7.5	8.0	192	126	55.0	11
201 Skelton	Alf/Gra	7.0	20.0	448	57	45.0	346
202 Reimer	corn sil	8.0	8.0	205	92	45.0	68
203 Heokstra	Alf/Gra	6.0	18.0	346	40	45.0	261
204 Granview Flats	Alf/Gra	4.5	15.0	216	86	0.0	130
205 Jessie	Alf/Gra	7.5	19.0	456	86	45.0	325
206 Ferguson	Alf/Gra	5.0	12.5	200	18	0.0	182
400 Lavington	corn sil	7.5	8.0	192	42	0.0	150

Table 8. Cropping and crop nitrogen requirements – 2016 and 2017

Field ID	2016 N app rate	Fall 2016 rating*	2017 N app rate in manure	2016 Crop	2017 crop
	Avail N lb/A		Avail N lb/A		
Corn fields (2017)					
104 Harold's	87	H-VH	22	Corn silage	Corn silage
105 Dixon Back	22	M	55	Alfalfa/grass	Corn silage
106 Dixon Front	87	M	55	Corn silage	Corn silage
109 Sylvia	130	H	18	Corn silage	Corn silage
202 Reimer	87	H	66	Corn silage	Corn silage
401/2/3 Pivots Lavington	9	NA	19	Corn silage	Corn silage
Alfalfa and grass fields (2017)					
101 B,C Yard	NA	NA	NA	Alfalfa-grass	Alfalfa-grass
101 Barns	22	M	88	Alfalfa/grass	Alfalfa/grass
103 A Hullcar Hall	87	M	110	Alfalfa/grass	Alfalfa/grass
103 B Doug's	87	M	110	Alfalfa/grass	Alfalfa/grass
103 C Island	58	VH	68	Corn silage	Grass
201 Skelton	87	M	110	Alfalfa/grass	Alfalfa/grass
203 Hoekstra	0	NA	0	Alfalfa	Alfalfa
205 Jessie	36	H	147	Alfalfa/grass	Alfalfa/grass
206 Ferguson	18	NA	0	Alfalfa	Alfalfa
102 Sorensen	18	H	37	Corn silage	Alfalfa (new seeding)

**Environmental risk factor based on soil post-harvest nitrate levels in fall 2016.*

7. Planned application rate of manure in 2017

Table 9 contains the planned manure applications by field for 2017. The manure application rate is determined on a weight basis (tons/A) and converted to a volume basis (gallons/A) in the NMP calculator. The application rate is calculated from the crop requirement and the nitrogen content of the manure.

Liquid manure (effluent): Will be applied to eleven fields in 2017 at or close to the recommended application rates. There will be excess manure effluent which will be provided via the farm's pipeline systems to neighbours on a contract basis.

Alfalfa:grass fields will receive small applications of manure after first, second and possibly third cut to provide up to the recommended maximum application rate of manure.

Fields 203 Hoekstra and 206 Ferguson are located away from the farm and will not receive either manure effluent or manure solids in 2017.

Table 9. Planned manure applications for 2017

Field ID	2017 N app rate in manure	2017 crop	2017 manure app rate*	
	Avail. N		Effluent	Solids
	Lb/A		Gal/A	Tons/A
Corn fields (2017)				
104 Harold's	22	Corn silage	6,000	0
105 Dixon Back	55	Corn silage	14,950	0
106 Dixon Front	55	Corn silage	14,950	0
109 Sylvia	18	Corn silage	5,000	0
202 Reimer	66	Corn silage	17,960	0
401/2/3 Pivots Lavington	19	Corn silage	0	10
Alfalfa and grass fields (2017)				
101 B,C Yard	NA	Alfalfa-grass	0	0
101 Barns	88	Alfalfa	23,950	0
103 A Hullcar Hall	110	Alfalfa	29,950	0
103 B Doug's	110	Alfalfa	29,950	0
103 C Island	68	Grass	18,500	0
201 Skelton	110	Alfalfa	29,950	0
203 Hoekstra	0	Alfalfa	0	0
205 Jessie	147	Alfalfa	39,900	0
206 Ferguson	0	Alfalfa	0	0
102 Sorensen	37	Alfalfa (new seeding)	10,000	0

**2017 manure application rates provided by D. Macfarlane, CCA*

Pre-sidedress nitrate testing for corn: A pre-sidedress nitrate-N test will be done on all corn silage fields in June to confirm that there is sufficient available nitrogen for the corn crop to achieve normal yields. If soil available nitrogen levels are insufficient to meet crop requirements for the remainder of the growing season, manure effluent or chemical fertilizer will be applied to meet the deficit. This decision will be made by Doug Macfarlane, crop advisor for HS Jansen, and he will determine the application rate required.

8. Agronomic balance calculations – Crop requirements vs. nutrients to be applied

Table 10 shows the nitrogen balance for each field for 2017 (3rd from last column). Application rates for 2017 were planned to achieve a zero or better nitrogen balance. The table shows that, based on the assumptions used in the calculator, the available farm-specific data and the planned manure application rates, each field should have a zero or close to nitrogen balance in 2017. Post-harvest soil nitrate testing in fall 2017 will show how close to nitrogen balance each field is, and further adjustments to manure application rates will be made in 2018 as required.

Manure application rates on corn fields are designed to meet crop requirements and result in a zero or close to nitrogen balance. Manure application rates on alfalfa fields will supply less than crop requirements; alfalfa will fix the remainder from the atmosphere.

Table 10. Agronomic balance calculations for 2017 cropping year

Worksheet 5. Estimate the Agronomic Balance for Nitrogen, Phosphorus and Potassium

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Field Description	Crop type	Field Size	Manure Source and Application Method	Manure Application Rate	Available Nutrients in the Year of Application							Crop Nutrient Recommendation (based on estimated soil nutrient supply)			Agronomic Balance (crop nutrient recommendation minus available nutrients in the year of application)		
					Manure Sources				Fertilizer								
(Worksheet 1, col. A)	(Worksheet 1, col. B)		Show/Hide Manure Source #2 / Show/Hide Manure Source #3	See note below for guidance in determining rate[a]	N (Col E x Worksheet 4, col. J)	P_2O_5 First-year P availability coefficient *	P_2O_5 (Col E x G x Worksheet 4, col. L)	K_2O (Col E x Worksheet 4, col. N)	N	P_2O_5	K_2O	N (Worksheet 1, col. H)	P_2O_5 (Worksheet 2, col. I)	K_2O (Worksheet 3, col. I)	N[b] (col. M – F – J)	P_2O_5[a] (col. N – H – K)	K_2O[a] (col. O – I – L)
(name or number)		(ac)	Click here for help to use the show/hide buttons. (select from drop-down list)	(tons/ac)	(lb N/ac)	-	(lb P_2O_5/ac)	(lb K_2O/ac)	Sum all planned fertilizer additions for the year. Use Worksheet 6.1 to the right to help. (lb N/ac)	(lb P_2O_5/ac)	(lb K_2O/ac)	(lb N/ac)	(lb P_2O_5/ac)	(lb K_2O/ac)	(lb N/ac)	(lb P_2O_5/ac)	(lb K_2O/ac)
101 Barns Yard	Alf/Gra	56.2	Flush Lagoon	120	88	0.75	35	191									
			Dairy Solids	0	0	0.75	0	0									
				0	0	0.75	0	0									
			all manures		88	n/a	35	191	0			313	24	0	225	-11	-191
102 Sorenson	Alf/Gra	100.6	Flush Lagoon	50	37	0.65	13	80									
			Dairy Solids		0	0.65	0	0									
					0	0.65	0	0									
			all manures		37	n/a	13	80	0			118	43	0	81	30	-80
103A Hullcar Hall	Alf/Gra	101.6	Flush Lagoon	150	110	0.65	38	239									
			Dairy Solids		0	0.65	0	0									
					0	0.65	0	0									
			all manures		110	n/a	38	239	0			305	60	101	195	21	-138
103B Dougs	Alf/Gra	96.0	Flush Lagoon	150	110	0.75	44	239									
			Dairy Solids		0	0.75	0	0									
					0	0.75	0	0									
			all manures		110	n/a	44	239	0			294	24	0	184	-20	-239
103C Island	Grass	12.4	Flush Lagoon	92	68	0.50	18	146									
			Dairy Solids		0	0.50	0	0									
					0	0.50	0	0									
			all manures		68	n/a	18	146	0			68	23	72	0	5	-74
104 Harolds	corn sil	110.3	Flush Lagoon	30	22	0.65	8	48									
			Dairy Solids	0	0	0.65	0	0									
					0	0.65	0	0									
			all manures		22	n/a	8	48	0			16	37	0	-6	29	-48
105 Dixon Back	corn sil	101.0	Flush Lagoon	75	55	0.50	15	119									
			Dairy Solids	0	0	0.50	0	0									
				0	0	0.50	0	0									
			all manures		55	n/a	15	119	0			76	37	115	21	22	-4
106 Dixon Front	corn sil	15.0	Flush Lagoon	75	55	0.65	19	119									
			Dairy Solids	0	0	0.65	0	0									
					0	0.65	0	0									
			all manures		55	n/a	19	119	0			80	35	54	25	15	-65
109 Sylvia	corn sil	73.5	Flush Lagoon	25	18	0.85	8	40									
			Dairy Solids		0	0.85	0	0									
					0	0.85	0	0									
			all manures		18	n/a	8	40	0			11	0	54	-7	-8	14
201 Skelton	Alf/Gra	72.0	Flush Lagoon	150	110	0.65	38	239									
			Dairy Solids		0	0.65	0	0									
					0	0.65	0	0									
			all manures		110	n/a	38	239	0			346	60	202	236	21	-37
202 Reimer	corn sil	36.6	Flush Lagoon	90	66	0.65	23	143									
			Dairy Solids		0	0.65	0	0									
				0	0	0.65	0	0									
			all manures		66	n/a	23	143	0			68	68	115	2	45	-28
203 Heokstra	Alf/Gra	30.0	Flush Lagoon		0	0.75	0	0									
			Dairy Solids	0	0	0.75	0	0									
					0	0.75	0	0									
			all manures		0	n/a	0	0	0			261	19	86	261	19	86
204 Granview Flats	Alf/Gra	114.0	Flush Lagoon		0	0.85	0	0									
			Dairy Solids	0	0	0.85	0	0									
					0	0.85	0	0									
			all manures		0	n/a	0	0	55			130	0	0	75	0	0
205 Jessie	Alf/Gra	30.0	Flush Lagoon	200	147	0.65	51	318									
			Dairy Solids		0	0.65	0	0									
					0	0.65	0	0									
			all manures		147	n/a	51	318	0			325	52	108	178	1	-210
206 Ferguson	Alf/Gra	39.7	Flush Lagoon		0	0.50	0	0									
			Dairy Solids	0	0	0.50	0	0									
					0	0.50	0	0									
			all manures		0	n/a	0	0	55			182	35	36	127	35	36
400 Lavington	corn sil	308.0	Flush Lagoon		0	0.65	0	0									
			Dairy Solids	10	19	0.65	21	13									
					0	0.65	0	0									
			all manures		19	n/a	21	13	0			150	43	108	131	22	95
Total		1296.9															

9. Timing of manure applications

Manure applications will occur throughout the growing season as required. On corn fields the bulk of the application will occur before planting. If required based on pre-sidedress nitrate testing a small additional application of effluent or chemical fertilizer will be made to ensure sufficient nutrients to meet crop requirements for the rest of the growing season. No manure will be applied to corn fields after harvest.

Alfalfa fields will receive an application of effluent after each cut up to the total indicated application rate.

All manure applications on perennial cropped fields will be complete by October 31st , the BC Ministry of Agriculture recommended deadline for manure application on perennial cropped land. Less than 50% of the annual nutrient demand will be applied during the September –October period on alfalfa/grass fields.

10. Method of manure application

Liquid manure will be applied by irrigation gun via the farm's dragline system. Solid manure will be applied by solid manure spreader. Both of these manure application methods allow accurate tracking of volumes of manure applied for record keeping.

11. Tracking of manure applications

All manure applications made to HS Jansen's land base during 2017 will be tracked and recorded. One of the manure application guns currently has a flow meter, the others are scheduled to have flow meters installed during the summer. Effluent application rates are set by nozzle size and area covered, and gun travel speed. Flow rate volumes are used to confirm application rates. Volumes applied per acre on each field will be recorded and made available to the Director on request. This information will be used to confirm 2017 manure application rates.

12. Setbacks

HS Jansen and Sons maintains the following setbacks when applying manure:

- 30 m (100 ft) from all wells, surface water and residences
- 10 m (30 ft) from roads and other buildings

13. Other fertilizer application in 2017

No phosphorus or potassium fertilizer will be applied to fields owned or rented by HS Jansen in 2017. Other non-nitrogen fertilizer (sulphur and boron) as required based on soil test results will be applied in 2017.

14. Irrigation rate

HS Jansen and Sons Hullcar operations are situated on soils with a texture of sand, sandy loam or loamy sand. These soils are rapidly permeable and have low moisture and nutrient holding capacity. Nitrate leaching can occur easily from these soils if irrigation water moves down below the crop rooting depth. For this reason, HS Jansen will irrigate according to soil moisture sensors to ensure that irrigation water

does not move deeper than 60 cm in the soil, the approximate crop rooting depth. Soil moisture monitors have been installed in several fields and more are scheduled to be installed in summer 2017.

15. Manure storage capacity

HS Jansen and Sons has two manure storage facilities for liquid manure (effluent) and one storage area for separated manure solids (identified on Figure 3).

Liquid storage: The farm has two in-ground, HDPE-lined lagoons for liquid manure (effluent) storage. The smaller lagoon has dimensions 90 m by 45 m by 5.5 m deep with 3:1 slope on sides, and holds an estimated 6 million litres (1.32 million gallons). The larger lagoon has dimensions 160 m by 100 m by 7 m deep with 3:1 slope on lagoon sides, and holds an estimated 53 million litres (11.66 million gallons). Total storage capacity is estimated to be 59 million litres (13 million gallons). This storage capacity assumes a 1 m freeboard in each lagoon at all times. (Values from the 2016 Jansen EIA).

The farm currently has 960 milking cows plus 120 dry cows and 100 calves less than 3 months of age on site. This number of livestock plus runoff from roofs and yard areas and precipitation in manure storages is expected to produce 99,941.6 tons of effluent (19.9 million gallons) of manure effluent per year (calculated using the NMP calculator, see Table 4).

Based on these calculations, the farm appears to have sufficient storage to hold manure plus rainwater and runoff for up to 7.8 months which is sufficient for the typical minimum overwinter storage period of 6 months.

Solid manure storage: The farm has a concrete storage area of dimensions 58 m by 160 m or **9280 m^2** in area. The pad slopes from the manure separator to liquid collection bins allowing separated solids to dry and the leachate from the solids to flow down the concrete pad and into the lagoon system. All leachate from the pad flows into the lagoons.

For a 12 month period, solids production is estimated at **2645 tons** (**4000 m^3** based on BD of 600 kg/m^3). If solids are piled 2 m high on the concrete storage slab, the area required for 12 months of storage is 2000 m^2.

Based on these calculations, the farm appears to have sufficient storage capacity for solid manure for more than 12 months of storage.

16. Post-harvest soil nitrate testing – fall 2017

After crop harvest in fall 2017, soil sampling will be done in each field to at least 60 cm depth to assess the accuracy of 2017 manure application rates. At this time, the 2017 manure application rates will be reviewed based on residual soil nitrate-N levels, and adjustments made to rates and timing as required for 2018.

17. Reference

Associated Environmental. 2017. Comprehensive Monitoring Program and Environmental Impact Assessment: HS Jansen and Sons Farms Ltd. February 2017 http://www2.gov.bc.ca/gov/content/environment/air-land-water/site-permitting-compliance/hullcar-aquifer

Prepared by:

Ruth McDougall, M.Sc., PAg

Consulting Agrologist

May 23, 2017

Figure 1. Location Map – HS Jansen and Sons Hullcar Farm

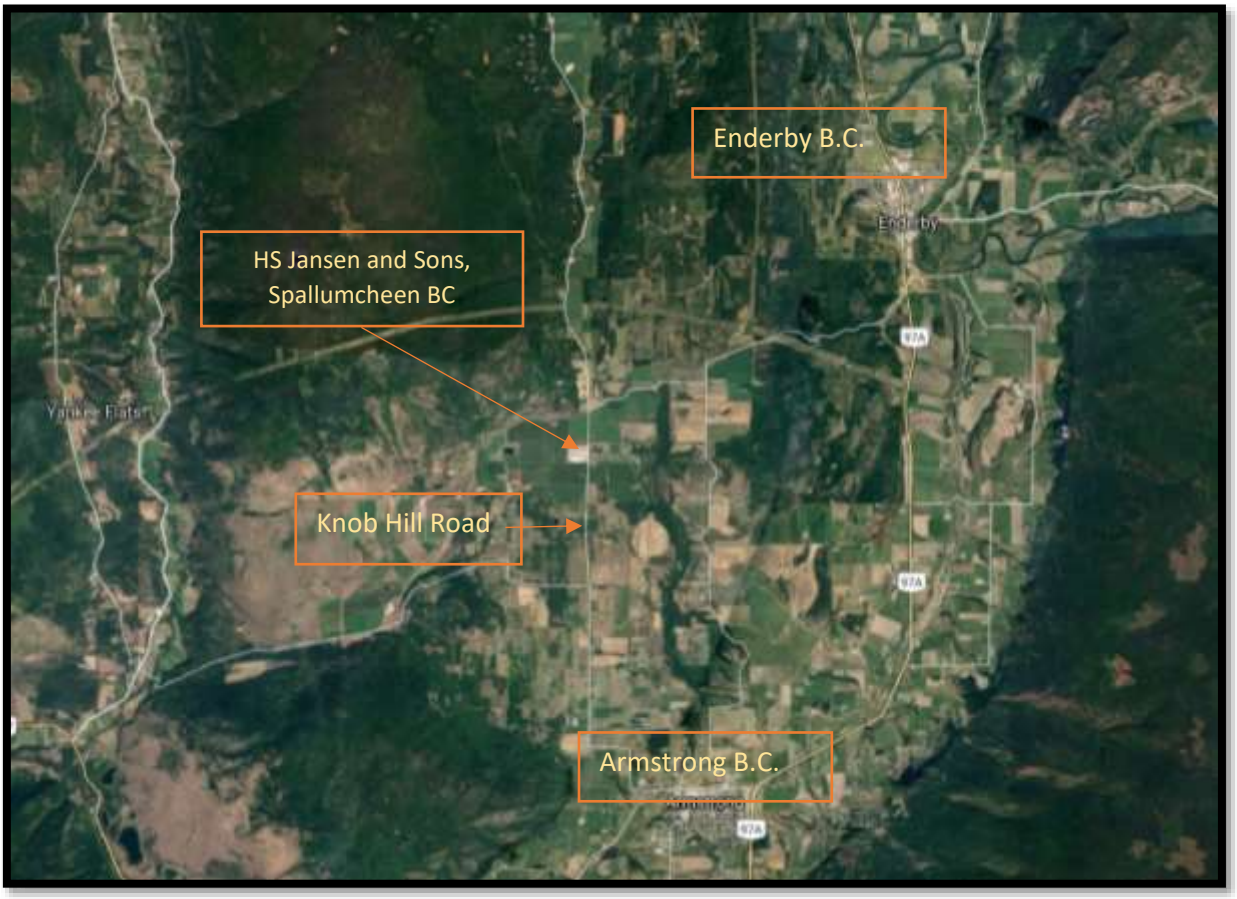


Figure 2. Map of HS Jansen and Sons fields in Hullcar area and wells (see Figure 3 for wells close to farmstead)

Wells:

Red = domestic wells

Blue = irrigation wells

Figure 3. Close-up of HS Jansen barns, manure storages and wells close to farmstead

Wells:

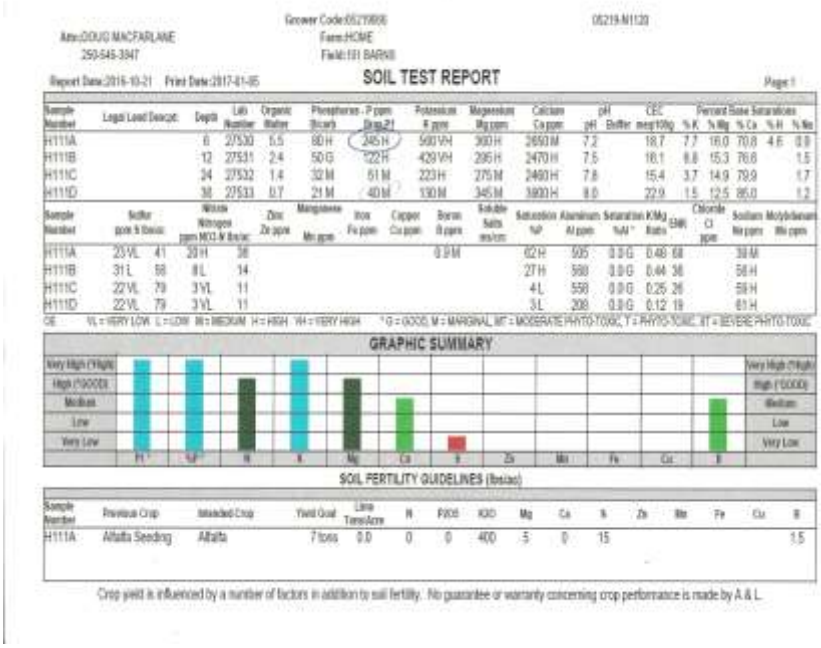
Red = domestic wells

Orange = livestock watering wells

Blue = irrigation wells

Appendix 1. Fall 2016 PHNT Soil Data

Field 101 Barns



Grower Code:05219868 05219-N1120
Attn:DOUG MACFARLANE Farm:HOME
250-545-3847 Field:101 BARNS

Report Date:2016-10-21 Print Date:2017-01-05

SOIL TEST REPORT

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Sample Number	Legal Land Descpt.	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations %K	%Mg	%Ca	%H	%Na
H111A		6	27530	5.5	60 H	245 H	560 VH	360 H	2650 M	7.2		18.7	7.7	16.0	70.8	4.6	0.9
H111B		12	27531	2.4	50 G	122 H	429 VH	295 H	2470 H	7.5		16.1	8.8	15.3	76.6		1.5
H111C		24	27532	1.4	32 M	51 M	223 H	275 M	2460 H	7.8		15.4	3.7	14.9	79.9		1.7
H111D		36	27533	0.7	21 M	40 M	130 M	345 M	3800 H	8.0		22.9	1.5	12.5	85.0		1.2

Sample Number	Sulfur ppm S lbs/ac		Nitrate Nitrogen ppm NO3-N lbs/ac		Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	EMR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H111A	23 VL	41	39 H	36					0.9 M		62 H	595	0.0 G	0.49	68		39 M	
H111B	31 L	58	8 L	14							27 H	568	0.0 G	0.44	36		58 H	
H111C	22 VL	79	3 VL	11							4 L	558	0.0 G	0.25	26		59 H	
H111D	22 VL	79	3 VL	11							3 L	208	0.0 G	0.12	19		61 H	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

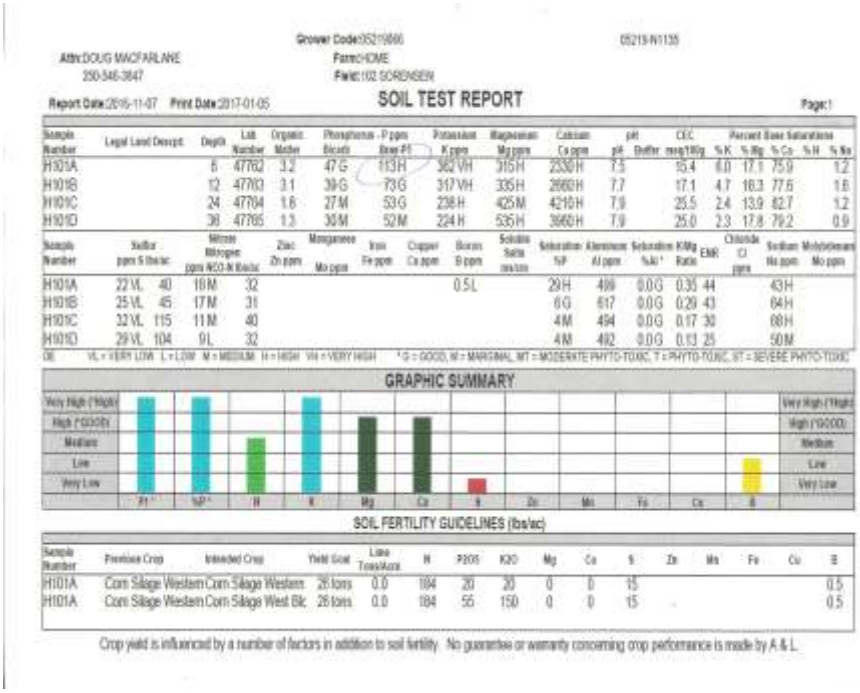
GRAPHIC SUMMARY

SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H111A	Alfalfa Seeding	Alfalfa	7 tons	0.0	0	0	400	5	0	15					1.5

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 102 Sorensen



Grower Code:05219868 05219-N1135
Attn:DOUG MACFARLANE Farm:HOME
250-545-3847 Field:102 SORENSEN

Report Date:2016-11-07 Print Date:2017-01-05

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descpt.	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations %K	%Mg	%Ca	%H	%Na
H101A		6	47762	3.2	47 G	113 H	362 VH	315 H	2330 H	7.5		15.4	6.0	17.1	75.9		1.2
H101B		12	47763	3.1	39 G	73 G	317 VH	335 H	2660 H	7.7		17.1	4.7	16.3	77.6		1.6
H101C		24	47764	1.6	27 M	53 G	238 H	425 M	4210 H	7.9		25.5	2.4	13.9	82.7		1.2
H101D		36	47765	1.3	30 M	52 M	224 H	535 H	3660 H	7.9		25.0	2.3	17.8	79.2		0.9

Sample Number	Sulfur ppm S lbs/ac		Nitrate Nitrogen ppm NO3-N lbs/ac		Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	EMR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H101A	22 VL	40	16 M	32					0.5 L		29 H	489	0.0 G	0.35	44		43 H	
H101B	25 VL	45	17 M	31							6 G	617	0.0 G	0.29	43		64 H	
H101C	32 VL	115	11 M	40							4 M	494	0.0 G	0.17	30		68 H	
H101D	29 VL	104	9 L	32							4 M	492	0.0 G	0.13	25		50 M	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY

SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H101A	Corn Silage Western	Corn Silage Western	26 tons	0.0	184	20	20	0	0	15					0.5
H101A	Corn Silage Western	Corn Silage West Blc	26 tons	0.0	184	55	150	0	0	15					0.5

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 103A North

Grower Code:05219066 05219-N1124

Attn:DOUG MACFARLANE
250-546-3847

Farm:HOME
Field:103A (NORTH)

Report Date:2016-10-21 Print Date:2017-01-05

SOIL TEST REPORT

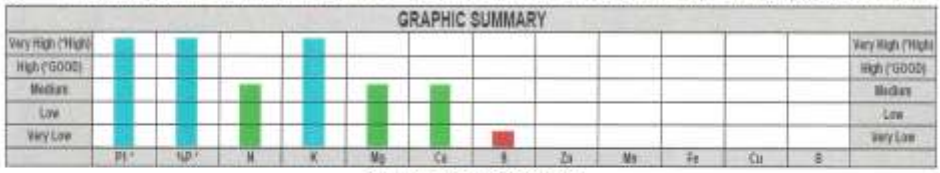
Page:1

Sample Number	Legal Land Descpt	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations %K	%Mg	%Ca	%H	%Na
H11A		6	27542	5.0	62 H	183 H	319 VH	250 M	2370 M	7.1		16.3	5.0	12.8	72.6	8.9	0.7
H11B		12	27543	3.2	52 H	109 H	182 H	265 M	2560 H	7.2		16.4	2.8	13.4	77.9	4.6	1.3
H11C		24	27544	1.6	15 L	20 VL	59 L	85 M	800 H	7.5		5.0	3.1	14.3	80.7		2.1
H11D		36	27545	0.8	18 L	28 L	133 M	205 H	1710 H	7.7		10.8	3.2	15.8	79.3		1.9

Sample Number	Sulfur ppm S lbs/ac		Nitrate Nitrogen ppm NO3-N lbs/ac		Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	EMR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H11A	14 VL	25	14 M	25							44 H	472	0.0 G	0.39	63		27 M	
H11B	25 L	45	5 L	9							9 G	586	0.0 G	0.21	44		48 H	
H11C	10 L	36	3 VL	11							2 VL	239	0.0 G	0.22	28		24 VH	
H11D	20 L	72	2 VL	7							2 VL	552	0.0 G	0.20	20		48 VH	

GE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY



SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H11A	Alfalfa	Alfalfa	7 tons	0.0	0	0	400	10	0	20					

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L

Field 103A South

Grower Code:05219066 05219-N1123

Attn:DOUG MACFARLANE
250-546-3847

Farm:HOME
Field:103A(SOUTH)

Report Date:2016-10-21 Print Date:2017-01-05

SOIL TEST REPORT

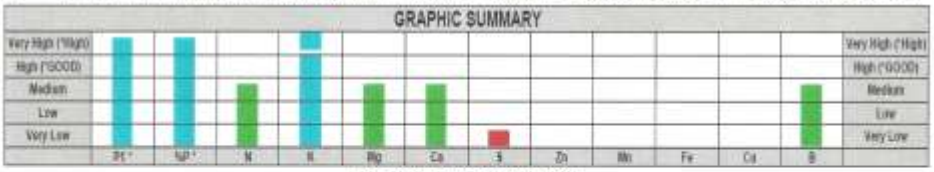
Page:1

Sample Number	Legal Land Descpt	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations %K	%Mg	%Ca	%H	%Na
H21A		6	27534	4.0	60 G	174 H	316 VH	225 M	1870 M	7.1		13.3	6.1	14.1	70.2	8.9	0.7
H21B		12	27535	1.9	52 G	118 G	313 VH	215 H	1820 H	7.3		11.8	6.8	15.1	76.9		1.4
H21C		24	27536	1.0	22 L	44 M	169 H	200 H	1510 H	7.5		9.8	4.4	16.9	76.7		2.2
H21D		36	27537	0.4	16 L	23 VL	78 M	170 H	1070 M	7.9		7.2	2.8	19.8	74.7		3.0

Sample Number	Sulfur ppm S lbs/ac		Nitrate Nitrogen ppm NO3-N lbs/ac		Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	EMR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H21A	14 VL	25	18 M	32					0.6 M		52 H	434	0.1 G	0.43	52		22 M	
H21B	16 VL	29	4 VL	7							24 H	635	0.1 G	0.45	31		39 H	
H21C	16 VL	58	3 VL	11							10 G	587	0.1 G	0.26	22		50 VH	
H21D	10 VL	36	1 VL	4							8 L	369	0.0 G	0.14	15		49 VH	

GE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY

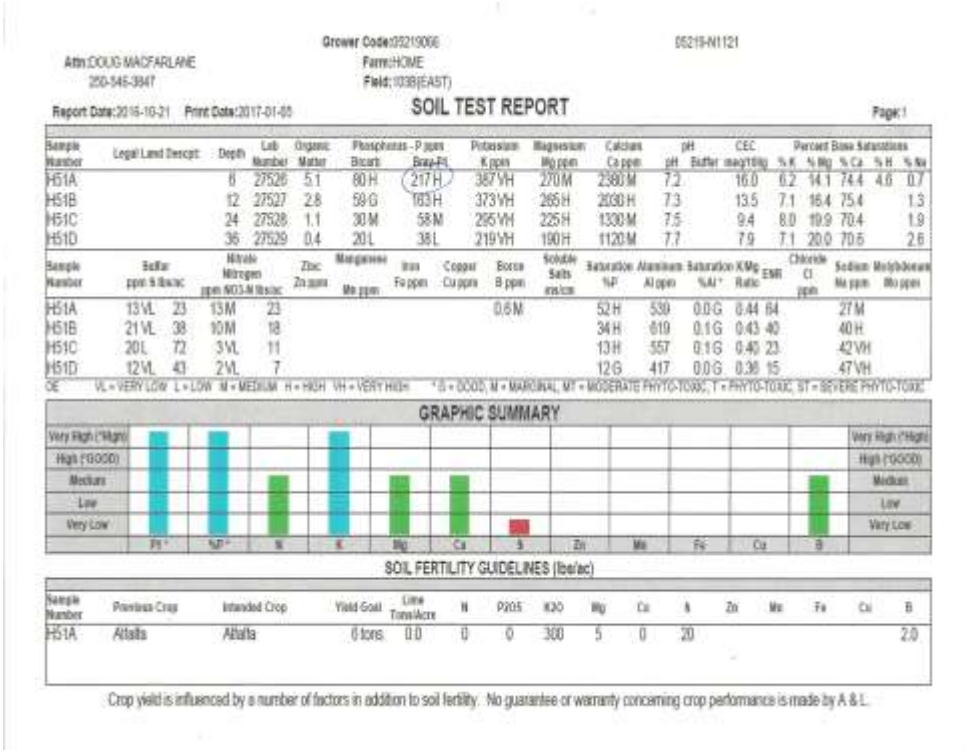


SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H21A	Alfalfa	Alfalfa	7 tons	0.0	0	0	400	5	0	15					2.0

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L

Field 103B East



Grower Code:05219066 05219-N1121
Attn:DOUG MACFARLANE Farm:HOME
250-546-3847 Field:103B(EAST)

SOIL TEST REPORT

Report Date:2016-10-21 Print Date:2017-01-05 Page:1

Sample Number	Legal Land Descpt	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
H51A		6	27526	5.1	60 H	217 H	367 VH	270 M	2360 M	7.2		16.0	6.2	14.1	74.4	4.6	0.7
H51B		12	27527	2.8	59 G	183 H	373 VH	265 H	2030 H	7.3		13.5	7.1	16.4	75.4		1.3
H51C		24	27528	1.1	30 M	58 M	295 VH	225 H	1330 M	7.5		9.4	8.0	19.9	70.4		1.9
H51D		36	27529	0.4	20 L	38 L	219 VH	190 H	1120 M	7.7		7.9	7.1	20.0	70.5		2.6

Sample Number	Sulfur ppm S lbs/ac		Nitrate Nitrogen ppm NO3-N lbs/ac		Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H51A	13 VL	23	13 M	23					0.6 M		52 H	539	0.0 G	0.44	64		27 M	
H51B	21 VL	38	10 M	18							34 H	619	0.1 G	0.43	40		40 H	
H51C	20 L	72	3 VL	11							13 H	557	0.1 G	0.40	23		42 VH	
H51D	12 VL	43	2 VL	7							12 G	417	0.0 G	0.36	15		47 VH	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

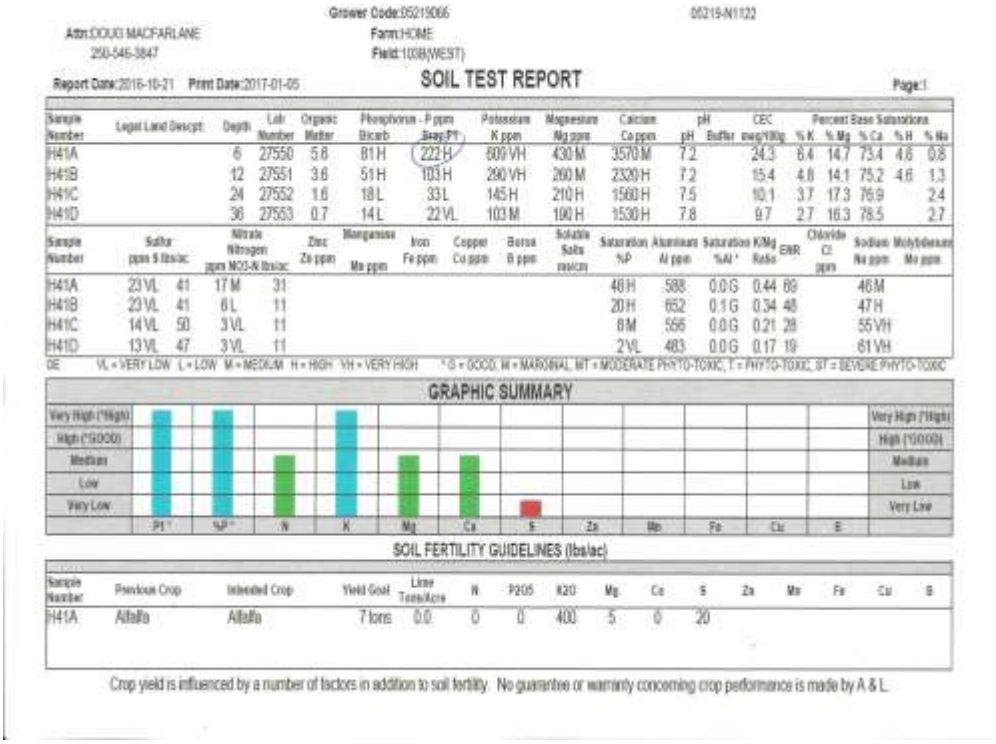
GRAPHIC SUMMARY

SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Cu	S	Zn	Mn	Fe	Cu	B
H51A	Alfalfa	Alfalfa	6 tons	0.0	0	0	300	5	0	20					2.0

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 103B West



Grower Code:05219066 05219-N1122
Attn:DOUG MACFARLANE Farm:HOME
250-546-3847 Field:103B(WEST)

SOIL TEST REPORT

Report Date:2016-10-21 Print Date:2017-01-05 Page:1

Sample Number	Legal Land Descpt	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
H41A		6	27550	5.6	81 H	222 H	609 VH	430 M	3570 M	7.2		24.3	6.4	14.7	73.4	4.6	0.8
H41B		12	27551	3.6	51 H	103 H	290 VH	260 M	2320 H	7.2		15.4	4.8	14.1	75.2	4.6	1.3
H41C		24	27552	1.6	18 L	33 L	145 H	210 H	1560 H	7.5		10.1	3.7	17.3	76.9		2.4
H41D		36	27553	0.7	14 L	22 VL	103 M	190 H	1530 H	7.8		9.7	2.7	16.3	78.5		2.7

Sample Number	Sulfur ppm S lbs/ac		Nitrate Nitrogen ppm NO3-N lbs/ac		Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H41A	23 VL	41	17 M	31							48 H	588	0.0 G	0.44	69		46 M	
H41B	23 VL	41	6 L	11							20 H	652	0.1 G	0.34	48		47 H	
H41C	14 VL	50	3 VL	11							8 M	556	0.0 G	0.21	28		55 VH	
H41D	13 VL	47	3 VL	11							2 VL	483	0.0 G	0.17	19		61 VH	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY

SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Cu	S	Zn	Mn	Fe	Cu	B
H41A	Alfalfa	Alfalfa	7 tons	0.0	0	0	400	5	0	20					

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 103C Island

To:EMERALD BAY AG SERVICES
10 MARYS EMERALD BAY ROAD
VERNON, BC V1H 2A7

For:JANSEN

Grower Code:05210080 05210-W1138
Farm:HOME
Field:103 The island field

Attn:DOUG MACFARLANE
250-545-3947

Report Date:2016-11-14 Print Date:2017-03-27

SOIL TEST REPORT

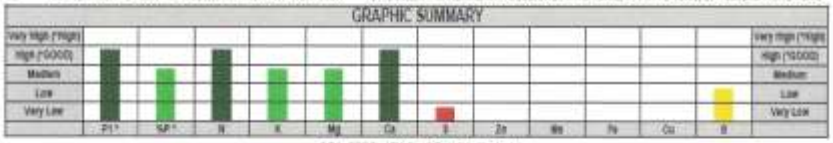
Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
H131A		6	58090	3.8	36 G	60 O	149 M	330 M	3080 H	7.4		19.7	2.0	14.7	82.6		0.8
H131B		12	58091	3.0	20 L	28 L	96 M	250 M	2410 H	7.6		14.5	1.7	14.3	83.0		1.2
H131C		24	58092	2.0	7 VL	10 VL	65 L	205 M	2000 H	7.8		12.0	1.4	14.2	83.0		1.6
H131D		36	58093	1.8	6 VL	8 VL	69 M	230 M	2160 H	7.8		13.2	1.7	14.8	82.1		1.8

Sample Number	Sulfur ppm S lbs/ac		Nitrate Nitrogen ppm NO3-N lbs/ac		Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H131A	16 VL	29	30 H	54					0.5 L		5 M	186	0.0 G	0.14	46		36 M	
H131B	16 VL	29	18 M	32							2 VL	425	0.0 G	0.12	45		40 H	
H131C	20 VL	72	9 L	32							1 VL	499	0.0 G	0.10	32		46 H	
H131D	26 L	94	14 M	50							1 VL	812	0.0 G	0.12	30		56 H	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY



SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H131A	Corn Silage Western	Corn Silage Western	25 tons	0.0	138	20	20	5	0	25					0.5
H131A	Corn Silage Western	Corn Silage West Blc	25 tons	0.0	138	55	215	5	0	25					0.5

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 104 Harold's Upper

Grower Code:05210066 05210-W1132
Farm:HOME
Field:104 HAROLDS UPPER

Attn:DOUG MACFARLANE
250-545-3947

Report Date:2016-11-14 Print Date:2017-01-05

SOIL TEST REPORT

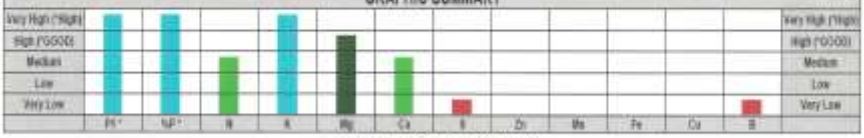
Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus Bicarb	P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
H71A		6	58096	2.6	69 G	151 H	336 VH	285 H	1960 M	7.6		12.7	6.8	16.7	73.2		1.5
H71B		12	58099	2.4	51 G	137 H	310 VH	220 H	1820 M	7.5		10.9	7.3	16.8	74.1		2.1
H71C		24	58100	1.1	33 M	63 M	223 H	190 M	2210 H	7.8		13.4	4.3	11.8	82.4		1.7
H71D		36	58101	0.4	18 L	34 M	147 M	200 M	2750 VH	7.8		16.0	2.4	10.4	86.0		1.3

Sample Number	Sulfur ppm S lbs/ac		Nitrate Nitrogen ppm NO3-N lbs/ac		Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H71A	10 VL	18	13 M	23					0.3 VL		32 H	596	0.0 G	0.36	38		44 H	
H71B	15 VL	27	13 M	23							26 H	668	0.1 G	0.43	36		52 VH	
H71C	16 VL	58	10 M	36							5 M	474	0.0 G	0.36	23		53 H	
H71D	15 VL	54	9 L	32							3 L	281	0.0 G	0.23	15		49 H	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY



SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H71A	Corn Silage Western	Corn Silage Western	20 tons	0.0	135	20	15	0	0	25					0.5
H71A	Corn Silage Western	Corn Silage West Blc	20 tons	0.0	135	50	125	0	0	25					0.5

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 104 Harold's Lower

Attn:DOUG MACFARLANE
250-546-3847

Farm:HOME
Field:104 HAROLDS LOWER

Report Date:2016-11-14 Print Date:2017-01-05

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descript	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	Percent Base Saturations %K	%Mg	%Ca	%H	%Na
H61A		6	58094	2.5	46 M	106 G	365 VH	350 H	2120 M	7.5		14.7	6.4	19.9	72.3		1.7
H61B		12	58095	2.4	50 G	109 G	362 VH	380 H	1820 M	7.3		13.4	6.9	23.6	67.7		2.1
H61C		24	58096	1.3	42 M	71 M	240 VH	405 VH	2000 M	7.5		15.0	4.1	27.5	66.6		2.1
H61D		36	58097	1.3	35 G	58 G	151 M	480 H	2440 M	7.9		16.6	2.3	29.8	72.5		1.7

Sample Number	Sulfur ppm S lbs/ac		Nitrate Nitrogen ppm NO3-N lbs/ac		Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H61A	13 VL	23	14 M	25					0.3 VL		22 H	617	0.0 G	0.32	37		56 H	
H61B	14 VL	25	21 H	38							22 H	642	0.1 G	0.29	36		68 VH	
H61C	11 VL	40	15 M	54							13 H	681	0.0 G	0.15	25		74 VH	
H61D	12 VL	43	13 M	47							15 H	506	0.0 G	0.10	25		65 H	

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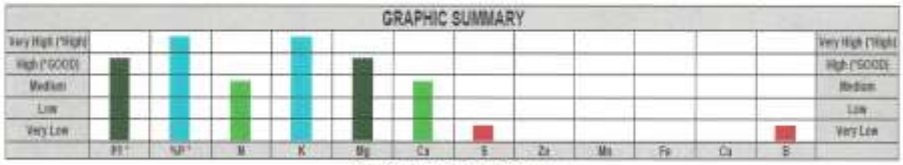
GRAPHIC SUMMARY



SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H61A	Corn Silage Western	Corn Silage Western	28 tons	0.0	178	20	20	0	0	25					0.5
H61A	Corn Silage Western	Corn Silage West Blc	28 tons	0.0	178	55	150	0	0	25					0.5

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 105 Dixon Back

Grower Code:05219066 05219-N1125

Attn:DOUG MACFARLANE
250-546-3847

Farm:HOME
Field:105 DIXON BACK

Report Date:2016-10-21 Print Date:2017-01-05

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descript	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	Percent Base Saturations %K	%Mg	%Ca	%H	%Na
H121A		6	27518	1.9	34 M	79 M	134 M	225 H	1580 M	7.2		10.8	3.2	17.4	73.4	4.5	1.5
H121B		12	27519	1.2	31 M	51 M	94 M	290 H	1550 M	7.2		11.1	2.2	21.8	69.8	4.5	1.8
H121C		24	27520	0.8	25 M	48 M	71 L	355 M	3850 VH	8.0		22.6	0.8	13.1	85.3		1.0
H121D		36	27521	0.5	31 M	50 M	54 L	405 M	3910 H	8.1		23.3	0.8	14.5	83.9		1.2

Sample Number	Sulfur ppm S lbs/ac		Nitrate Nitrogen ppm NO3-N lbs/ac		Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H121A	17 VL	31	10 M	18					0.2 VL		28 H	500	0.1 G	0.18	31		37 H	
H121B	26 L	47	4 VL	7							12 H	555	0.1 G	0.10	24		45 H	
H121C	42 M	151	3 VL	11							4 M	203	0.0 G	0.06	20		50 M	
H121D	58 H	209	2 VL	7							4 M	52	0.0 G	0.04	16		64 H	

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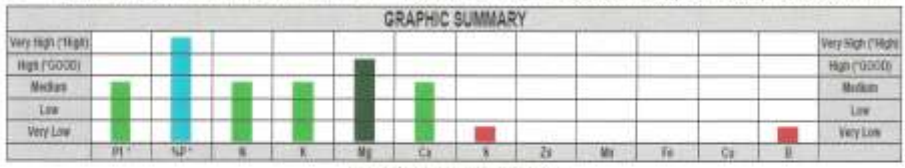
GRAPHIC SUMMARY



SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H121A	Alfalfa	Alfalfa	7 tons	0.0	0	0	400	0	0	10					2.5

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 106 Dixon Front

Attn:DOUG MACFARLANE
250-546-3947

Farm:HOME
Field:100 FRONT

Report Date:2016-11-08 Print Date:2017-03-27

SOIL TEST REPORT

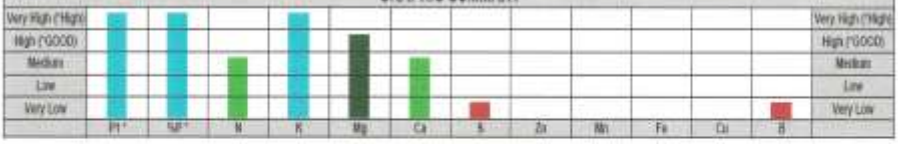
Page:1

Sample Number	Legal Land Descpt	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	Percent Base Saturations %K	%Mg	%Ca	%H	%Na
H31A		6	47757	2.0	55 G	155 H	251 VH	185 H	1360 M	7.3		9.2	7.0	17.6	73.7		1.9
H31B		12	47758	2.8	47 M	121 H	184 H	185 H	1240 M	7.5		8.3	5.7	18.5	74.5		1.6
H31C		24	47759	1.1	40 M	83 M	161 H	195 M	1890 H	7.8		11.6	3.6	14.0	81.5		1.1
H31D		36	47760	0.6	23 M	43 M	95 M	280 M	3460 VH	8.0		20.0	1.2	11.7	86.5		0.8

Sample Number	Sulfur ppm S lbs/ac	Nitrate Nitrogen ppm NO3-N lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H31A	17 VL 31	10 M 18					0.2 VL		35 H	565	0.1 G	0.40	32		40 VH	
H31B	11 VL 20	12 M 22							46 H	336	0.0 G	0.31	40		30 H	
H31C	11 VL 40	6 L 22							7 M	371	0.0 G	0.26	23		29 H	
H31D	18 VL 65	4 VL 14							3 L	328	0.0 G	0.10	18		38 M	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY



SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H31A	Corn Silage Western	Corn Silage Western	29 tons	0.0	266	20	20	0	0	10					0.5
H31A	Corn Silage Western	Corn Silage West Blc	28 tons	0.0	266	55	150	0	0	10					0.5

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 109 Sylvia

Grower Code:05219066 05219-N1134

Attn:DOUG MACFARLANE
250-546-3947

Farm:HOME
Field:109 SILVIA

Report Date:2016-11-10 Print Date:2017-01-05

SOIL TEST REPORT

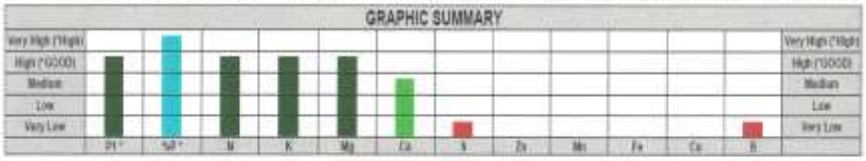
Page:1

Sample Number	Legal Land Descpt	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	Percent Base Saturations %K	%Mg	%Ca	%H	%Na
H91A		6	58106	2.5	37 G	82 G	240 H	465 H	2650 M	7.8		17.9	3.4	21.6	73.9		1.3
H91B		12	58107	2.5	37 G	62 G	150 M	410 H	2330 M	7.8		15.7	2.5	21.8	74.3		1.8
H91C		24	58108	1.7	32 M	62 G	129 M	550 H	3170 H	8.0		21.1	1.6	21.8	75.2		1.7
H91D		36	58109	1.0	26 M	49 M	84 L	560 H	3300 H	8.1		21.9	1.0	22.4	75.3		1.6

Sample Number	Sulfur ppm S lbs/ac	Nitrate Nitrogen ppm NO3-N lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H91A	15 VL 27	23 H 41					0.2 VL		34 H	305	0.0 G	0.16	37		53 H	
H91B	15 VL 27	15 M 27							20 H	392	0.0 G	0.11	37		64 H	
H91C	19 VL 68	13 M 47							27 H	291	0.0 G	0.07	29		63 H	
H91D	25 VL 90	10 M 36							4 M	96	0.0 G	0.04	22		79 H	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY

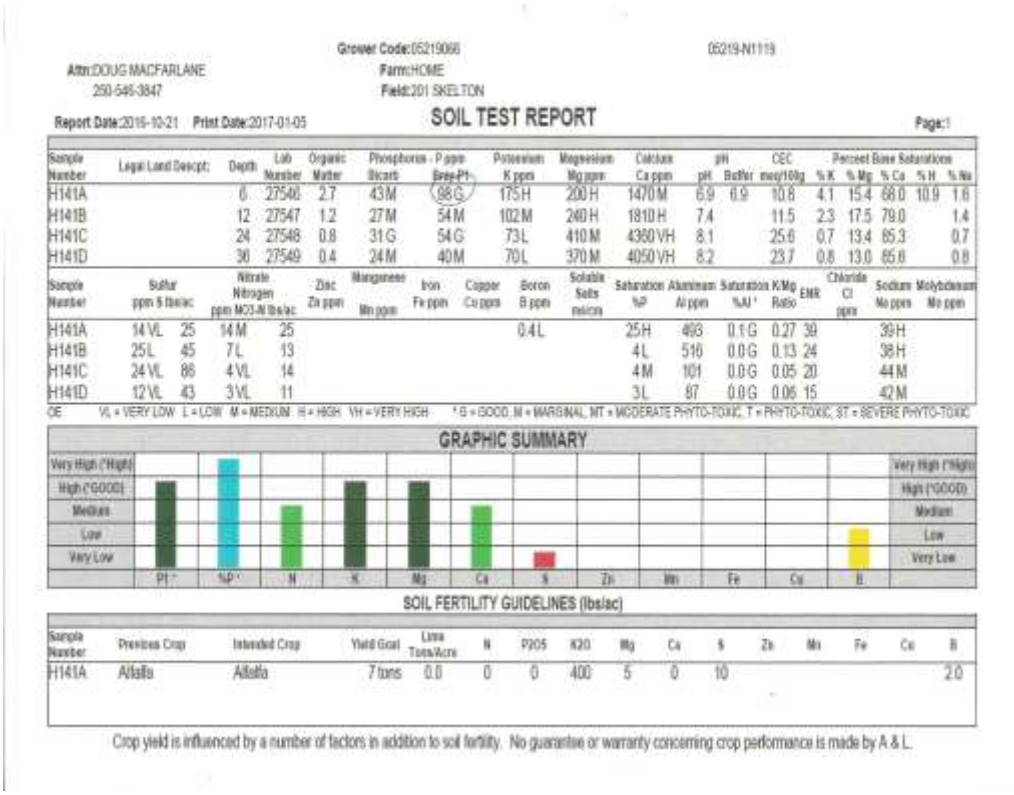


SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H91A	Corn Silage Western	Corn Silage Western	25 tons	0.0	156	20	20	0	0	30					0.5
H91A	Corn Silage Western	Corn Silage West Blc	25 tons	0.0	156	55	150	0	0	30					0.5

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 201 Skelton



Grower Code:05219066 05219-N1119
Attn:DOUG MACFARLANE Farm:HOME
250-546-3847 Field:201 SKELTON

SOIL TEST REPORT

Report Date:2016-10-21 Print Date:2017-01-05 Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
H141A		6	27546	2.7	43 M	98 G	175 H	200 H	1470 M	6.9	6.9	10.8	4.1	15.4	68.0	10.9	1.6
H141B		12	27547	1.2	27 M	54 M	102 M	240 H	1810 H	7.4		11.5	2.3	17.5	79.0		1.4
H141C		24	27548	0.8	31 G	54 G	73 L	410 M	4360 VH	8.1		25.6	0.7	13.4	85.3		0.7
H141D		36	27549	0.4	24 M	40 M	70 L	370 M	4050 VH	8.2		23.7	0.8	13.0	85.6		0.8

Sample Number	Sulfur ppm	S lbs/ac	Nitrate Nitrogen ppm NO3-N	lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K:Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H141A	14 VL	25	14 M	25					0.4 L		25 H	493	0.1 G	0.27	39		39 H	
H141B	25 L	45	7 L	13							4 L	516	0.0 G	0.13	24		38 H	
H141C	24 VL	86	4 VL	14							4 M	101	0.0 G	0.05	20		44 M	
H141D	12 VL	43	3 VL	11							3 L	87	0.0 G	0.06	15		42 M	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

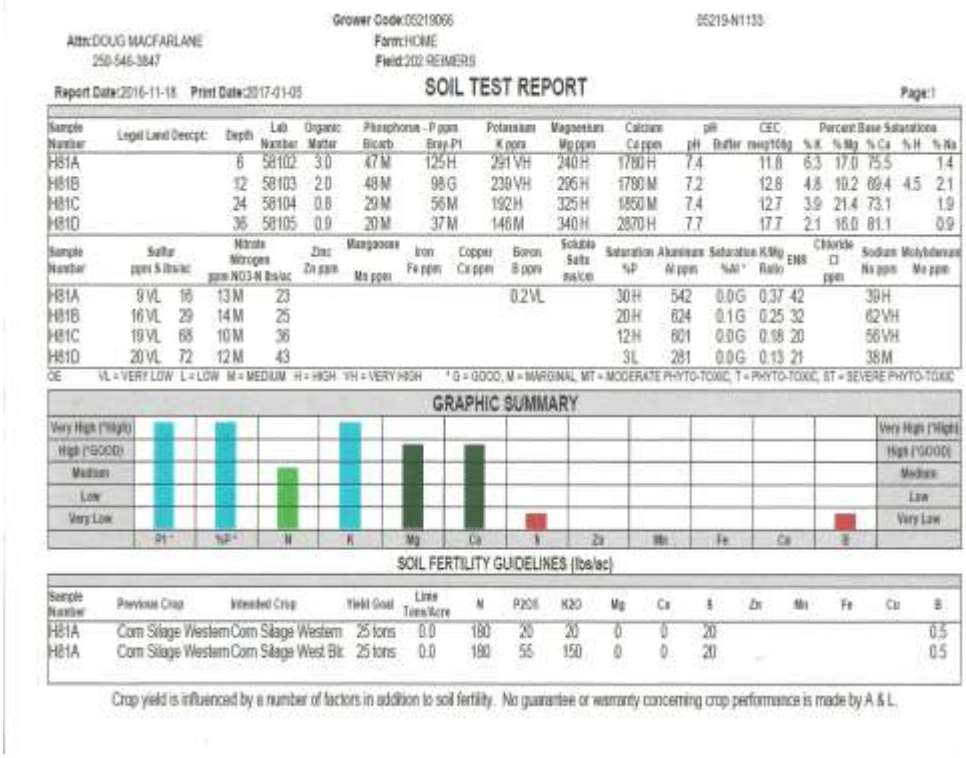
GRAPHIC SUMMARY

SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H141A	Alfalfa	Alfalfa	7 tons	0.0	0	0	400	5	0	10					2.0

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 202 Reimer's



Grower Code:05219066 05219-N1133
Attn:DOUG MACFARLANE Farm:HOME
250-546-3847 Field:202 REIMERS

SOIL TEST REPORT

Report Date:2016-11-18 Print Date:2017-01-05 Page:1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
H81A		6	58102	3.0	47 M	125 H	291 VH	240 H	1760 H	7.4		11.8	6.3	17.0	75.5		1.4
H81B		12	58103	2.0	48 M	98 G	239 VH	296 H	1780 M	7.2		12.8	4.8	10.2	69.4	4.5	2.1
H81C		24	58104	0.8	29 M	56 M	192 H	325 H	1850 M	7.4		12.7	3.9	21.4	73.1		1.9
H81D		36	58105	0.9	20 M	37 M	146 M	340 H	2870 H	7.7		17.7	2.1	16.0	81.1		0.9

Sample Number	Sulfur ppm	S lbs/ac	Nitrate Nitrogen ppm NO3-N	lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K:Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H81A	9 VL	16	13 M	23					0.2 VL		30 H	542	0.0 G	0.37	42		39 H	
H81B	16 VL	29	14 M	25							20 H	624	0.1 G	0.25	32		62 VH	
H81C	19 VL	68	10 M	36							12 H	601	0.0 G	0.18	20		56 VH	
H81D	20 VL	72	12 M	43							3 L	281	0.0 G	0.13	21		38 M	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

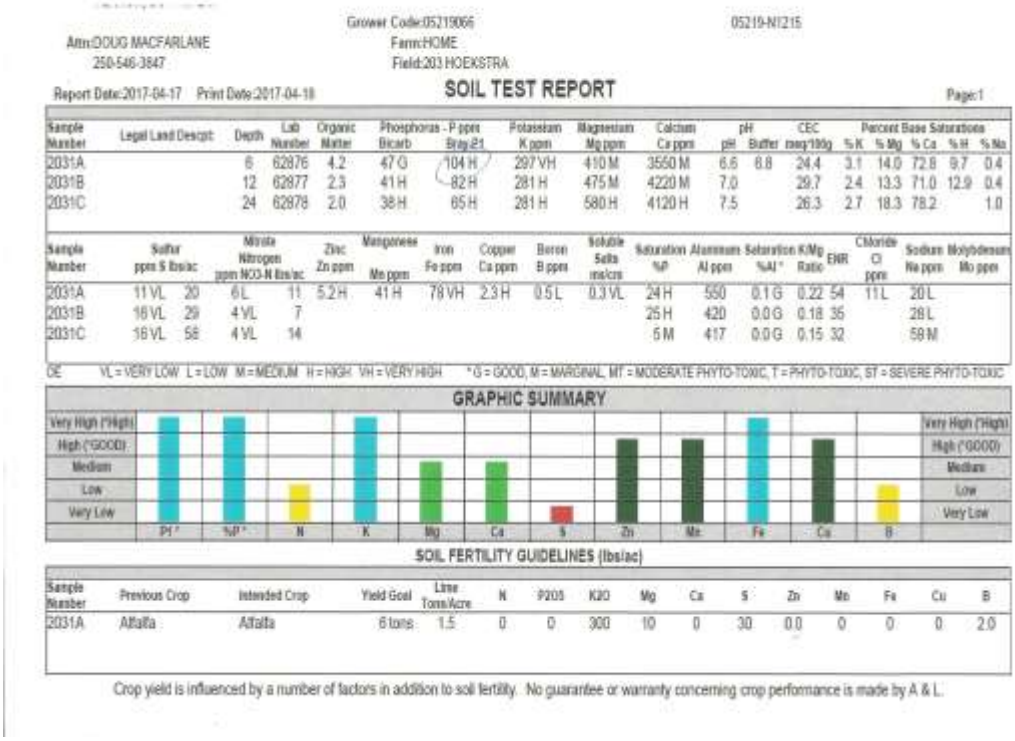
GRAPHIC SUMMARY

SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H81A	Corn Silage Western	Corn Silage Western	25 tons	0.0	180	20	20	0	0	20					0.5
H81A	Corn Silage Western	Corn Silage West Blt	25 tons	0.0	180	55	150	0	0	20					0.5

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 203 Hoekstra



Grower Code:05219066 05219-NI215
Attn:DOUG MACFARLANE Farm:HOME
250-546-3847 Field:203 HOEKSTRA

Report Date:2017-04-17 Print Date:2017-04-18

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descpt	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-21	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	%K	%Mg	%Ca	%H	%Na
2031A		6	62876	4.2	47 G	104 H	297 VH	410 M	3550 M	6.6	6.8	24.4	3.1	14.0	72.8	9.7	0.4
2031B		12	62877	2.3	41 H	82 H	281 H	475 M	4220 M	7.0		29.7	2.4	13.3	71.0	12.9	0.4
2031C		24	62878	2.0	38 H	65 H	281 H	580 H	4120 H	7.5		26.3	2.7	18.3	78.2		1.0

Sample Number	Sulfur ppm S lbs/ac	Nitrate Nitrogen ppm NO3-N lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
2031A	11 VL 20	6 L 11	5.2 H	41 H	78 VH	2.3 H	0.5 L	0.3 VL	24 H	550	0.1 G	0.22	54	11 L	20 L	
2031B	16 VL 29	4 VL 7							25 H	420	0.0 G	0.18	35		28 L	
2031C	16 VL 58	4 VL 14							5 M	417	0.0 G	0.15	32		59 M	

GE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

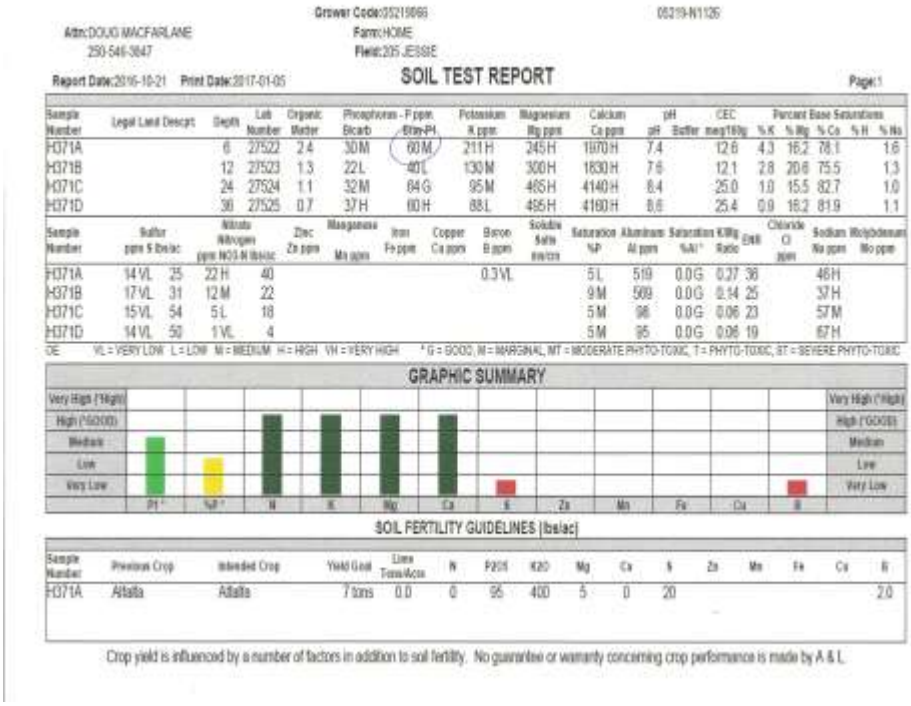
GRAPHIC SUMMARY

SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
2031A	Alfalfa	Alfalfa	6 tons	1.5	0	0	300	10	0	30	0.0	0	0	0	2.0

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 205 Jessie



Grower Code:05219066 05219-N1126
Attn:DOUG MACFARLANE Farm:HOME
250-546-3847 Field:205 JESSIE

Report Date:2016-10-21 Print Date:2017-01-05

SOIL TEST REPORT

Page:1

Sample Number	Legal Land Descpt	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	%K	%Mg	%Ca	%H	%Na
H371A		6	27522	2.4	30 M	60 M	211 H	245 H	1970 H	7.4		12.6	4.3	16.2	78.1		1.6
H371B		12	27523	1.3	22 L	40 L	130 M	300 H	1830 H	7.6		12.1	2.8	20.6	75.5		1.3
H371C		24	27524	1.1	32 M	64 G	95 M	485 H	4140 H	8.4		25.0	1.0	15.5	82.7		1.0
H371D		36	27525	0.7	37 H	60 H	88 L	495 H	4160 H	8.6		25.4	0.9	16.2	81.9		1.1

Sample Number	Sulfur ppm S lbs/ac	Nitrate Nitrogen ppm NO3-N lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
H371A	14 VL 25	22 H 40					0.3 VL		5 L	519	0.0 G	0.27	36		46 H	
H371B	17 VL 31	12 M 22							9 M	569	0.0 G	0.14	25		37 H	
H371C	15 VL 54	5 L 18							5 M	98	0.0 G	0.06	23		57 M	
H371D	14 VL 50	1 VL 4							5 M	95	0.0 G	0.06	19		67 H	

GE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY

SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
H371A	Alfalfa	Alfalfa	7 tons	0.0	0	95	400	5	0	20					2.0

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Field 206 Ferguson

Grower Code:05219066 05219-N1216

Attn:DOUG MACFARLANE
250-546-3647

Farm:HOWE
Field:206 FERGUSON

Report Date:2017-04-17 Print Date:2017-04-18

SOIL TEST REPORT

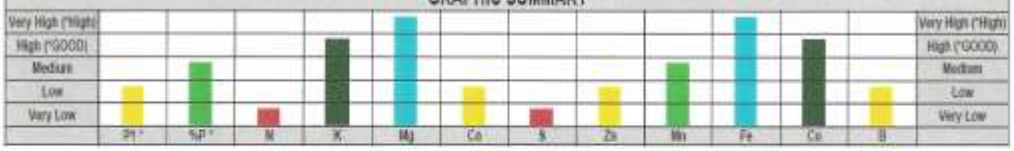
Page:1

Sample Number	Legal Land Descpt	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations %K	%Mg	%Ca	%H	%Na
2061A		6	62879	3.9	22	32 L	247 H	995 VH	2310 L	6.5	6.7	24.2	2.6	34.3	47.8	14.5	0.8
2061B		12	62880	3.5	8	9 VL	232 H	1070 VH	1930 VL	6.7	6.5	31.6	1.9	49.4	28.5	18.4	1.8
2061C		24	62881	2.3	4	4 VL	184 M	1725 VH	4010 M	7.6		35.4	1.3	40.6	56.7		1.9

Sample Number	Sulfur ppm S	lbs/ac	Nitrate Nitrogen ppm NO3-N	lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
2061A	9 VL	16	2 VL	4	2.8 L	28 M	80 VH	2.1 H	0.4 L	0.2 VL	5 M	878	0.1 G	0.08	51	10 L	43 M	
2061B	11 VL	20	2 VL	4							1 VL	996	0.1 G	0.04	47		133 H	
2061C	29 VL	104	2 VL	7							1 VL	480	0.0 G	0.03	35		154 VH	

OE VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH * G = GOOD, M = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

GRAPHIC SUMMARY



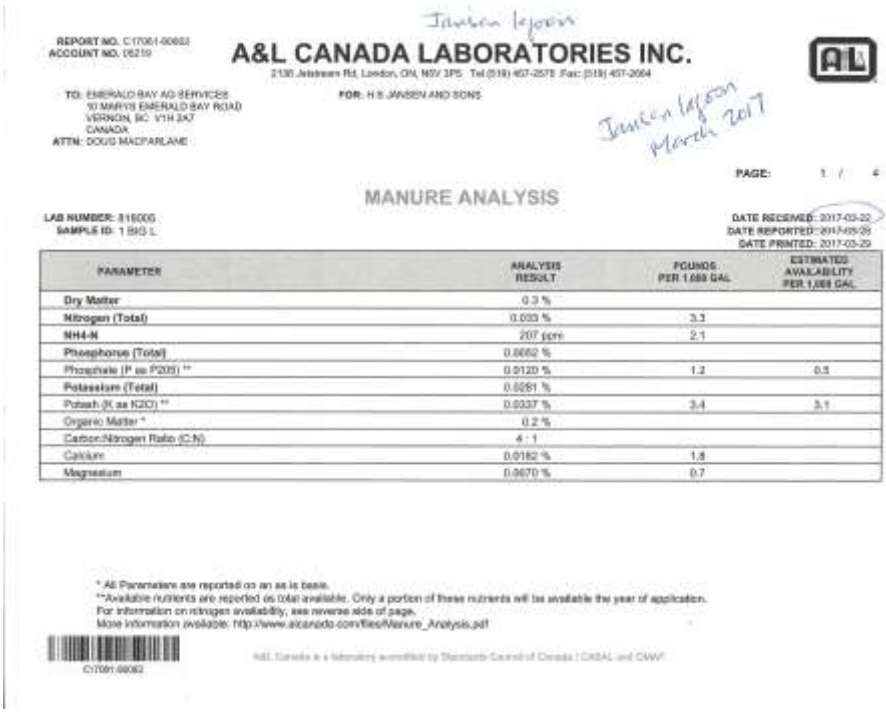
SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
2061A	Alfalfa	Alfalfa	5 tons	2.5	0	70	300	0	0	60	0.0	0	0	0	2.0

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

Appendix 2. Manure analyses – Spring 2017

Lagoon liquid effluent March 2017



Jansen lagoon

REPORT NO. C17061-00002
ACCOUNT NO. 05219

A&L CANADA LABORATORIES INC.

2136 Jetstream Rd, London, ON, N5V 3P5 Tel (519) 457-2575 Fax: (519) 457-2664

TO: EMERALD BAY AG SERVICES
10 MARYS EMERALD BAY ROAD
VERNON, BC V1H 2A7
CANADA
ATTN: DOUG MACFARLANE

FOR: H.S. JANSEN AND SONS

Jansen lagoon March 2017

PAGE: 1 / 4

MANURE ANALYSIS

LAB NUMBER: 816005
SAMPLE ID: 1 BIG L

DATE RECEIVED: 2017-03-22
DATE REPORTED: 2017-05-29
DATE PRINTED: 2017-03-29

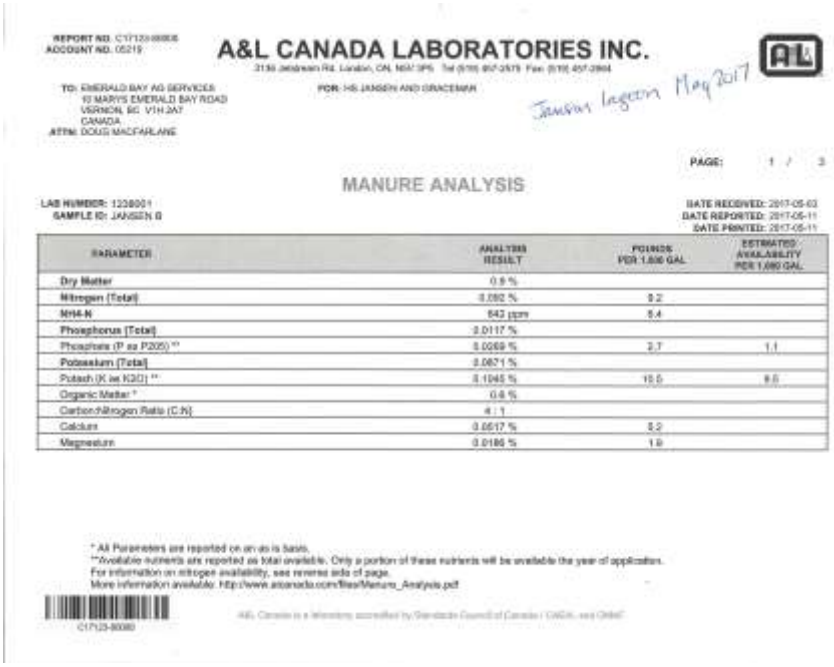
PARAMETER	ANALYSIS RESULT	POUNDS PER 1,000 GAL	ESTIMATED AVAILABILITY PER 1,000 GAL
Dry Matter	0.3 %		
Nitrogen (Total)	0.033 %	3.3	
NH4-N	207 ppm	2.1	
Phosphorus (Total)	0.0052 %		
Phosphate (P as P2O5) **	0.0120 %	1.2	0.3
Potassium (Total)	0.0281 %		
Potash (K as K2O) **	0.0337 %	3.4	3.1
Organic Matter *	0.2 %		
Carbon:Nitrogen Ratio (C:N)	4 : 1		
Calcium	0.0182 %	1.8	
Magnesium	0.0070 %	0.7	

* All Parameters are reported on an as is basis.
**Available nutrients are reported as total available. Only a portion of these nutrients will be available the year of application.
For information on nitrogen availability, see reverse side of page.
More information available: http://www.alcanada.com/files/Manure_Analysis.pdf

C17061-00002

A&L Canada is a laboratory accredited by Standards Council of Canada (CASCAL and CMA)

Lagoon liquid effluent May 2017



REPORT NO. C17123-00005
ACCOUNT NO. 05219

A&L CANADA LABORATORIES INC.

2136 Jetstream Rd, London, ON, N5V 3P5 Tel (519) 457-2575 Fax: (519) 457-2664

TO: EMERALD BAY AG SERVICES
10 MARYS EMERALD BAY ROAD
VERNON, BC V1H 2A7
CANADA
ATTN: DOUG MACFARLANE

FOR: HS JANSEN AND GRACEMAR

Jansen lagoon May 2017

PAGE: 1 / 3

MANURE ANALYSIS

LAB NUMBER: 1238001
SAMPLE ID: JANSEN G

DATE RECEIVED: 2017-05-03
DATE REPORTED: 2017-05-11
DATE PRINTED: 2017-05-11

PARAMETER	ANALYSIS RESULT	POUNDS PER 1,000 GAL	ESTIMATED AVAILABILITY PER 1,000 GAL
Dry Matter	0.9 %		
Nitrogen (Total)	0.092 %	9.2	
NH4-N	842 ppm	8.4	
Phosphorus (Total)	0.0117 %		
Phosphate (P as P2O5) **	0.0269 %	2.7	1.1
Potassium (Total)	0.0871 %		
Potash (K as K2O) **	0.1045 %	10.5	9.5
Organic Matter *	0.8 %		
Carbon:Nitrogen Ratio (C:N)	4 : 1		
Calcium	0.0517 %	5.2	
Magnesium	0.0186 %	1.9	

* All Parameters are reported on an as is basis.
**Available nutrients are reported as total available. Only a portion of these nutrients will be available the year of application.
For information on nitrogen availability, see reverse side of page.
More information available: http://www.alcanada.com/files/Manure_Analysis.pdf

C17123-00005

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Manure solids March 2017

REPORT NO. C17081-80002
ACCOUNT NO. 05219

A&L CANADA LABORATORIES INC.
2136 Jetstream Rd, London, ON, N5V 3P5 Tel (519) 457-2575 Fax: (519) 457-2664

Jansen solids March 2017

TO: EMERALD BAY AG SERVICES
10 MARYS EMERALD BAY ROAD
VERNON, BC V1H 2A7
CANADA
ATTN: DOUG MACFARLANE

FOR: H.S JANSEN AND SONS

PAGE: 3 / 4

MANURE ANALYSIS

LAB NUMBER: 818007
SAMPLE ID: 3 PAD

DATE RECEIVED: 2017-03-22
DATE REPORTED: 2017-03-28
DATE PRINTED: 2017-03-28

PARAMETER	ANALYSIS RESULT	POUNDS PER TON	ESTIMATED AVAILABILITY PER TON
Dry Matter	18 %		
Nitrogen (Total)	0.353 %	7.1	
NH4-N	204 ppm	0.4	
Phosphorus (Total)	0.0714 %		
Phosphate (P as P2O5) **	0.1642 %	3.3	1.3
Potassium (Total)	0.0522 %		
Potash (K as K2O) **	0.0626 %	1.3	1.2
Organic Matter *	15.1 %		
Carbon:Nitrogen Ratio (C:N)	24 : 1		
Calcium	0.1890 %	3.8	
Magnesium	0.0683 %	1.4	

* All Parameters are reported on an as is basis.
**Available nutrients are reported as total available. Only a portion of these nutrients will be available the year of application.
For information on nitrogen availability, see reverse side of page.
More information available: http://www.alcanada.com/files/Manure_Analysis.pdf

C17081-80002

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