

# **Douglas Regehr Nutrient Management Plan 2018**

---

**Final: November 3 2017**

**Prepared for:**

Douglas Regehr,  
5042 Schubert Road,  
Armstrong BC

**Prepared by:**

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

**November 2017**

## Contents

1. Introduction .....	4
2. Livestock on site 2018.....	4
3. Cropping report – 2018.....	4
4. Post-harvest soil nitrate levels.....	5
5. Nitrogen to be applied to D Regehr fields from all sources in 2018.....	6
5.1 Manure application.....	6
5.2 Other sources of nitrogen on farm .....	7
6. Cropping and nitrogen requirements of crops – 2018 .....	7
7. Nutrients required for 2018 crop of field peas.....	8
8. Agronomic balance calculations – Crop requirements vs. nutrient supply .....	8
9. Timing of manure applications .....	9
10. Method of manure application.....	9
11. Tracking of manure applications.....	9
12. Setbacks .....	9
13. Other fertilizers - 2018.....	9
14. Soil phosphorus status.....	10
15. Irrigation rate .....	10
16. Manure storage capacity .....	10
17. On-going soil monitoring – 2018 post-harvest nitrate testing .....	10
18. Groundwater monitoring.....	11
19. Surface water monitoring .....	11

## List of Tables and Figures

Table 1. Cropping report – 2014- 2017 .....	5
Table 2. Fall 2016 PHNT Soil Test Results .....	6
Table 3. Nutrient application in manure.....	7
Table 4. Crop nitrogen requirement calculations 2017 .....	8
Table 5. Agronomic Balance Calculations for 2017 .....	9
Table 6. Soil Phosphorus Status- Fall 2016 .....	10
Figure 1. Location Map .....	12
Figure 2. Site Map .....	13
Figure 3. Post-harvest soil test results – August and September 2017 .....	14-16

## 1. Introduction

This is a Nutrient Management Plan (NMP) for Douglas Regehr (D Regehr), 5042 Schubert Road, Spallumcheen BC for the 2018 cropping year (see Figure 1 for 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. This Nutrient Management Plan runs from September 2017 to August 2018 due to the fall planting of crops on the farm.

The Douglas Regehr property consists of 19.3 hectares (47.6 acres) of arable land as well as the farmstead. The farm operated a feedlot on-site from 1980 to 1997. The feedlot was depopulated in 1997. From 2002 to 2007 the feedlot was rented by H.S. Jansen who housed 1000 replacement heifers in it year-round. The farm has not had any animals on-site since 2007 when Jansen moved his replacement heifers elsewhere. The farm has been managed organically since 2012; since that time there has been no chemical fertilizer used on the farm and all nutrients used by crops have been provided in broiler or liquid dairy manure. The farm currently has organic status. The land base farmed now includes the area of the old feedlot; prior to 2015 this area was not farmed.

This plan considers the agronomic balance of nitrogen only. The residual levels of phosphorus and potassium in the soil will meet crop needs for these nutrients for 2018. Current soil levels of phosphorus are higher than agronomic levels but this is not considered to pose an environmental hazard due to the distance of the Regehr fields from surface water. See section 14 for a more in-depth discussion of soil phosphorus levels and management.

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

This Nutrient Management Plan describes cropping and nutrient applications planned to be undertaken by Douglas Regehr in 2018. However, weather and other factors can result in changes to plans 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 farm-specific data and industry-standard estimates are used in nutrient management planning, there is considerable imprecision in the process. This plan has been prepared with the goal of ensuring 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.

## 2. Livestock on site 2018

D Regehr has no livestock on site. There has been no livestock on site since 2007 when the feedlot on site was depopulated.

## 3. Cropping report – 2018

Table 2 below shows the farm's fields, acreages cropped and crops grown in 2017 and 2018. The current crop cycle at D Regehr's begins in fall with application of manure and planting of cereal crop or canola,

and finishes in late summer the following year with harvest of that crop. The farm's arable land was planted to peas in fall 2017 for harvest in late summer 2018. Figure 2 shows the farm's fields.

**Note:** the Home Field now includes the area of the Horse pasture. Prior to 2016, the Horse Pasture was a separate field.

**Table 1. Cropping Report – 2017-2018**

Field ID	Area		2017 crop	2018 Crop
	ha	acres		
101 Home Field (includes area of horse pasture)	16.2	39.9	Canola	Field peas (grain)
102 Old Feedlot	3.1	7.7	Canola	Field peas (grain)
<b>Total</b>	<b>19.3</b>	<b>47.6</b>		

#### 4. Post-harvest soil nitrate levels

D Regehr's cropping cycle runs from 1 September of one year to 31 August of the next because he plants crops in the fall and fertilizes in late summer to provide nutrients for the crop. The 2017 canola crop was harvested in July 2017. A post-harvest soil test was done on the Home Field on August 1, 2017 after harvest of the canola crop (Table 2: August 1 post-harvest soil test results). This sample showed that there was low residual nitrate-N in the field. The Old Feedlot was not sampled at this time. As a result of the very low residual nitrate-N levels in the field, manure was applied to the Home field in September 2017.

Both fields were sampled for the Ministry of Agriculture's post-harvest nitrate soil testing program in late September 2017. Both fields had an agronomic rating of medium in fall 2017 (Table 2: Sept 22 post-harvest soil test) (this is in contrast with the high to very high soil residual nitrate-N in the soil in fall 2016). The rating is based on the BC Ministry of Agriculture (AGRI) scale that is used to assess residual soil nitrate-N levels. Residual soil nitrate-N was measured to 90 cm in the soil. The nitrate-N levels observed in the Home Field are at least partially due to the manure application in early September.

The residual soil nitrate-N levels to 60 cm from the August 1 soil sample have been included in calculations of nutrient requirements for 2018 in both 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.

**Bulk density conversions:** Residual soil nitrate-N was converted from mg/kg to kg/ha assuming a soil bulk density of 1470 kg/m<sup>3</sup> which is typical of soils with a sandy texture such as those on the D Regehr property.

**Table 2. 2017 Post-harvest Soil Nitrate-N Data – August 1 and September 22 soil test results**

	August 1 2017 post-harvest soil test		September 22 2017 post-harvest soil test	
Field ID	Sampling depth	Nitrate-N (NO <sub>3</sub> -N)	Sampling Depth	Nitrate-N (NO <sub>3</sub> -N)
	cm	mg/kg	cm	mg/kg
101 Home field	0-15	2	0-15	13
	15-30	3	15-30	10
	30-60	2	30-60	6
	60-90	1	60-90	4
<b>Total residual N to 90 cm (kg/ha)*</b>		<b>17.8 (low)</b>		<b>95 (medium)</b>
102 Old Feedlot	na	na	0-15	9
			15-30	11
			30-60	7
			60-90	4
<b>Total residual N to 90 cm (kg/ha)*</b>		<b>na</b>		<b>93 (medium)</b>

\*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. Note: Residual nitrate-N in soil was calculated at a soil BD of 1470 kg/m<sup>3</sup>.

## 5. Nitrogen to be applied to D Regehr fields from all sources in 2018

### 5.1 Manure application

**Dairy manure:** 4754 gallons per acre of dairy slurry (medium dry matter content) were applied to the Home Field in the first week of September 2017. The slurry was disked in after 2 days. None was applied to the Old Feedlot area.

**Broiler manure:** 2 tons per acre of aged broiler manure were applied to the Home Field in the first week of September 2017. The manure was disked in after 2 weeks. None was applied to the Old Feedlot area.

Table 3 shows the approximate amount of nutrients in the September 2017 application of dairy and broiler manure. Nutrient values are from the NMP xcel spreadsheet as no manure analyses were available. The broiler manure was assumed to have lost 30% of its initial nitrogen and ammonium as it had been aging in place for two years.

**Table 3. 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 <sub>2</sub> O <sub>5</sub> and K <sub>2</sub> O			
	Total nitrogen content	Ammonium content (NH <sub>4</sub> - N)	Organic nitrogen content	N Mineralization factor	Organic nitrogen mineralized this cropping year	Ammonia (NH <sub>3</sub> - N) retention factor	Ammonia (NH <sub>3</sub> - N) remaining after volatilization	Nitrate (NO <sub>3</sub> -N) content of manure	First-year plant available nitrogen	Total P	Total P <sub>2</sub> O <sub>5</sub>	Total K	Total K <sub>2</sub> O
	(lab report)	(lab report)	(col. B – C / 10 <sup>4</sup> x 20)	(Table 6)	(col. D x E)	(Table 7)	(col. C / 10 <sup>4</sup> x 20) x col. G	(lab report)	(col. F + H) + (col. I / 10 <sup>4</sup> )	(lab report)	(col. K x 20 x 2.3)	(lab report)	(col. M x 20 x 1.2)
	(%) <sup>a</sup>	(ppm) <sup>a</sup>	(lb N/ton)	(select from drop- down list)	(lb N/ton)		(lb N/ton)	(ppm) <sup>a,b</sup>	(lb N/ton)	(%) <sup>a</sup>	(lb P <sub>2</sub> O <sub>5</sub> /ton)	(%) <sup>a</sup>	(lb K <sub>2</sub> O/ton)
dairy manure	0.28	1450	2.7	0.5	1.35	0.6	1.74	0.00	3.09	0.060	2.8	0.25	6.0
aged broiler manure	2.40	3990	40.0	0.25	10.01	0.6	4.79	0.00	14.79	1.090	50.1	1.29	31.0

## 5.2 Other sources of nitrogen on farm

**Fertilizer nitrogen:** No nitrogen fertilizer will be used by D Regehr in 2018 as the farm is managed organically.

**Irrigation water:** The farm irrigates with one well that is assumed to have the same nitrate concentration as the D Regehr irrigation well, an average nitrate-N concentration of 15.6 mg/L of nitrate (June 2017 sample). Based on approximately 5" (12.7 cm) of irrigation applied to the farm's fields per growing season, approximately 20 kg/ha of nitrate is supplied in the irrigation water. This amount of nitrogen has been accounted for as fertilizer N when calculating crop nitrogen requirements for 2017. It is recommended that irrigation water is tested for nitrates annually in mid-season so that up-to-date data can be used in estimating nitrate contribution from irrigation water.

## 6. Cropping and nitrogen requirements of crops – 2018

The 2018 crop of field peas is estimated to take up approximately 115 lb/acre of nitrogen based on expected yield and protein content. 2018 cropping information is found in columns B, C and D of Table 4. Estimated dry yield and protein content of the field peas are based on literature sources. Because the amount of nitrogen expected to be available in 2018 exceeds expected crop uptake of nitrogen (column H of Table 4), and because the peas are a legume crop and can fix some of their own nitrogen, the crop is estimated to require no additional nitrogen in 2018. Therefore no additional manure should be applied to this crop in 2018.

**Explanation of crop nitrogen requirements for 2017:** Table 4, 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 August 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 soil test results to 60 cm depth. Values for the Home field are from the August 1, 2017 soil test. Values for the Old feedlot are from the September 22, 2017 soil test.

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. The Home field was

given a nitrogen fertility credit of 22 lbs/A because it has been minimally manured for the past 8 years, and had extremely low residual nitrate-N in August 2017 when the 2017 crop was harvested. The Old Feedlot was given a fertility factor of 45 lb/A. Field 102 Old feedlot has not been manured or fertilized since the area was decommissioned as a feedlot in 2007 but the organic matter content of the surface soil is still very high and the soil appears to be continuing to release a significant amount of nitrogen annually.

**Table 4. Crop nitrogen requirement calculations -2018**

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) <sup>a</sup>	Protein content of crop <sup>b</sup>  (estimated)  (%)	Crop Nitrogen (N) Uptake  (col. C x D x 1.6 x 2)  (lb N/ac)	Available soil nitrogen (nitrate plus ammonia) <sup>c</sup> (lab report)  (lb N/ac)	Nitrogen fertility factor  (Table 1)  (lb N/ac)	(col. E – F - G)  (lb N/ac)
101 Home Field	peas	1.5	24.0	115	15	22.0	78
102 Old Feedlot	peas	1.5	24.0	115	75	45.0	-5

## 7. Nutrients required for 2018 crop of field peas

There is no requirement for additional nitrogen to be applied to either field to meet the nitrogen requirement of the peas for 2018. Manure was applied in September based on the August 1 soil test result which showed very low residual nitrate-N. The September 2017 post-harvest nitrate test indicated that there is almost 70 lb/A of residual nitrogen in the soil in both fields (to 60 cm depth). It is estimated that both fields will release some additional nitrogen in 2018. In addition, it is expected that irrigation water will supply an additional 20 lb/A of nitrate. This is more than the pea crop will require for normal yield in 2018.

## 8. Agronomic balance calculations – Crop requirements vs. nutrient supply

Nitrogen supply and uptake for 2018 is summarized below. Table 5 shows the nitrogen balance for each field for 2018 (3<sup>rd</sup> from last column).

### Home field

- **Estimated 2018 nitrogen supply:** 15 lb/A residual N + 22 lb/A release from organic matter + 88 lb/A from Sept 2017 manure application + 20 lb/A from irrigation water = 145 lb/A available N for 2018.
- **Estimated nitrogen uptake by crop in 2018:** 115 lb/A
- **Supply less uptake:** 145-115 = 30 lb/A excess available nitrogen in 2018.

### Old feedlot

- **Estimated 2018 nitrogen supply:** 75 lb/A residual N + 45 lb/A release from organic matter + 20 lb/A from irrigation water = 140 lb/A available N for 2018



- **Estimated nitrogen uptake by crop in 2018:** 115 lb/A
- **Supply less uptake:** 140-115 = 25 lb/A excess available nitrogen in 2018

Based on the assumptions used in the calculator, both fields are expected to have a modest excess of nitrogen in 2018 (column P of Table 5). The calculated amount of excess nitrogen (supply less crop uptake) in the Home Field is 30 lb/A and 25 lb/A in the Old Feedlot.

**Note:** The 20 lb/A of nitrogen found in column J (fertilizer nitrogen column) represents the amount of nitrate estimated to be applied annually to fields in irrigation water.

**Table 5. 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)			
(Worksheet 1, col. A)	(Worksheet 1, col. B)		Show/Hide Manure Source #2	Show/Hide Manure Source #3		Manure Sources				Fertilizer				N (Worksheet 1, col. H)	P <sub>2</sub> O <sub>5</sub> (Worksheet 2, col. I)	K <sub>2</sub> O (Worksheet 3, col. I)	N* (col. M - F)	P <sub>2</sub> O <sub>5</sub> * (col. N - H - K)	K <sub>2</sub> O* (col. O - I - L)	
						Click here for help to use the show/hide buttons. (select from drop-down list)	N (Col E x Worksheet 4, col. J)	First-year P availability coefficient	P <sub>2</sub> O <sub>5</sub> (Col E x G x Worksheet 4, col. N)	K <sub>2</sub> O (Col E x Worksheet 4, col. N)	Sum all planned fertilizer additions for the year. Use Worksheet 6.1 to the right to help.	N (lb N/ac)	P <sub>2</sub> O <sub>5</sub> (lb P <sub>2</sub> O <sub>5</sub> /ac)							K <sub>2</sub> O (lb K <sub>2</sub> O/ac)
(name or number)		(ac)																		
101 Home Field	peas	39.9	dairy manure		19	59	0.85	45	114											
			aged broiler manure		2	30	0.85	85	62											
			all manures			88	n/a	130	176	20		78	0	0	-30	-130	-176			
102 Old Feedlot	peas	7.7	dairy manure		0	0	0.85	0	0											
			aged broiler manure		0	0	0.85	0	0											
			all manures			0	n/a	0	0	20		-5	0	0	-25	0	0			

## 9. Timing of manure applications

No manure is recommended for the 2018 crop of peas.

## 10. Method of manure application

Solid manure is normally applied by solid manure spreader. Liquid manure is typically applied by vacuum tanker.

## 11. Tracking of manure applications

No manure is recommended for the 2018 crop of peas.

When manure is used at the farm, it is purchased and brought on to the farm by the load; total volumes used are tracked by the load.

## 12. Setbacks

D Regehr 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 fertilizers - 2018

No synthetic fertilizer is ever used on D Regehr's fields as the farm is managed organically and has organic designation.

## 14. Soil phosphorus status

Both fields farmed by D Regehr had soil available phosphorus levels in the excess range in fall 2017 (Table 6). 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 Field 102 Old Feedlot in a north-south direction. Along the boundary with Deep Creek there is a > 150 m treed buffer between the field and Deep Creek which is expected to effectively slow down runoff and allow runoff water to move into the soil which will capture phosphorus. The risk of movement of phosphorus from Field 102 Old Feedlot into Deep Creek is minimal.

Steele Springs is located >50 m south of the southern boundary of the D. Regehr property. There is a >100 m buffer between D. Regehr's arable land and Steele Springs which will effectively slow down runoff and allow runoff water to move into the soil which will capture phosphorus in runoff.

**Table 6. Soil phosphorus status – fall 2017**

Worksheet 2. Calculate the Crop Phosphorus Application Recommendation								
A	B	C	D	E	F	G	H	I
Field Description (Worksheet 1, col. A)	Crop Information		Crop Phosphorus (P) Applicator Calculations					Crop Phosphorus Application Recommendation (SEE NOTE BELOW)
(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) <sup>a</sup> 0-15 cm depth  (ppm)	Soil phosphorus status  (Table 3, col. 2)	Soil phosphorus level factor  (Table 3, col. 5)	(col. E x H) x 2.3  (lb P <sub>2</sub> O <sub>5</sub> /ac)
101 Home Field	peas	1.5	10.0	15	222	Excess	0	0
102 Old Feedlot	peas	1.5	10.0	15	881	Excess	0	0

## 15. Irrigation rate

D Regehr's fields 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, D Regehr irrigates according to soil moisture requirements to ensure that no excess irrigation water is applied.

## 16. Manure storage capacity

D Regehr has no manure storage on site. Manure is not stockpiled on site. It is applied as soon as it is hauled to the farm.

## 17. On-going soil monitoring – 2018 post-harvest nitrate testing

After crop harvest in late summer 2018, soil sampling should be done in each field to at least 60 cm depth to assess the amount of residual nitrate-N in the soil. At this time, decisions should be made about rates and timing of manure application for 2019.

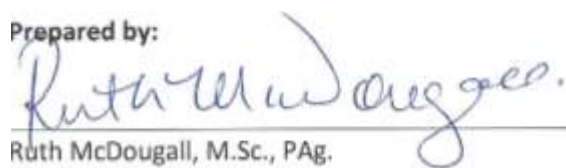
## 18. Groundwater monitoring

D Regehr's domestic well has historically been tested approximately 3 times per year (spring, summer and fall) by Steele Springs Water District (Brian Upper). 2017 nitrate data is found in the 2017 Nutrient Management Plan.

## 19. Surface water monitoring

There are no surface water sources on the D. Regehr property. There are no streams or seasonal runoff channels on the property. The nearest surface water is Steele Springs which is located > 50 m south of the south property line, and Deep Creek which is located >150 metres to the east of the eastern edge of the property. Therefore no surface water monitoring is being conducted as part of this Nutrient Management Plan.

Prepared by:



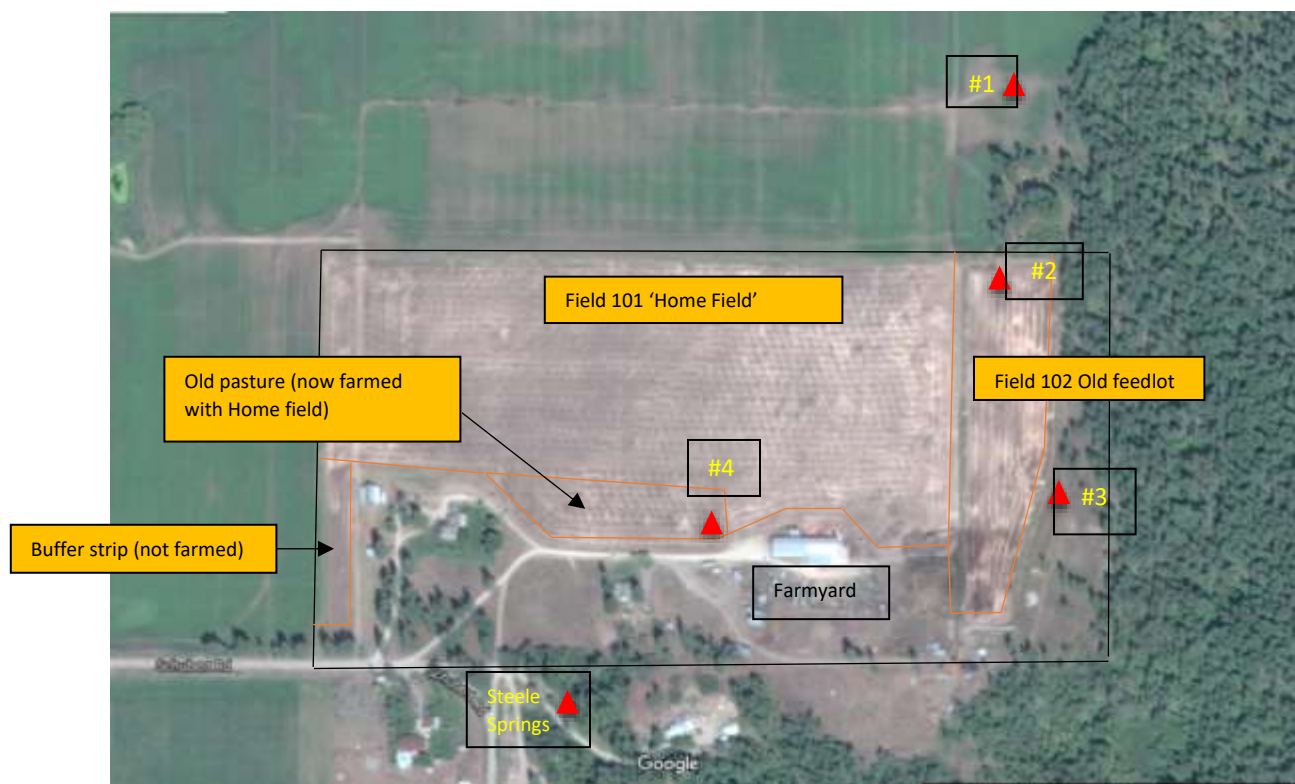
Ruth McDougall, M.Sc., PAg.  
Consulting Agrologist

November 3, 2017

**Figure 1. Location Map showing D. Regehr property, 5042 Schubert Road, Spallumcheen BC in relation to Hullcar Road and Knob Hill Road**



**Figure 2. Site map showing boundaries of Douglas Regehr property, fields and wells**



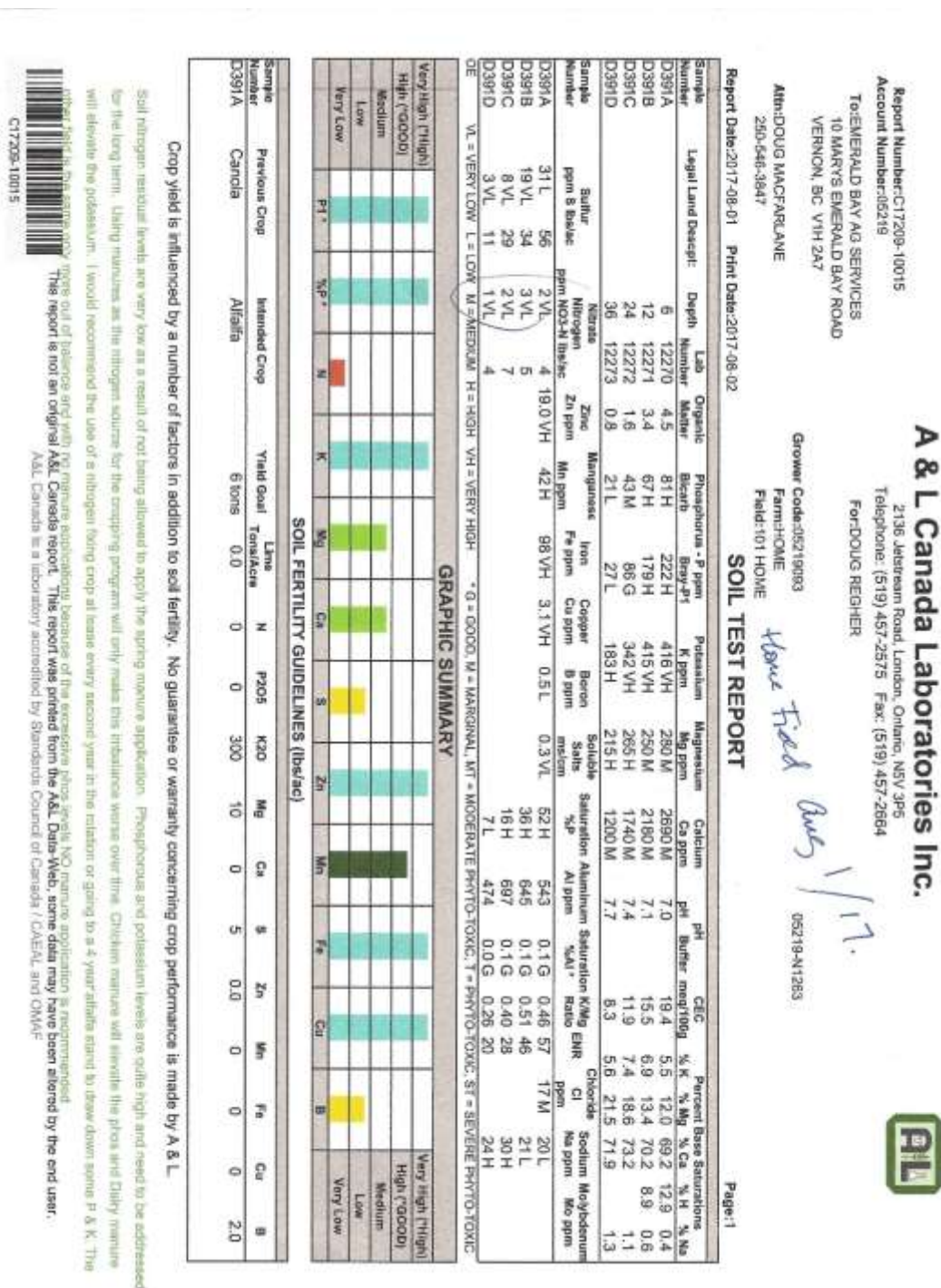
**Well ID:**

- 1 – Irrigation well
- 2 – Domestic well
- 3 – Golder 2016 permanent monitoring well
- 4 – Golder temporary well (borehole) (filled in)



### Figure 3. Soil data – August and September 2017

**a. Post-harvest soil test report – Home field – August 1, 2017**



November 2017

November 2017