HS Jansen and Sons Ltd 2018 Nutrient Management Plan

v.2 June 2018

Prepared for:

HS Jansen and Sons, Armstrong BC

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1. Introduction

This is a Nutrient Management Plan (NMP) for HS Jansen and sons, Hullcar Road, Spallumcheen BC for the 2018 cropping year (see Figure 1 in Appendix 1 for farm location). It contains information on all nitrogen sources on the farm, and nitrogen requirements for crops in 2018 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 2018 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 2018. See section 14 for a discussion of soil phosphorus levels and management.

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

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 2018. 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 2018 is low. However, no guarantee is made that this will be achieved in 2018. Results of post-harvest soil nitrate testing in fall 2018 will be used to further fine-tune manure application rates in 2019 as required.

Table 1. Summary of 2018 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 11)
	Lb/A	Liquid manure Imp. Gal/A	Solid manure Tons/A	Lb/A	N requirement less N supply
Corn fields (2018)					
103 D Skelton	27	3,000	0	28	1
104 Harold's	136	18,000	0	133	-3
105 Dixon Back	70	10,000	0	74	4
106 Dixon Front	33	5,000	0	37	4
201 Skelton	55	6,000	0	44	-11
202 Reimer	127	16,000	0	118	-9
400 Lavington Pivots	118	0	9.5	17	101
Alfalfa fields (2018)					
101 Barns	322	0	0	0	322
102 Sorensen	377	14,000	0	99	278
103 A Hullcar	342	12,000	0	85	257
103 B Doug's	309	10,000	0	71	238
103 C Island	393	16,000	0	113	280
109 Sylvia	237	16,000	0	113	124
205 Jessie	376	16,000	0	113	263

**** The supply of nitrogen in 2018 will be less than or very close to crop requirements. Nitrate in irrigation water will provide a small amount of nitrogen to several fields.***

2. Livestock on site 2018

HS Jansen and Sons is a dairy farm located in the Hullcar valley in Spallumcheen BC. As of the time of writing, they have 1200 milking cows on site as well as 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 - 2018

HS Jansen will apply the operation's manure on 1111 acres (450 hectares) of land in 2018. The fields that will receive manure or fertilizer are listed with areas and 2018 cropping information in Table 2 below. Fields are identified on the maps found in Appendix 1.

Cropping is summarized as follows:

- 660.9 acres (267 hectares) in corn silage.

- 450.2 acres (189 hectares) in alfalfa and alfalfa:grass, 73.5 acres (30 hectares) to be planted in spring 2018, remainder are 2 to 5 year old stands.

Table 2. 2018 Acreage Report – Land Receiving Nitrogen from HS Jansen Manure

Field ID	Area		2016 Crop	2017 Crop	2018 Crop
	ha	acres			
Home farm (Hullcar)					
101 Barns	21.9	54.1	Alfalfa/grass 1	Alfalfa/grass 2	Alfalfa/grass 3
102 Sorensen	40.7	100.6	Corn silage	Alfalfa/grass (new seeding) 1	Alfalfa/grass 2
103 A Hullcar	41.1	101.6	Alfalfa/grass 3	Alfalfa/grass 4	Alfalfa/grass 5
103 B Doug's	31.6	78	Alfalfa/grass 3	Alfalfa/grass 4	Alfalfa/grass 5
103 C Island	5	12.4	Corn silage	Alfalfa/grass 1	Alfalfa/grass 2
104 Harold's	44.6	110.3	Corn silage	Corn silage	Corn silage
105 Dixon Back	40.9	101	Alfalfa/grass	Alfalfa/grass	Corn silage
106 Dixon Front	6.1	15	Corn silage	Corn silage	Corn silage
109 Sylvia	29.7	73.5	Corn silage	Corn silage	Alfalfa/grass 1
202 Reimer	14.8	36.6	Corn silage	Corn silage	Corn silage
Total – home farm	**276.5**	**683.1**			
Rented land – Armstrong area					
103 D (Skelton) (NE corner of 103B)	7.3	18	Alfalfa/grass 3	Alfalfa/grass 4	Corn silage
201 Skelton	29.1	72	Alfalfa/grass 3	Alfalfa/grass 4	Corn silage
205 Jessie	12.1	30	Alfalfa/grass 1	Alfalfa/grass 2	Alfalfa/grass 3
Total –rented land Armstrong area	**41.3**	**120**			
Lavington property					
400 Lavington Pivots	124.6	308	Corn silage	Corn silage	Corn silage
Total - Lavington	**124.6**	**308**			
Total acreage 2018	**450**	**1111**			

Note: Alfalfa/grass 1, 2, 3 etc. refers to the age of the stand. For example, stands in the establishment year are alfalfa/grass 1. Two year old stands are alfalfa/grass 2.

4. Results of BC Ministry of Agriculture 2017 Post-harvest Soil Nitrate Study

Table 3a and b contain the results of the Ministry of Agriculture fall 2017 post-harvest nitrate soil testing at HS Jansen and Sons for the fields that will be farmed in 2018 (lab data in Appendix 1). Fifteen fields farmed by Jansen in 2017 were included in the fall 2017 study. The fields had an agronomic rating ranging from low to high soil residual nitrate-N 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 2017. Residual soil nitrate-N was measured to 90 cm in the soil.

Nine alfalfa and one grass field were included in the study. All fields had residual soil nitrate-N in the low or medium agronomic range. Fields with a medium agronomic rating were in the lower half of the medium range. The management recommendation for fields with a medium agronomic rating is to 'consider changes to nitrogen management'. Fields within the low agronomic range are not considered to require a reduction in nitrogen application rate.

Five fields that had been planted to corn silage in 2017 were included in the study. There were two fields with a low rating, two with a medium rating and one at the low end of the high rating. 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.

In the fall 2017 soil data, residual nitrate-N was concentrated primarily in the top 15 cm of soil and the soil concentration declined with each soil depth so that there was in all fields low residual nitrate-N in both the 30 to 60 and 60 to 90 cm depths. This suggests that there was very little downward movement of nitrate-N during the 2017 growing season, and that most of the residual nitrate-N will be available for crop use in 2018.

Bulk density conversions: Residual soil nitrate-N was converted from mg/kg to kg/ha assuming a soil bulk density of 1300 kg/m^3 at the 0 to 30 cm depth, and 1500 kg/m^3 in the 30 to 90 cm depth to reflect the sandy texture of the soils in and around the HS Jansen property.

The amount of residual nitrate-N from fall 2017 PHNT testing (to 60 cm depth) has been included when calculating manure application rates for 2018 in all fields.

Residual soil ammonium-N data has not been included in residual soil nitrogen levels. There is currently no Ministry of Agriculture interpretation for residual soil ammonium-N. In general, soil levels of ammonium-N were low in fall 2017.

Table 3a. Soil residual nitrate-N levels from fall 2017 PHNT program – Alfalfa and Grass Fields

Field ID	2017 Crop	Sampling depth cm	Nitrate-N (NO_3-N) mg/kg	NO_3-N by depth and total to 90 cm* kg/ha	BC Ministry of Agriculture Agronomic Rating
ALFALFA AND GRASS FIELDS					
101 Barns	Alfalfa	0-15	11.0	21.5	Low
		15-30	5.0	9.8	
		30-60	2.0	9.0	
		60-90	1.0	4.5	
Total				**44.7**	
103A (north)	Alfalfa	0-15	10.0	19.5	Medium
		15-30	5.0	9.8	
		30-60	4.0	18.0	
		60-90	4.0	18.0	
Total				**65.3**	
103A (south)	Alfalfa	0-15	14.0	27.3	Low
		15-30	4.0	7.8	
		30-60	1.0	4.5	
		60-90	1.0	4.5	
Total				**44.1**	
103B (west)	Alfalfa	0-15	19.0	37.1	Medium
		15-30	5.0	9.8	
		30-60	3.0	13.5	
		60-90	2.0	9.0	
Total				**69.3**	
103B (east)	Alfalfa	0-15	17.0	33.2	Medium
		15-30	4.0	7.8	
		30-60	2.0	9.0	
		60-90	2.0	9.0	
Total				**59.0**	
105 Dixon Back	Alfalfa	0-15	9.0	17.6	Low
		15-30	5.0	9.8	
		30-60	2.0	9.0	
		60-90	1.0	4.5	
Total				**40.8**	
201 Skelton	Alfalfa	0-15	11.0	21.5	Low
		15-30	4.0	7.8	
		30-60	2.0	9.0	
		60-90	1.0	4.5	
Total				**42.8**	
205 Jessie	Alfalfa	0-15	2.0	3.9	Low
		15-30	16.0	31.2	
		30-60	1.0	4.5	
		60-90	1.0	4.5	
Total				**44.1**	
102 Sorensen	Alfalfa	0-15	10.0	19.5	Medium
		15-30	4.0	7.8	
		30-60	3.0	13.5	
		60-90	2.0	9.0	
Total				**49.8**	
103C Island	Grass	0-15	4.0	7.8	Low
		15-30	3.0	5.9	
		30-60	2.0	9.0	
		60-90	1.0	4.5	
Total				**27.2**	

**Soil bulk density assumed as 1300 kg/m^3 in 0-30 cm depth and 1500 kg/m^3 in 30-90 cm depth.*

Note: Ministry of Agriculture (AGRI) Agronomic Rating: 0-49 kg/ha low, 50-99 kg/ha medium, 100-199 kg/ha high, 200+ kg/ha very high.

Table 3b. Soil residual nitrate-N levels from fall 2017 PHNT program – Corn Fields

Field ID	2017 Crop	Sampling depth cm	Nitrate-N (NO_3-N) mg/kg	NO_3-N by depth and total to 90 cm* kg/ha	BC Ministry of Agriculture Agronomic Rating
SILAGE CORN FIELDS					
104 Harold's lower upper	Silage corn	0-15	4.0	7.8	Low
		15-30	2.0	3.9	
		30-60	4.0	18.0	
		60-90	2.0	9.0	
Total				**38.7**	
104 Harold's upper lower	Silage corn	0-15	4.0	7.8	Low
		15-30	2.0	3.9	
		30-60	3.0	13.5	
		60-90	2.0	9.0	
Total				**34.2**	
106 Dixon Front	Silage corn	0-15	18.0	35.1	High
		15-30	8.0	15.6	
		30-60	6.0	27.0	
		60-90	7.0	31.5	
Total				**109.2**	
109 Sylvia	Silage corn	0-15	16.0	31.2	Medium
		15-30	6.0	11.7	
		30-60	4.0	18.0	
		60-90	8.0	36.0	
Total				**96.9**	
202 Reimers	Silage corn	0-15	5.0	9.8	Medium
		15-30	2.0	3.9	
		30-60	2.0	9.0	
		60-90	6.0	27.0	
Total				**49.7**	

**Soil bulk density assumed as 1300 kg/m^3 in 0-30 cm depth and 1500 kg/m^3 in 30-90 cm depth.*

Note: Ministry of Agriculture (AGRI) Agronomic Rating: 0-49 kg/ha low, 50-99 kg/ha medium, 100-199 kg/ha high, 200+ kg/ha very high.

5. Nitrogen from all sources in 2018

5.1 Manure production – October 2017 to September 2018

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 2017 to September 2018 period including all runoff from roofs and areas around the barns and precipitation in manure storages is estimated at: **103,769 tons (approx. 20.7 million Imperial gallons). (Table 4)**

Solid manure: Total solid manure production October 2017 to September 2018 (Table 4): **2885 tons**.

Table 4. Calculation of manure production October 2017 to September 2018

Worksheet 7.1. Annual Manure Production for Dairy Cattle

Manure and Waste Generation

Type of Milk Cow: Holstein | Number of Cows Milking: 1200 | Days Grazing:
Average milk production per milked cow (lb/day): 72.3 (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	1,200	1200	☑	Slurry	☑	6	2,988	329
Dry Cow	240	240	☑	Slurry	☐		0	0
Heifers (16 to 26 months)	396		☑	Slurry	☐		0	0
Heifers (7 to 15 months)	336		☑	Slurry	☐		0	0
Calves (4 to 6 months)	120		☐	Solid	☐		0	0
Calves (0 to 3 months)	120	100	☑	Slurry	☑	20	20	9
Total	2,412	1,300			**Total Daily Manure Production**		3,007	337

Milk House Effluent (typically 0.75 to 1.5 ft^3/day/milk cow): 1.5 ft^3/day/milk cow — 1,800 (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)
4907 437 (ft^3/day)

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

Manure and Waste Production: 66341 5912 (yd^3/year); 55910 2885 (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: Vernon North

How is this calculated? **Total Rainwater Collection**: 56786.9 (yd^3/year); 47858.7 (tons/year)

Total Weight of Manure

Total Weight of Manure Produced: Slurry 103769.2 Solid 2885 (tons/year)

Nitrogen content in manure: a sample of solid manure was collected in March 2018 and a sample of liquid from the effluent storage lagoon was collected in April 2018 after ice had melted off the lagoon. The liquid manure contained 0.13 % total nitrogen and 815 ppm of ammonium-N. The solid manure contained 0.361% total nitrogen and 45 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 2018 (Table 5). Original lab data is found in Appendix 2.

Note: A March 2018 manure sample from the receiving tank (not the effluent storage lagoon) was used to calculate application rates in version 1 (March 2018) of this 2018 LAP. This version uses the data from the April 2018 sample from the effluent storage lagoon.

Table 5. Calculation of Nutrient 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 (NO_3-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	*0.13*	*815*	*1.0*	*0.35*	*0.34*	*0.7*	*1.14*		*1.48*	*0.020*	*0.9*	*0.16*	*3.8*
Manure solids	*0.36*	*45*	*7.1*	*0.25*	*1.78*	*0.3*	*0.03*		*1.80*	*0.042*	*1.9*	*0.10*	*2.4*
			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*
			0.0		*0.00*		*0.00*		*0.00*		*0.0*		*0.0*

5.2 Other sources of nitrogen on farm

A. Fertilizer nitrogen: No nitrogen fertilizer is planned to be used at the HS Jansen and Sons Hullcar operation in 2018 unless results of pre-sidedress nitrogen soil testing on silage corn fields show 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 nitrate-N level is below 25-30 ppm), either manure effluent or nitrogen fertilizer will be applied at the rate required to meet corn nitrogen 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, and will be approved by the QP.

Nitrogen fertilizer (110 lb/A as N) will be applied to the 400 Lavington Pivot fields to meet crop requirements. These fields are located in Lavington BC and also receive the separated solids from the Hullcar operation.

B. Irrigation water: The farm irrigates with 14 wells located around the property. Seven of these wells had nitrates above the lab detection limit of 0.025 mg/L when sampled in September 2017 by Mountainview Electric (Table 6). The remainder of the farm's irrigation wells had nitrate below the lab's detection limit. The estimated contribution of nitrate-N from irrigation water has been calculated as shown in Table 6, and has been accounted for as fertilizer N in the NMP calculator.

Nitrate-N contribution from home farm wells: The average nitrate concentration in samples from 11 irrigation wells on the home farm was 7 mg/L (Table 6). At an estimated irrigation rate of 8" over the 2018 growing season (20 cm), this will supply an estimated 14 kg/ha (12.5 lb/A) of nitrate-N over the home farm fields.

Nitrate-N contribution from Dixon field wells: Well water samples from the two wells used to irrigate these fields had below the lab's detection limit of nitrate-N. There should therefore be no nitrate-N contribution from irrigation of these fields.

Nitrate-N contribution from Harold field well: The irrigation well on the Harold Jansen property had 3 mg/L of nitrate-N in fall 2017 which at a typical irrigation rate of 8" (20 cm) will contribute 6 kg/ha or 5 lb/A nitrate-N. This nitrate-N contribution has been accounted for in the NMP calculator as fertilizer N.

Table 6. Nitrate-N contribution from irrigation wells in September 2017

Well name	Well Plate ID	Nitrate-N concentration in irrigation water	Location
		mg/L	
Home farm irrigation wells			
Well #1	25853	9.7	103A Hullcar SE corner
Well #2	25852	6.07	103A Hullcar SE corner
Well #4	25864	0.025	103B Doug's middle
Bill Skelton well	25865	0.025	103B Doug's middle
Well #3	28038	6.91	101 Barns
Well #6	28063	0.025	101 Barns
Krebber east well	28635	15	Krebber
Krebber west well	28636	26.1	Krebber
Sorensen east well	28634	0.025	Sorensen
Sorensen west well	35187	0.025	Sorensen
Sorensen east #2	35188	15.4	Sorensen
Average in home farm wells		**7**	
Harold irrigation well	25867	3.32	Harold
Dixon big well	28064	<0.025	Dixon
Dixon small well	28640	<0.025	Dixon

C. 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 – 2018

2018 Crops: 2018 cropping information is found in columns B, C and D of Table 7. Crop, estimated dry yield and protein content of crop have been provided by Doug Macfarlane, CCA for HS Jansen, and reviewed by the QP. Yield and protein estimates are based on average values for the North Okanagan and the experience of Mr. Macfarlane at the Jansen farm.

Crop nitrogen requirements for 2018: Table 7, Column H contains the nitrogen application rate recommendations for 2018. 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 2017 PHNT results) and less the amount of nitrogen that is estimated to be released from soil organic matter in 2018 for each field (column G).

Column E contains the estimated crop nitrogen uptake values by field for 2018. 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 2018 soil test results to 60 cm depth. This is the depth to which most crop roots grow.

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 2018 growing season. All fields farmed by HS Jansen have moderate to high fertility due to longterm application of manure to the land base. Fertility

factors are roughly based on soil organic matter content and length of time the fields have been amended with manure.

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	Alf/grass	7.0	20.0	448	36	90.0	322
102 Sorensen	Alf/grass	7.5	20.0	480	36	67.0	377
103A Hullcar	Alf/grass	7.0	20.0	448	39	67.0	342
103B Doug's	Alf/grass	7.0	20.0	448	49	90.0	309
103C Island	Alf/grass	7.5	20.0	480	20	67.0	393
103D Skelton	corn sil	7	8	166	49	90	27
104 Harold's	corn sil	8.0	8.0	205	24	45.0	136
105 Dixon back	corn sil	7.5	8.0	192	32	90.0	70
106 Dixon front	corn sil	7.5	8.0	192	69	90.0	33
109 Sylvia	Alf/grass	5.0	21.0	336	54	45.0	237
201 Skelton	corn sil	7.0	8.0	179	34	90.0	55
202 Reimer	corn sil	7.5	8.0	192	20	45.0	127
205 Jessie	Alf/grass	7.5	19.0	456	35	45.0	376
400 Lavington	corn sil	7.5	8.0	192	29	45.0	118
203 Hoekstra	Alf/grass	6.0	18.0	346	38	0.0	308
206 Ferguson	Alf/grass	5.0	12.5	200	17	0.0	183

General comments on 2018 nitrogen application recommendations

All fields: The crop nitrogen application recommendation for each field is calculated as the amount of nitrogen that the crop is expected to require for normal growth (Table 7, column E) *less* the sum of the amount of residual nitrate-N in the top 60 cm of soil in fall 2017 (Table 7, column F) and the amount of nitrogen that is expected to be released by soil organic matter in 2018 (Table 7, column G). The fall 2017 PHNT results were used directly to calculate the 2018 nitrogen requirements. The crop nitrogen application recommendation (Column H) is the amount of nitrogen that the crop will not be able to draw from existing soil reserves.

Silage corn fields: Fields planted to corn that are located over the Hullcar aquifer will be receiving a manure application that provides the amount of nitrogen that the crop will not be able to draw from existing soil reserves as detailed in Table 7 less the amount of nitrate-N expected to be contributed by irrigation water (Table 6). This applies to all fields planted to corn in 2018 except 400 Lavington which is located in Lavington BC, off the Hullcar aquifer. The Lavington fields receive fertilizer N to meet crop requirements.

Alfalfa and alfalfa/grass fields: Fields planted to alfalfa/grass are receiving up to 25% of their nitrogen requirement in manure (see Table 1 for summary of crop nitrogen requirement vs. planned application rate). The remaining nitrogen required by the stand will be fixed from atmospheric nitrogen.

Although alfalfa does not require nitrogen for normal growth because it is able to fix atmospheric nitrogen, it will take up inorganic nitrogen from the soil when it is available, and make up any deficiency with atmospheric fixation of nitrogen. For this reason, manure application on alfalfa is acceptable as long as the amount of plant-available nitrogen in the soil does not exceed crop uptake potential (Russelle et al 2007).

The yield estimate for first year plantings of alfalfa/grass is 5 dry tons per acre, and for years 2 and older is 7 to 7.5 dry tons per acre based on the experience of the farm's crop advisor. Therefore, the yield estimates for fields 102 and 103C have increased in 2018 over 2017 yields because these fields are now second year stands and are assumed to have reached their maximum yield potential. Yield estimate for field 109 is 5 dry tons per acre as it will be a new seeding in 2018.

Fields with crop changes in 2017: Fields 105 Dixon back, 103D Skelton, 201 Skelton and 109 Sylvia will have a change of crop in 2018.

The following comments are made on planned nitrogen application rates on these fields:

- Field 105 Dixon back: was an older stand of alfalfa/grass in 2017 and previous years. It will be planted to silage corn in 2018. The planned nitrogen application for 2018 is 74 lb/acre. The field has been given a fertility factor of 90 lb/acre to account for the nitrogen from the alfalfa plough-down. This field had low residual nitrate-N in fall 2017.
- Field 103D Skelton is an 18 acre piece of field 103B (northeast corner) that has been in alfalfa/grass for several years and is going to be put into corn in 2018. The planned nitrogen application rate for 2018 is 27 lb/acre. The field has been given a 90 lb/acre fertility factor due to the alfalfa plough-down. Field 103B had medium residual nitrate-N in fall 2017.
- Field 201 Skelton: this field was an older stand of alfalfa/grass in 2017 and previous years. It will be planted to silage corn in 2018. The planned nitrogen application rate for 2018 is 55 lb/acre. To account for the nitrogen release from the plough-down of the alfalfa/grass stand, the field has a fertility factor of 90 lb/A. This field had low residual nitrate-N in fall 2017.
- Field 109 Sylvia: this field grew corn silage in 2017 and will be planted to a new stand of alfalfa/grass in 2018. The planned nitrogen application rate of 113 lb/acre will provide half of the crop's nitrogen requirement in 2018 while it establishes.

Fields 203 Hoeskstra and 206 Ferguson: these two fields are located off the Hullcar aquifer area. They are leased by HS Jansen. They do not receive manure from the operation and are not fertilized. Therefore, they are not considered further in this NMP.

7. Planned applications of manure in 2018

7.1 2018 Manure applications on HS Jansen and Sons owned and leased land

Table 8 contains the planned manure applications by field for 2018. 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 12 fields in 2018 at or below to the recommended application rates.

Corn fields: The manure application rate will provide the nitrogen requirement as determined using the NMP calculator.

Alfalfa:grass fields: the manure application rate will provide up to 25% of the nitrogen requirement of the crop. 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. Depending on manure availability, fields may not receive the full prescribed amount in 2018.

Table 8. Planned manure applications for 2018

Field ID	2018 N app rate in manure	2018 crop	2018 manure app rate	
	Avail. N		Effluent	Solids
	Lb/A		Gal/A	Tons/A
Corn fields (2018)				
103 D Skelton	22	Corn silage	3,000	0
104 Harold's	133	Corn silage	18,000	0
105 Dixon Back	74	Corn silage	10,000	0
106 Dixon Front	37	Corn silage	5,000	0
201 Skelton	44	Corn silage	6,000	0
202 Reimer	118	Corn silage	16,000	0
400 Lavington Pivots	17	Corn silage	0	9.5
Alfalfa and grass fields (2018)				
101 Barns	0	Alfalfa/grass	0	0
102 Sorensen	99	Alfalfa/grass	14,000	0
103 A Hullcar	85	Alfalfa/grass	12,000	0
103 B Doug's	71	Alfalfa/grass	10,000	0
103 C Island	113	Alfalfa/grass	16,000	0
109 Sylvia	113	Alfalfa/grass (new seeding)	16,000	0
205 Jessie	113	Alfalfa/grass	16,000	0

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. Application rates will be reviewed and approved by the QP.

7.2 2018 Manure transfers to neighbouring farms

Two neighbouring farms will take effluent in 2018, Van Doersen and Tillaart (Fieldstone Granary). The volumes to be transferred are as follows:

- Van Doersen: 7.5 million Imperial gallons (spring 2018)
- Tillaart: up to 4 million Imperial gallons depending on availability (spring and summer 2018)

7.3 2018 Manure balance

Table 9 summarizes the estimated volume of manure effluent that will be produced at the HS Jansen farm, the applications for 2018 on each HS Jansen field receiving manure effluent, and manure transfers. Approximately 47% of the manure effluent is planned to be applied to HS Jansen's owned and leased land in the Hullcar area, and 53 % to be transferred to neighbouring farms. The total volume of manure effluent expected to be produced is accounted for either on the HS Jansen property or in transfers.
Note: Tillaart will take more than the allocated amount if available.

Table 9. Summary of Planned Manure Distribution – 2018

		Volume (Imp. Gal)	% of total
Estimated 2018 manure prod'n		20,707,103	100
Applied on HS Jansen fields	Field ID		
	104	1,985,400	10
	105	1,010,000	5
	106	75,000	0.4
	109	1,176,000	6
	202	585,600	3
	101	-	-
	103A	1,218,000	6
	103B	780,000	4
	103C	198,400	1
	201	432,000	2
	205	480,000	3
	103 D	54,000	0.3
	102	1,408,400	7
Total on HS Jansen land base		9,402,800	47
2017 Manure transfers:			
Van Doersen		7,500,000	36
Tillaart (will take more if available)		3,400,000	16
Total transfers		11,304,303	53
Total manure applied and transferred		20,707,103	100

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

Table 10 shows the nitrogen balance for each field for 2018 (column P, 3rd from last column). Application rates for 2018 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 zero nitrogen balance in 2018. Post-harvest soil nitrate testing in fall 2018 will show how close to nitrogen balance each field is, and further adjustments to manure application rates will be made in 2019 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 2018 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 Sum all planned fertilizer additions for the year. Use Worksheet 6.1 to the right to help.	P_2O_5	K_2O	N (Worksheet 1, col. H)	P_2O_5 (Worksheet 2, col. I)	K_2O (Worksheet 3, col. I)	N* (col. M – F – J)	P_2O_5* (col. N – H – K)	K_2O* (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)	(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	Alf/grass	54.1	Flush lagoon	0	0	0.85	0	0									
			Manure solids		0	0.85	0	0									
					0	0.85	0	0									
			all manures		0	n/a	0	0	13			322	0	0	309	0	0
102 Sorensen	Alf/grass	100.6	Flush lagoon	70	104	0.75	48	269									
			Manure solids		0	0.75	0	0									
					0	0.75	0	0									
			all manures		104	n/a	48	269	13			377	26	0	260	-23	-269
103A Hullcar	Alf/grass	101.6	Flush lagoon	60	89	0.85	47	230									
			Manure solids		0	0.85	0	0									
					0	0.85	0	0									
			all manures		89	n/a	47	230	13			342	0	101	240	-47	-130
103B Doug's	Alf/grass	78.0	Flush lagoon	50	74	0.85	39	192									
			Manure solids		0	0.85	0	0									
					0	0.85	0	0									
			all manures		74	n/a	39	192	13			309	0	0	222	-39	-192
103C Island	Alf/grass	12.4	Flush lagoon	80	118	0.65	48	307									
			Manure solids		0	0.65	0	0									
					0	0.65	0	0									
			all manures		118	n/a	48	307	13			393	64	360	262	16	53
103D Skelton	corn sil	18.0	Flush lagoon	15	22	0.85	12	58									
			Manure solids		0	0.85	0	0									
					0	0.85	0	0									
			all manures		22	n/a	12	58	13			27	0	0	-8	-12	-58
104 Harold's	corn sil	110.3	Flush lagoon	90	133	0.85	70	346									
			Manure solids		0	0.85	0	0									
					0	0.85	0	0									
			all manures		133	n/a	70	346	5			136	0	0	-2	-70	-346
105 Dixon back	corn sil	101.0	Flush lagoon	50	74	0.65	30	192									
			Manure solids		0	0.65	0	0									
					0	0.65	0	0									
			all manures		74	n/a	30	192	0			70	35	180	-4	5	-12
106 Dixon front	corn sil	15.0	Flush lagoon	25	37	0.85	20	96									
			Manure solids		0	0.85	0	0									
					0	0.85	0	0									
			all manures		37	n/a	20	96	0			33	0	54	-4	-20	-42
109 Sylvia	Alf/grass	73.5	Flush lagoon	80	118	0.75	55	307									
			Manure solids		0	0.75	0	0									
					0	0.75	0	0									
			all manures		118	n/a	55	307	13			237	17	72	106	-38	-235
201 Skelton	corn sil	72.0	Flush lagoon	30	44	0.65	18	115									
			Manure solids		0	0.65	0	0									
					0	0.65	0	0									
			all manures		44	n/a	18	115	13			55	32	101	-2	14	-14
202 Reimer	corn sil	36.6	Flush lagoon	80	118	0.85	63	307									
			Manure solids		0	0.85	0	0									
					0	0.85	0	0									
			all manures		118	n/a	63	307	13			127	0	0	-4	-63	-307
205 Jessie	Alf/grass	30.0	Flush lagoon	80	118	0.50	37	307									
			Manure solids		0	0.50	0	0									
					0	0.50	0	0									
			all manures		118	n/a	37	307	0			376	96	216	258	59	-91
400 Lavington	corn sil	308.0	Flush lagoon		0	0.50	0	0									
			Manure solids	9.5	17	0.50	9	23									
					0	0.50	0	0									
			all manures		17	n/a	9	23	110			118	35	180	-9	25	157
203 Hoekstra	Alf/grass	30.0	Flush lagoon	0	0	0.75	0	0									
			Manure solids	0	0	0.75	0	0									
					0	0.75	0	0									
			all manures		0	n/a	0	0	0			308	20	86	308	20	86
206 Ferguson	Alf/grass	39.7	Flush lagoon	0	0	0.50	0	0									
			Manure solids	0	0	0.50	0	0									
					0	0.50	0	0									
			all manures		0	n/a	0	0	55			183	64	72	128	64	72

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 the required amount of effluent or chemical fertilizer will be applied to corn fields 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 may 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 using 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 2018 will be tracked and recorded. One of the manure application drag line systems currently has a flow meter, the others are scheduled to have flow meters installed in 2018 (if ARDCORP funding is available). Effluent application rates are set by nozzle size and area covered, and tractor speed. Flow rate volumes are used to confirm application rates. Volumes applied per acre on each field will be recorded. This information will be used to confirm 2018 manure application rates.

12. Setbacks

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

- 30 m (100 ft) from all domestic wells, surface water and residences
- 3.5 m (10 ft) from industrial wells (including irrigation wells), roads and other buildings

13. Other fertilizer application in 2018

No phosphorus or potassium fertilizer will be applied to fields owned or rented by HS Jansen in the Hullcar area in 2018. Other non-nitrogen fertilizer (sulphur and boron) may be applied in 2018 as required based on soil test results.

14. Soil phosphorus status

All but two of the fields farmed by HS Jansen currently have soil available phosphorus levels in the optimum to excess range (Table 11). Two fields, 205 Jessie and 206 Ferguson currently have available

soil phosphorus in the medium range. Manure application plus soil reserves will meet crop requirements for 2018 on all fields except 206 Ferguson which will not receive manure.

Phosphorus from agricultural fields can move into surface water 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. The amount of phosphorus that can potentially move into surface water increases as soil residual phosphorus levels increase.

Deep Creek runs adjacent to sections of 103B Doug's as well as 103A Hullcar and 103C Island. There is potential for movement of phosphorus from these fields into Deep Creek during snowmelt if there is significant runoff. However, these fields are generally flat and have very permeable soils such that minimal runoff is expected. Along most of the boundary with Deep Creek there is a significant treed buffer between the fields and Deep Creek which is expected to effectively slow down runoff and allow runoff water to move into the soil which will capture phosphorus. There is a vegetated buffer along the remaining sections of the field that are adjacent to the creek which also will act to slow runoff and allow it to move into the soil. Further, HS Jansen maintains a 30 metre manure application buffer from the creek which minimizes the amount of residual phosphorus in the soil next to the creek. The farm's crop advisor is actively working with the operation to maintain soil phosphorus levels within the optimum range by rotating crops.

Table 11. Soil phosphorus status – fall 2018

Worksheet 2. Calculate the Crop Phosphorus Application Recommendation								
A	B	C	D	E	F	G	H	I
Field Description	Crop Information		Crop Phosphorus (P) Applicator Calculations					Crop
(Worksheet 1, col. A) (name or number)	Crop type to be fertilized	Crop dry yield (estimated) (tons/ac)	Crop phosphorus factor (Table 2) (lb P/ton)	Crop Phosphorus Uptake (col. C x D) (lb P/ac)	Soil test phosphorus value (Kelowna method) [a] 0-15 cm depth (ppm)	Soil phosphorus status (Table 3, col. 2)	Soil phosphorus level factor (Table 3, col. 5)	Phosphorus Application Recommendation (SEE NOTE BELOW) (col. E x H) x 2.3 (lb P_2O_5/ac)
101 Barns	Alf/grass	7	7.4	52	169	Excess	0	0
102 Sorensen	Alf/grass	7.5	7.4	56	99	High	0.2	26
103A Hullcar	Alf/gras	7	7.4	52	122	Excess	0	0
103B Doug's	Alf/grass	7	7.4	52	139	Excess	0	0
103C Island	Alf/gras	7.5	7.4	56	53	Optimum	0.5	64
103D Skelton	corn sil	6.5	4	26	118	Excess	0	0
104 Harold's	corn sil	8	4.0	32	147	Excess	0	0
105 Dixon back	corn sil	7.5	4.0	30	60	Optimum	0.5	35
106 Dixon front	corn sil	7.5	4.0	30	102	Excess	0	0
109 Sylvia	Alf/gras	5	7.4	37	100	High	0.2	17
201 Skelton	corn sil	7	4.0	28	64	Optimum	0.5	32
202 Reimer	corn sil	7.5	4.0	30	156	Excess	0	0
205 Jessie	Alf/grass	7.5	7.4	56	31	Medium	0.75	96
400 Lavington	corn sil	7.5	4.0	30	49	Optimum	0.5	35
203 Hoekstra	Alf/grass	6	7.4	44	77	High	0.2	20
206 Ferguson	Alf/grass	5	7.4	37	24	Medium	0.75	64

15. 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 2018 (depending on ARDCorp funding).

16. Manure storage capacity

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

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 8.13 million litres (1.79 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 62.1 million litres (13.66 million gallons). Total storage capacity is estimated to be 70 million litres (15.45 million gallons). This storage capacity assumes a 1 m freeboard in each lagoon at all times. (OMAFRA 2017).

The farm currently has 1200 milking cows plus 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 20.7 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 9 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 2885 **tons** (approx.. **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.

17. Post-harvest soil nitrate testing – fall 2018

After crop harvest in fall 2018, soil sampling will be done in each field to at least 60 cm depth to assess the accuracy of 2018 manure application rates. At this time, the 2018 manure application rates will be reviewed based on residual soil nitrate-N levels, and adjustments made to rates and timing as required for 2019.

18. References

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

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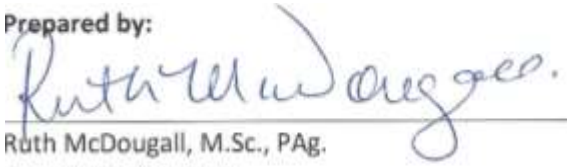
Prepared by:



Ruth McDougall, M.Sc., PAg.
Consulting Agrologist

June 1, 2018

Appendix 1.

HS Jansen and Sons 2018 Nutrient Management Plan – Site Maps

(all maps but Figure 1 courtesy of AGRI)

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

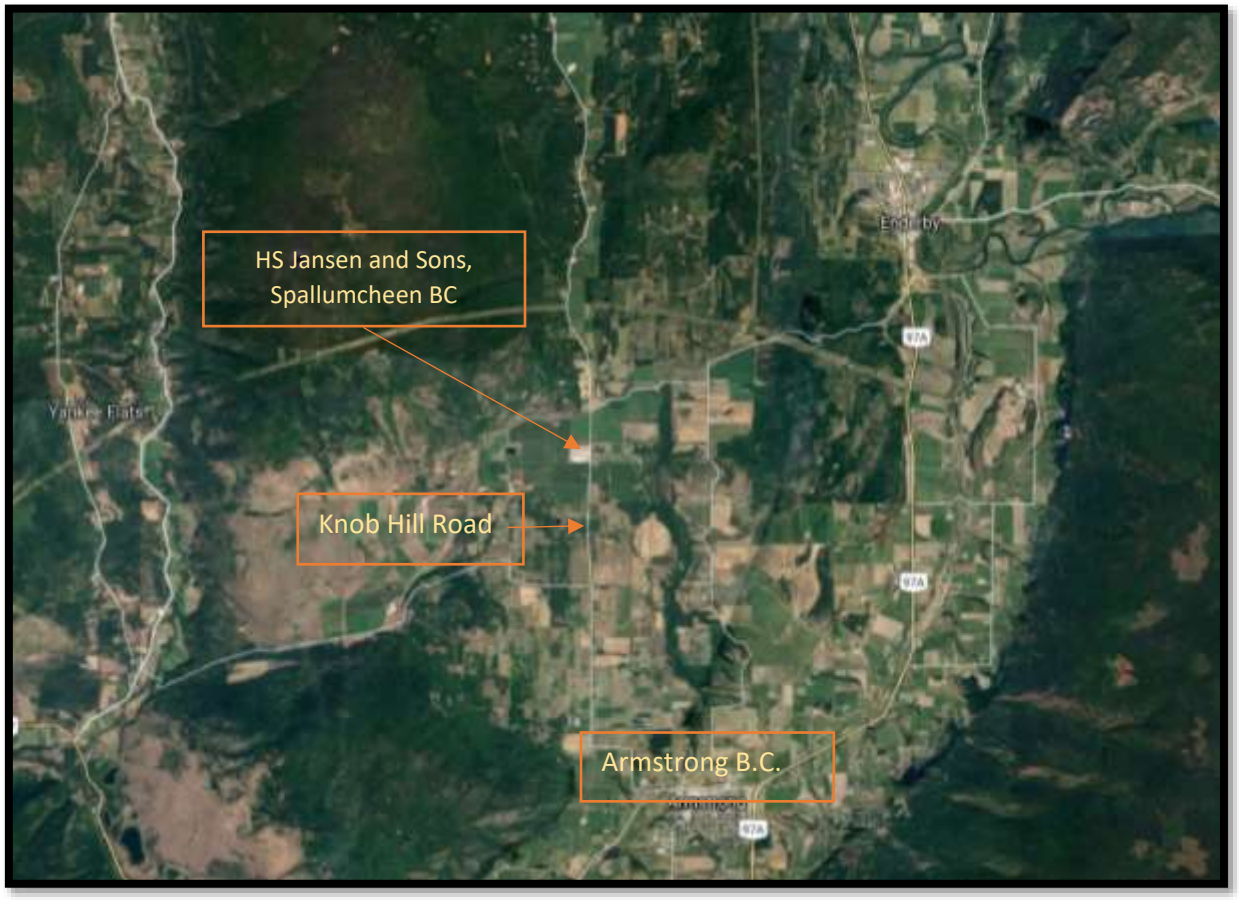
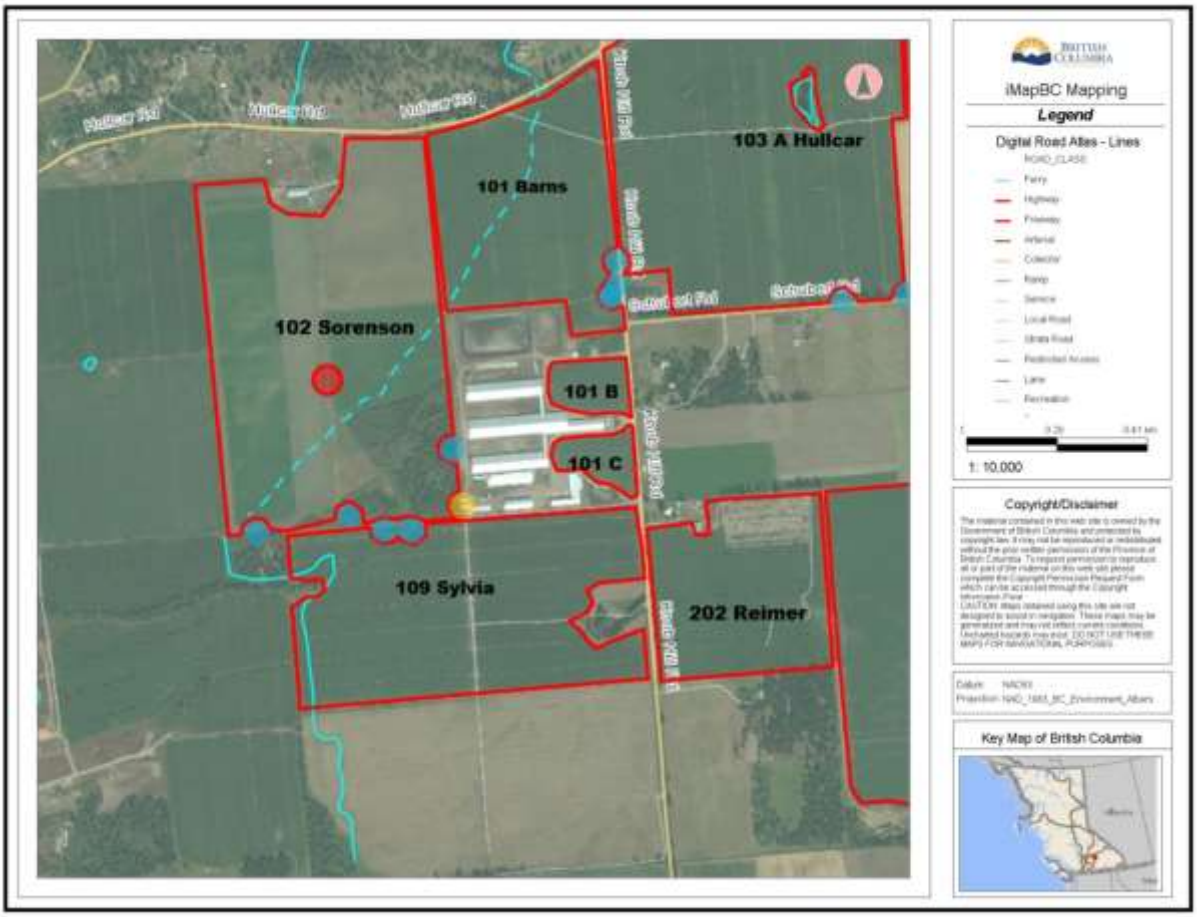


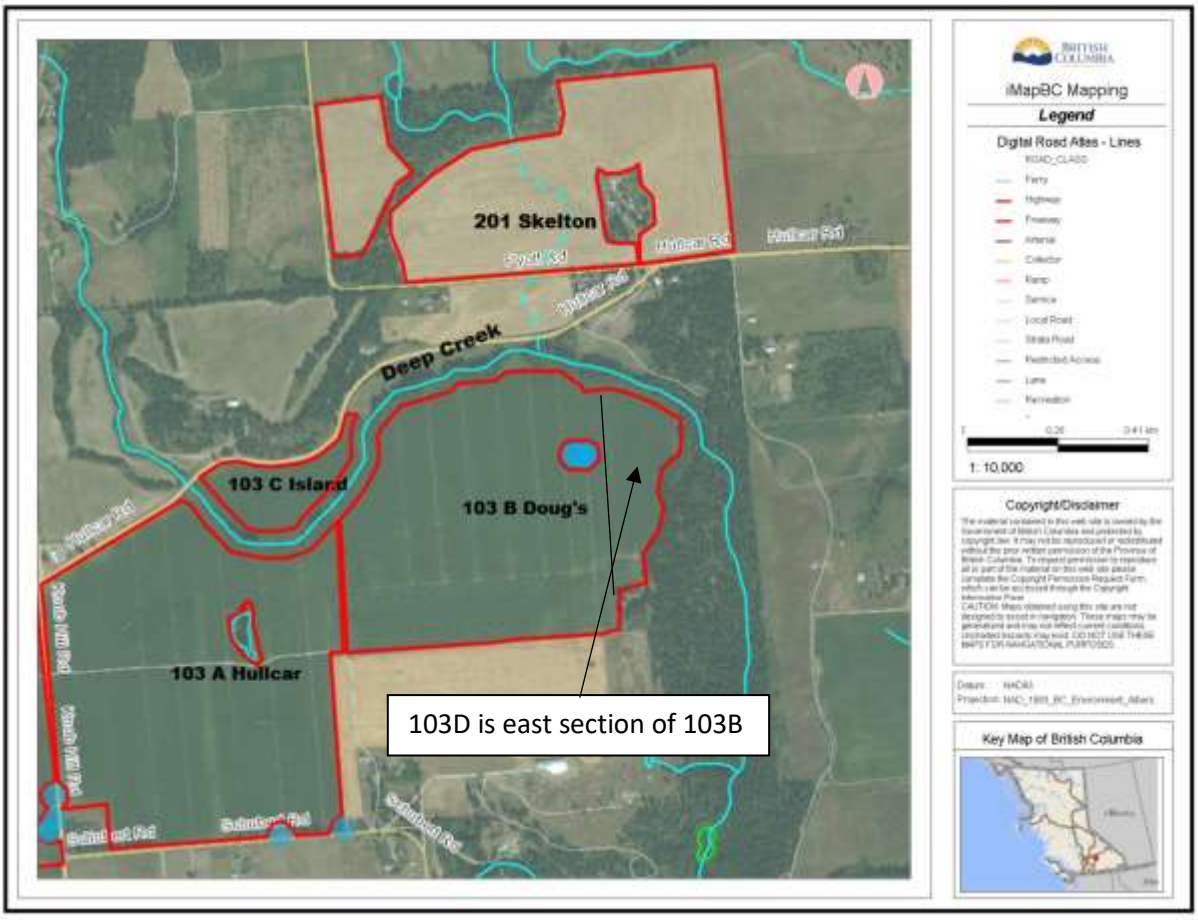
Figure 2. Fields 101, 102, 109 and 202



Legend	
	Field borders*
	Domestic well
	Livestock watering well
	Irrigation Well

*nutrient application areas including 30m setbacks to wells and surface water

Figure 3. Fields 103A, B, C and D, and 201



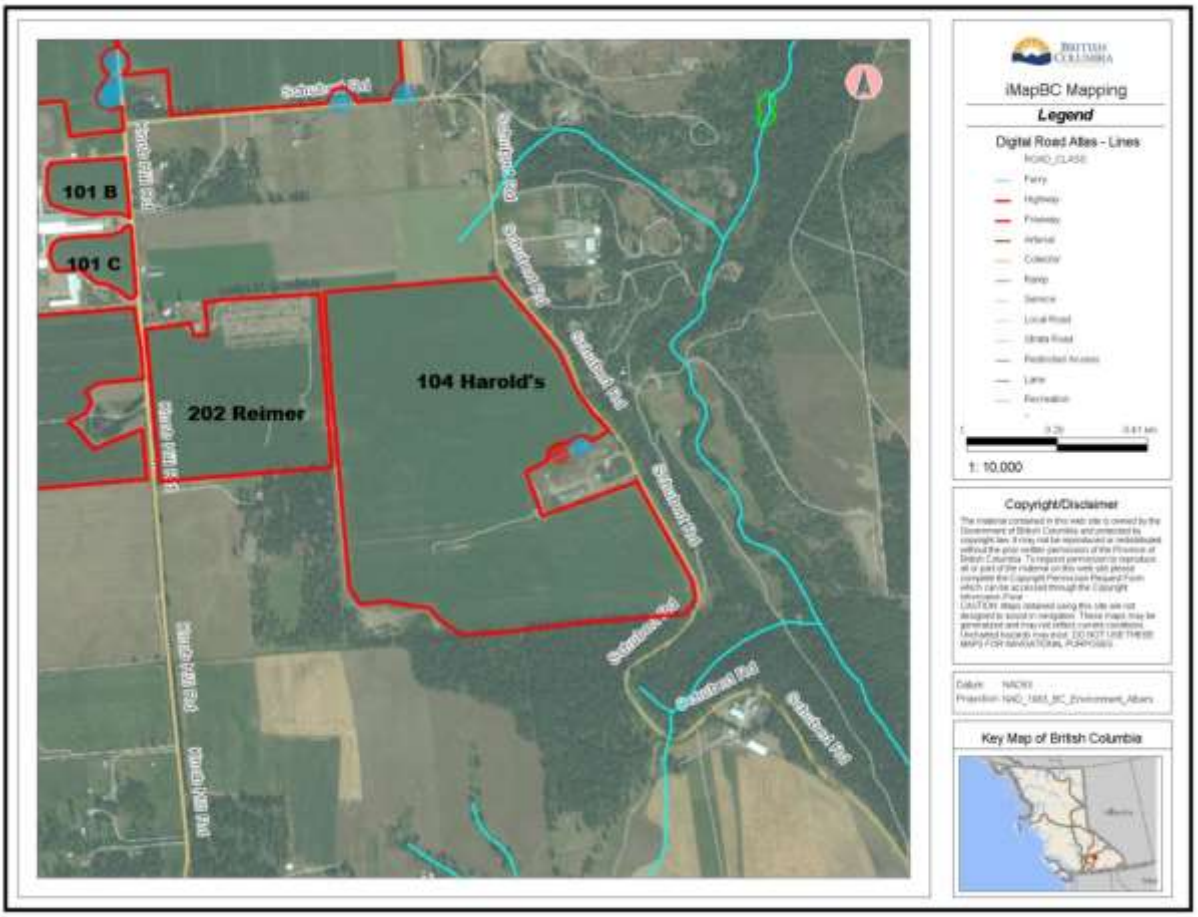
Legend	
	Field borders*
	Domestic well
	Livestock watering well
	Irrigation Well

*nutrient application areas including 30m setbacks to wells and surface water

Figure 4. Fields 105, 106 and 205

Legend	
	Field borders*
	Domestic well
	Livestock watering well
	Irrigation Well
*nutrient application areas including 30m setbacks to wells and surface water	

Figure 5. Fields 104 and 202



Legend	
	Field borders*
	Domestic well
	Livestock watering well
	Irrigation Well
*nutrient application areas including 30m setbacks to wells and surface water	

Figure 6. Field 400 (401 and 402) Lavington

Legend	
	Field borders*
	Domestic well
	Livestock watering well
	Irrigation Well
*nutrient application areas including 30m setbacks to wells and surface water	

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For:HULLCAR 2017

Grower Code:05219123
Farm:H.S. JANSEN
Field:17 - 205 JESSIES

05219-N1375

Report Date:2017-10-27 **Print Date:**2017-11-14

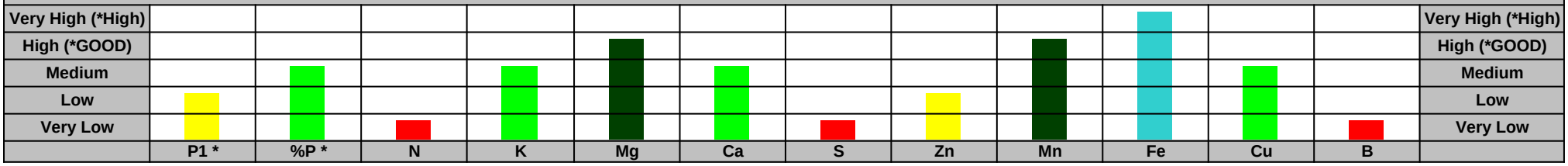
SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - 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
171A		6	18330	1.2	23 L	33 L	135 M	275 H	1560 M	7.5		10.7	3.2	21.4	72.8		2.8
171B		12	18331	2.5	30 M	53 M	247 VH	245 H	1980 H	7.4		12.8	5.0	16.0	77.4		1.9
171C		24	18332	1.1	22 M	30 L	90 M	285 M	3510 VH	8.0		20.3	1.1	11.7	86.3		1.0
171D		36	18333	0.9	17 L	23 L	71 L	260 M	3520 VH	8.2		20.1	0.9	10.8	87.6		0.8

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
171A	14 VL	25	2 VL	4	1.6 L	39 H	72 VH	1.0 M	0.2 VL	0.2 VL	8 M	558	0.0 G	0.15	24	17 M	69 VH	
171B	20 VL	36	16 M	29							4 L	441	0.0 G	0.31	37		55 VH	
171C	12 VL	43	1 VL	4							2 L	286	0.0 G	0.09	23		48 M	
171D	9 VL	32	1 VL	4							2 L	242	0.0 G	0.08	21		39 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

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.

C17298-10008

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C17298-10010
Account Number:05219

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

Attn:DOUG MACFARLANE
250-546-3847

For:HULLCAR 2017

Grower Code:05219123
Farm:H.S. JANSEN
Field:19 - 201 B SKELTON WEST

05219-N1377

Report Date:2017-10-27 **Print Date:**2017-11-14

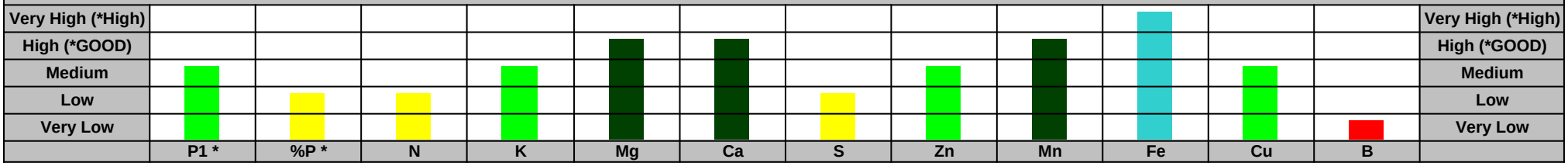
SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
191A		6	18339	2.4	33 M	53 M	141 M	195 H	1610 H	7.4		10.2	3.5	15.9	79.0		1.7
191B		12	18340	1.7	25 L	42 L	125 M	255 H	1900 H	7.4		12.2	2.6	17.5	78.0		2.1
191C		24	18341	1.1	19 L	36 M	73 L	365 M	3950 VH	8.0		23.1	0.8	13.1	85.3		0.9
191D		36	18342	0.8	14 L	25 L	52 L	355 M	3950 VH	8.2		23.0	0.6	12.9	85.9		0.8

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
191A	19 L	34	9 L	16	3.6 M	43 H	61 VH	1.0 M	0.2 VL	0.3 VL	4 L	309	0.0 G	0.22	36	24 M	41 H	
191B	18 VL	32	5 L	9							3 VL	507	0.0 G	0.15	29		59 VH	
191C	18 VL	65	1 VL	4							3 L	271	0.0 G	0.06	23		47 M	
191D	16 VL	58	1 VL	4							2 L	179	0.0 G	0.05	20		41 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

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.

C17298-10010

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C17298-10018
Account Number:05219

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

Attn:DOUG MACFARLANE
250-546-3847

For:HULLCAR 2017

Grower Code:05219123
Farm:H.S. JANSEN
Field:1 - 103 A NORTH

05219-N1364

Report Date:2017-10-27 **Print Date:**2017-11-14

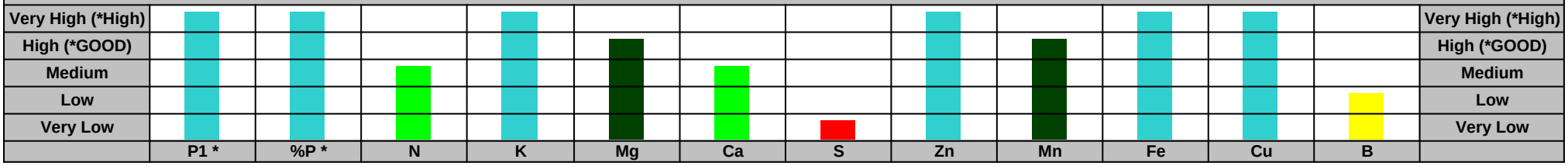
SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
11A		6	18370	4.4	49 G	120 H	296 VH	310 H	2430 M	7.2		16.4	4.6	15.8	74.1	4.6	0.9
11B		12	18371	3.1	45 G	90 H	180 H	280 M	2270 M	7.0		16.4	2.8	14.2	69.0	12.9	1.1
11C		24	18372	1.5	24 L	34 L	128 M	220 M	2080 H	7.5		12.7	2.6	14.4	81.7		1.5
11D		36	18373	0.7	9 VL	13 VL	114 M	245 L	3870 VH	7.9		21.9	1.3	9.3	88.5		0.9

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
11A	18 VL	32	10 M	18	14.5 VH	41 H	86 VH	3.1 VH	0.5 L	0.3 VL	33 H	470	0.0 G	0.29	56	13 L	34 M	
11B	23 VL	41	5 L	9							21 H	548	0.1 G	0.20	43		42 H	
11C	20 VL	72	4 VL	14							3 VL	575	0.0 G	0.18	27		45 H	
11D	23 VL	83	4 VL	14							1 VL	262	0.0 G	0.14	19		45 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

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.

C17298-10018

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C17298-10019
Account Number:05219

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

Attn:DOUG MACFARLANE
250-546-3847

For:HULLCAR 2017

Grower Code:05219123
Farm:H.S. JANSEN
Field:2 - 103 A SOUTH

05219-N1365

Report Date:2017-10-27 **Print Date:**2017-11-14

SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - 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
21A		6	18374	4.5	53 H	139 H	320 VH	270 M	2210 M	7.1		15.7	5.2	14.4	70.6	8.9	0.9
21B		12	18375	2.6	49 G	108 G	297 VH	250 H	1790 M	6.7	6.9	13.1	5.8	15.9	68.3	8.9	1.1
21C		24	18376	1.1	23 L	32 L	179 H	200 H	1390 M	7.1		10.2	4.5	16.4	68.3	8.9	1.9
21D		36	18377	0.6	9 VL	11 VL	67 M	145 H	840 M	7.4		5.7	3.0	21.1	73.4		2.7

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
21A	18 VL	32	14 M	25	15.5 VH	44 H	86 VH	2.8 H	0.5 L	0.3 VL	41 H	434	0.0 G	0.36	57	14 L	32 M	
21B	19 VL	34	4 VL	7							24 H	576	0.1 G	0.36	38		33 H	
21C	13 VL	47	1 VL	4							7 M	549	0.1 G	0.27	23		44 VH	
21D	7 VL	25	1 VL	4							6 L	234	0.0 G	0.14	18		36 VH	

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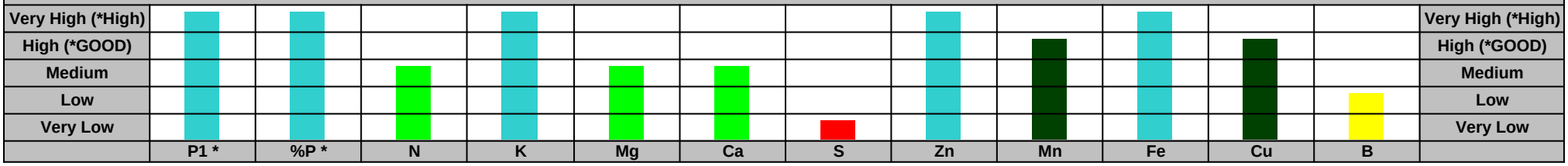
GRAPHIC SUMMARY



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

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.

C17298-10019

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C17298-10020
Account Number:05219

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

Attn:DOUG MACFARLANE
250-546-3847

For:HULLCAR 2017

Grower Code:05219123
Farm:H.S. JANSEN
Field:3 - 103 C ISLAND

05219-N1366

Report Date:2017-10-27 **Print Date:**2017-11-14

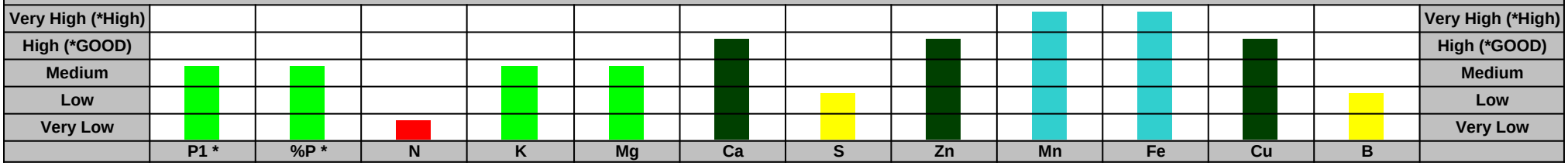
SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
31A		6	18378	3.8	34 M	56 M	110 M	220 M	2090 H	7.2		13.3	2.1	13.8	78.4	4.6	1.1
31B		12	18379	3.0	24 M	34 M	70 L	220 M	2640 VH	7.4		15.3	1.2	12.0	86.0		1.0
31C		24	18380	2.0	18 L	26 L	89 M	260 M	3740 VH	8.0		21.3	1.1	10.2	88.0		0.9
31D		36	18381	1.3	13 L	19 L	85 L	240 L	4000 VH	8.0		22.4	1.0	8.9	89.4		0.8

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
31A	27 L	49	4 VL	7	6.1 H	59 VH	84 VH	1.7 H	0.5 L	0.3 VL	5 M	330	0.0 G	0.15	50	9 L	34 H	
31B	30 L	54	3 VL	5							2 VL	296	0.0 G	0.10	42		35 M	
31C	36 M	130	2 VL	7							2 L	412	0.0 G	0.11	32		45 M	
31D	40 M	144	1 VL	4							1 VL	313	0.0 G	0.11	25		41 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

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.

C17298-10020

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C17298-10021
Account Number:05219

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

For:HULLCAR 2017

Grower Code:05219123

05219-N1367

Attn:DOUG MACFARLANE
250-546-3847

Farm:H.S. JANSEN
Field:4 - 103 B WEST

Report Date:2017-10-27 **Print Date:**2017-11-14

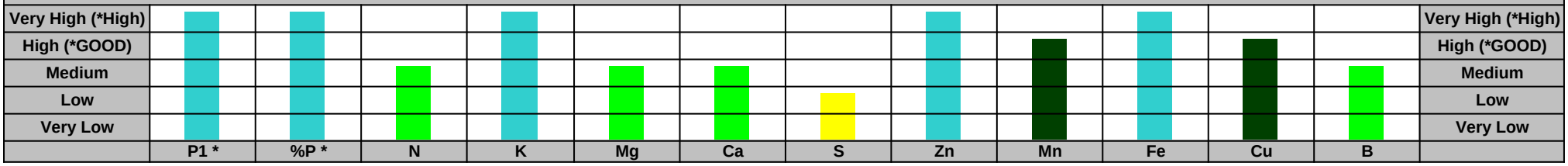
SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
41A		6	18382	5.6	58 H	134 H	355 VH	295 M	2460 M	7.2		16.6	5.5	14.8	74.0	4.6	1.2
41B		12	18383	5.1	45 G	93 H	254 VH	260 M	2240 M	7.1		15.6	4.2	13.9	71.8	8.9	1.3
41C		24	18384	2.5	20 L	39 L	207 H	290 H	2310 H	7.5		14.7	3.6	16.4	78.4		1.8
41D		36	18385	1.9	16 L	30 L	163 H	270 H	2150 H	7.7		13.7	3.1	16.5	78.6		2.1

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
41A	31 L	56	18 M	32	15.6 VH	42 H	87 VH	2.9 H	0.8 M	0.4 L	36 H	473	0.0 G	0.37	69	20 M	47 H	
41B	25 L	45	5 L	9							22 H	549	0.1 G	0.30	64		45 H	
41C	19 VL	68	3 VL	11							3 L	722	0.0 G	0.22	37		60 H	
41D	15 VL	54	2 VL	7							2 VL	681	0.0 G	0.19	31		66 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

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.

C17298-10021

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C17298-10022
Account Number:05219

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

For:HULLCAR 2017

Grower Code:05219123

05219-N1368

Attn:DOUG MACFARLANE
250-546-3847

Farm:H.S. JANSEN
Field:5 - 103 B EAST

Report Date:2017-10-27 **Print Date:**2017-11-14

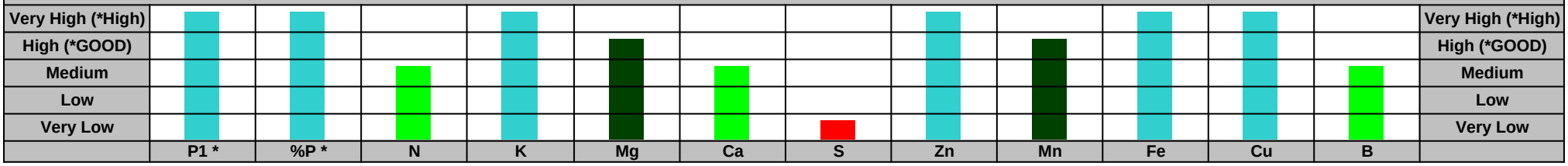
SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
51A		6	18386	5.5	58 H	160 H	420 VH	295 H	2160 M	7.2		15.2	7.1	16.2	71.0	4.5	1.2
51B		12	18387	3.3	40 M	94 G	304 VH	230 H	1650 M	7.1		12.2	6.4	15.7	67.8	8.9	1.2
51C		24	18388	1.3	14 L	22 VL	159 H	165 H	1030 M	7.5		7.1	5.8	19.4	72.8		2.3
51D		36	18389	1.0	13 VL	20 VL	127 M	145 H	860 M	7.3		6.0	5.5	20.2	72.0		2.5

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
51A	23 VL	41	17 M	31	16.5 VH	43 H	92 VH	3.1 VH	0.6 M	0.4 VL	43 H	477	0.0 G	0.44	68	19 M	42 H	
51B	22 L	40	4 VL	7							26 H	457	0.1 G	0.41	45		34 H	
51C	9 VL	32	2 VL	7							8 L	351	0.0 G	0.30	25		37 VH	
51D	7 VL	25	2 VL	7							9 L	283	0.1 G	0.27	22		35 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

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.

C17298-10022

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C17298-10023
Account Number:05219

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

For:HULLCAR 2017

Grower Code:05219123 05219-N1369

Attn:DOUG MACFARLANE
250-546-3847

Farm:H.S. JANSEN
Field:10 - 109 SYLVIA WEST

Report Date:2017-10-27 **Print Date:**2017-11-14

SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
101A		6	18391	3.5	45 M	102 G	274 VH	420 VH	1900 M	7.6		13.9	5.1	25.2	68.3		1.8
101B		12	18392	2.0	29 M	50 M	122 M	435 VH	1730 M	7.6		12.9	2.4	28.2	67.3		2.5
101C		24	18393	1.0	25 L	35 L	107 M	580 VH	1880 M	7.8		14.8	1.9	32.7	63.5		2.4
101D		36	18394	0.9	31 G	55 G	113 M	620 H	4000 H	8.2		25.7	1.1	20.1	77.8		1.3

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
101A	49 M	88	14 M	25	6.4 H	75 VH	89 VH	1.5 H	0.5 L	0.4 L	25 H	528	0.0 G	0.20	47	20 M	57 H	
101B	23 VL	41	4 VL	7							11 G	607	0.0 G	0.09	32		73 VH	
101C	16 VL	58	1 VL	4							7 G	619	0.0 G	0.06	22		82 VH	
101D	19 VL	68	4 VL	14							5 M	268	0.0 G	0.05	21		74 H	

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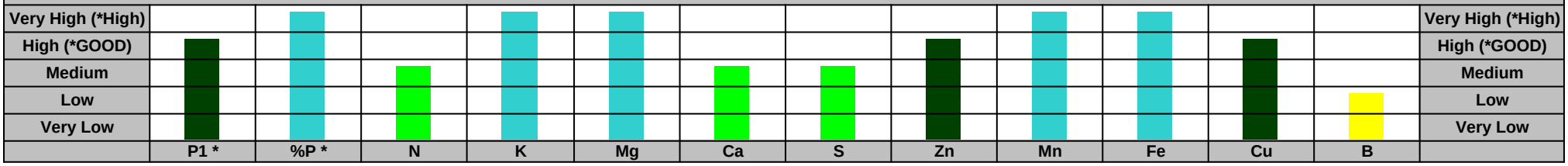
GRAPHIC SUMMARY



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

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.

C17298-10023

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C17298-10024
Account Number:05219

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

For:HULLCAR 2017

Grower Code:05219123
05219-N1370

Attn:DOUG MACFARLANE
250-546-3847

Farm:H.S. JANSEN
Field:11 - 101 BARNS

Report Date:2017-10-27 **Print Date:**2017-11-14

SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - 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
111A		6	18395	5.1	60 H	178 H	484 VH	440 H	3400 H	7.5		22.1	5.6	16.6	77.0		0.9
111B		12	18396	3.2	43 G	100 H	408 VH	350 H	2860 H	7.5		18.5	5.7	15.8	77.4		1.4
111C		24	18397	1.1	18 L	35 M	88 M	220 L	3240 VH	8.2		18.5	1.2	9.9	87.7		1.3
111D		36	18398	0.8	17 L	24 L	62 L	195 L	3640 VH	8.3		20.2	0.8	8.0	90.1		1.2

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
111A	25 VL	45	11 M	20	13.7 VH	39 H	80 VH	2.5 H	0.7 M	0.4 VL	15 H	381	0.0 G	0.34	64	15 L	48 M	
111B	32 L	58	5 L	9							8 H	544	0.0 G	0.36	44		59 H	
111C	25 L	90	2 VL	7							3 L	217	0.0 G	0.12	23		55 H	
111D	27 L	97	1 VL	4							2 L	119	0.0 G	0.10	20		55 H	

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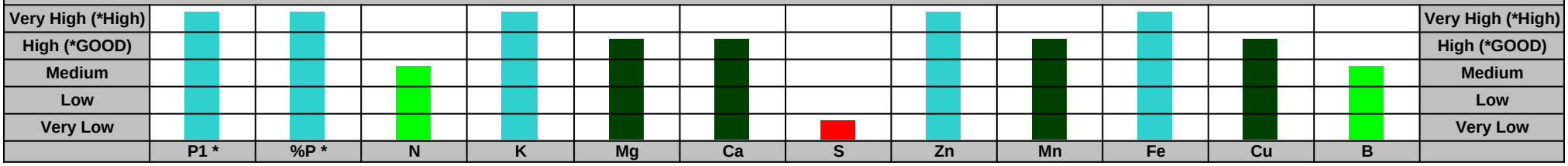
GRAPHIC SUMMARY



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

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.

C17298-10024

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C17298-10025
Account Number:05219

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

For:HULLCAR 2017

Grower Code:05219123 05219-N1371

Attn:DOUG MACFARLANE
250-546-3847

Farm:H.S. JANSEN
Field:12 - 102 SORENSEN SOUTH

Report Date:2017-10-27 **Print Date:**2017-11-14

SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
121A		6	18399	4.6	46 G	105 H	428 VH	350 H	2670 H	7.7		17.5	6.3	16.7	76.3		1.0
121B		12	18400	2.6	39 H	75 H	492 VH	450 M	4430 H	7.7		27.5	4.6	13.6	80.5		1.5
121C		24	18401	1.5	29 G	50 G	265 H	510 M	5050 H	8.0		30.5	2.2	13.9	82.8		1.2
121D		36	18402	0.9	22 M	36 M	172 M	560 H	4000 H	8.1		25.3	1.7	18.5	79.2		0.8

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
121A	29 L	52	12 M	22	6.4 H	40 H	60 VH	1.5 H	0.4 L	0.4 VL	40 H	331	0.0 G	0.38	59	26 M	39 M	
121B	48 M	86	3 VL	5							6 G	364	0.0 G	0.34	38		93 H	
121C	30 VL	108	3 VL	11							4 G	223	0.0 G	0.16	27		85 H	
121D	15 VL	54	2 VL	7							3 L	331	0.0 G	0.09	21		47 M	

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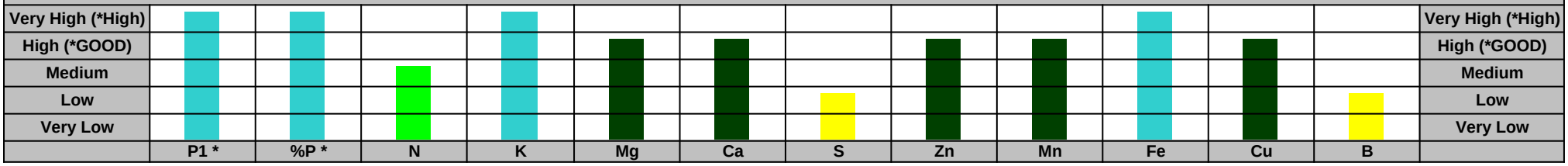
GRAPHIC SUMMARY



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

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.

C17298-10025

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

Report Number:C17298-10026
Account Number:05219

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

For:HULLCAR 2017

Grower Code:05219123 05219-N1372

Attn:DOUG MACFARLANE
250-546-3847

Farm:H.S. JANSEN
Field:13 - 102 SORENSEN NORTH

Report Date:2017-10-27 **Print Date:**2017-11-14

SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH pH	pH Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
131A		6	18403	3.9	45 G	101 H	368 VH	365 H	3170 H	7.6		20.0	4.7	15.2	79.3		0.9
131B		12	18404	3.5	33 G	59 G	222 H	350 M	4010 H	7.7		23.8	2.4	12.3	84.3		1.3
131C		24	18405	1.6	15 L	19 L	124 M	280 M	2700 H	7.8		16.5	1.9	14.2	82.0		2.1
131D		36	18406	1.0	8 VL	14 VL	113 M	265 H	1640 M	7.6		11.0	2.6	20.1	74.7		2.8

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
131A	25 VL	45	8 L	14	9.6 H	43 H	61 VH	2.3 H	0.4 L	0.4 VL	8 H	409	0.0 G	0.31	51	16 M	42 M	
131B	33 L	59	5 L	9							5 M	393	0.0 G	0.20	47		69 H	
131C	16 VL	58	2 VL	7							1 VL	503	0.0 G	0.13	28		81 VH	
131D	9 VL	32	2 VL	7							3 VL	554	0.0 G	0.13	22		70 VH	

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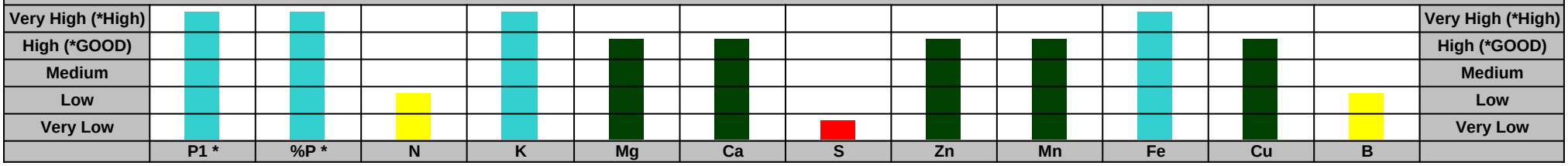
GRAPHIC SUMMARY



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

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.

C17298-10026