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July 7, 2017

Department of Sustainable Development Environmental Approvals Branch Government of Manitoba Box 80, 160-123 Main Street Winnipeg, Manitoba R3C 1A5

ATTENTION: Mr. Asit Dey Environmental Engineer

RE: Town of Melita Land Application of Biosolids - File 108.30

Dear Mr. Dey:

Over the past two weeks KGS Group has been discussing the Melita biosolids project with Sustainable Development and with Jordan Karpinchik at Tone Ag who was responsible for the agronomic assessment for the project and for determining the appropriate rate to apply the biosolids. We have scheduled a meeting at the KGS Group office for next Thursday, but hope that this letter will clear up some of the concerns raised by Sustainable Development.

File No. 16-0429-004

As the biosolids are now proposed to be spread as a solid rather than a slurry, KGS Group requested that Tone Ag convert the application rates from lbs/1,000 imperial gallons to kg/tonne. We provided the converted application rates in a Notice of Alteration letter to the Environmental Approvals Branch dated June 19, 2017.

Discussions between KGS Group, Tone Ag and Sustainable Development indicate that the application rate, as it relates to phosphorus, has been raised as a concern as well as the amount of time it would take for the receiving field to return to pre-application Olsen-P soil levels. We have provided an updated Table 11 (Attachment 1) which relates to the Land Suitability Assessment originally provided in the EAP submitted on August 11, 2016. At the bottom of new Table 11 we indicate that it will take approximately 12 years for the proposed field to return to pre-application Olsen-P soil levels following application of biosolids from the Primary cell.

During the excavation of the Primary and Secondary cells it was observed that there was a large amount of river silt in the matrix as a result of flooding in 2011 which caused the lagoon to be completely inundated for a period of 30 days. KGS Group recently submitted new composite samples of the excavated biosolids to ALS Labs for analysis and we anticipate that the composite samples will have lower levels of all parameters of concern, including phosphorus, due to the mixing of the river silt. We will provide the analysis to Sustainable Development upon receipt from the lab.









Mr. Dey Page 2

As stated in the Section 5.8 of Attachment 1, based on the application rate outlined in Table 11, the nitrogen application rates for both Primary and Secondary cells (45 and 42 tons/acre, respectively) are suitable for the receiving land within NW-25-3-27W. The soil test results from ALS Labs from October 2016 for the proposed field (Field #2) are also enclosed (Attachment 2). As the report indicates, the field is low in phosphorus (just over 7 ppm) and would benefit from application of biosolids with minimal agronomic and environmental risk. Assuming 25 lbs of phosphate increases the Olsen-P level in soil by 1 ppm, there will be an increase of 23 ppm and 11 ppm from application of biosolids from the Primary and Secondary cell, respectively. Based on the Nutrient Management Regulation, phosphorus does not appear to be a limiting factor for biosolids application on this field.

We hope that the explanation and the information provided in this email and in previous correspondence sufficiently addresses the concerns that Sustainable Development has raised relating to the biosolids application rate and phosphorus. The delay in approval of the Notice of Alteration is affecting the ability of the Town of Melita to move forward with the necessary upgrades to the lagoon.

Yours truly,

Gene Senior, M.A. Environmental Scientist

GS/jr Attachments

cc: Travis Parsons, Manitoba Water Services Board

ATTACHMENT 1



Name	Description	Unit	Primary Cell Results	Secondary Cell Results
Volume (Plus 10%)	Field	m3	20.000	10.000
Specific Gravity	As Received	Kg/L	1.04	1.08
Moisture	As Received	%	92.8	84
	Nitro	ogen Characteristi	cs	
Total Kjeldahl N	% Dried Basis	%	0.53	0.68
Total Kjeldahl N	Dried Basis	mg/kg	5,300	6,800
Total Kjeldahl N	Dried Basis	kg/tonne	5.3	6.8
Ammonium N	Dried Basis	mg/kg	1,030	316
Ammonium N	Dried Basis	kg/tonne	1.03	0.32
Available Nitrate	Dried Basis	mg/kg	0	0
Available Nitrate-N	Dried Basis	mg/kg	0	0
Organic N	Dried Basis	mg/kg	4,270	6,484
Organic N	Dried Basis	kg/tonne	4.27	6.48
Application Method			Braodcast/Incorp	Braodcast/Incorp
Anticipated Weather			Cool/Dry	Cool/Dry
Anticipated Volatilization			35%	35%
Available Organic N	Dried Basis	kg/tonne	1.07	1.62
Available Ammonium N	Dried Basis	kg/tonne	0.67	0.21
Total Available N (Year 1)	Dried Basis	kg/tonne	1.74	1.83
Mineralization N (Year 2)	Dried Basis	kg/tonne	0.7	0.73
Mineralization N (Year 3)	Dried Basis	kg/tonne	0.35	0.37
	Phosp	horus Characteris	stics	
Total Phosphorus	Dried Basis	mg/kg	5,440	2,870
Total Phosphorus	Dried Basis	kg/tonne	5.44	2.87
P2O5 (P * 2.3)	Dried Basis	kg/tonne	12.51	6.6
Total Available P205 (50% available Year 1)	Dried Basis	kg/tonne	6.25	3.3

Table 8 – Biosolid Characteristics (Nitrogen and Phosphorus) for Primary and SecondaryCells – Based on June 2016 Sludge Samples

Source: Tri-Provincial Manure Application and Use Guidelines, 2004 and MMM Group, 2013.

5.7 Soil Sampling

5.8 Proposed Application Rates

The target biosolids application rates for the primary and secondary cells will be based on the nitrogen requirement of either a cereal or oilseed crop (ie. spring wheat or canola). The target N rate will be 155 lbs/acre in order to grow a 55 bushel canola crop. Table 11 below shows the biosolids application rate based on N requirement and P2O5 crop removal for comparison.

Name	Unit	Primary Cell	Secondary Cell
Nitro	gen & Phosphorus Ba	ased Application Rates	
Total Kjeldahl N	kg/tonne	0.53	0.68
Ammonium N	kg/tonne	1.03	0.32
Available Nitrate-N	kg/tonne	0	0
Organic N	kg/tonne	4.27	6.48
Application Method		Broadcast/Incorp	Broadcast/Incorp
Anticipated Weather		Cool/Dry	Cool/Dry
Anticipated Volatilization		35%	35%
Available Organic N	kg/tonne	1.07	1.62
Available Ammonium N	kg/tonne	0.67	0.21
Total Available N	kg/tonne	1.74	1.83
Total Available N	lbs/ton	3.48	3.66
N based Rate	tons/acre	45	42
Total N Applied	lbs/acre	155	155
2X P2O5 Removal based	tons/acre	7.5	14
Application Rate			
Total P2O5	kg/tonne	12.51	6.6
Total Available P2O5	kg/tonne	6.25	3.3
(50% in Year 1)			
Amount of Total P2O5	lbs/acre	1125.9	554.4
applied (N based rate)			
Amount of Available P2O5	lbs/acre	563	277.2
applied (50% in Year 1 – N			
based)			
Crop Removal Rate	lbs/acre	47	47
Years to pre-application		12	6
Olsen-P soil levels (N-			
based rate)			

 Table 11 – Application Rate Calculation Worksheet (Metric/Imperial Units)

Based on the application rate outlined in Table 11, the nitrogen application rates for both primary and secondary cells (45 and 42 tons/acre, respectively) are suitable for the receiving land within the PPA (NW 25-3-27W1) as soil test phosphorus is below 60 ppm (7 ppm). Assuming 25 lbs of phosphate increases the Olsen P level in soil by 1 ppm, there will be an increase of 23 ppm and 11 ppm from the primary and secondary cell application of biosolids, respectively. According to

the Nutrient Management Regulations, phosphorus is not a limiting factor for biosolids application on all fields within the PPA. These soils are rated very low to low in phosphorus and would benefit greatly from an N based application rate of biosolids with minimal agronomic and environmental risk.

ATTACHMENT 2





Tone Ag Consulting (St. Pierre-Jolys) ATTN: Shannon Wiebe 31022 Rat River Rd St. Pierre-Jolys Manitoba ROA 1V0 Date Received: 29-SEP-16 Report Date: 11-OCT-16 09:38 (MT) Version: FINAL REV. 2

Client Phone: 204-433-7189

Certificate of Analysis

Lab Work Order #: L1836271

Project P.O. #: Job Reference: C of C Numbers: Legal Site Desc: NOT SUBMITTED PT 1/2-36-3-27W

Craig **B**iddell, B.Sc.Ag Account Manager

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Environmental 💭

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
1836271-1 1437293 - FIFL D #1							
Sampled By: CLIENT on 27-SEP-16							
Maurix. SOIL Miscellaneous Parameters							
Mercury (Ha)	0.0214		0.0050	ma/ka	03-OCT-16	04-OCT-16	R3563570
Metals in Soil by CRC ICPMS	0.0214		0.0050	iiig/kg	03-001-10	04 001 10	113303373
Aluminum (Al)	12100		50	ma/ka	03-OCT-16	03-OCT-16	R3562810
Antimony (Sb)	0.20		0.10	ma/ka	03-OCT-16	03-OCT-16	R3562810
Arsenic (As)	4.10		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Barium (Ba)	147		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Beryllium (Be)	0.48		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Boron (B)	12.3		5.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Bismuth (Bi)	<0.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cadmium (Cd)	0.275		0.020	mg/kg	03-OCT-16	03-OCT-16	R3562810
Calcium (Ca)	26600		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Chromium (Cr)	21.5		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cobalt (Co)	5.86		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Copper (Cu)	11.5		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Iron (Fe)	15500		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lead (Pb)	6.14		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Litnium (LI) Magnasium (Mg)	9.9		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Magnesium (Mg)	9980		20	mg/kg	03-0CT-16	03-0CT-16	R3562810
Molybdenum (Mo)	576		1.0	mg/kg	03-0CT-16	03-0CT-16	R3302010
Nickel (Ni)	0.19		0.10	mg/kg	03-0CT-16	03-0CT-16	R3002010
Phosphorus (P)	/12		50	mg/kg	03-OCT-16	03-0CT-16	R3562810
Potassium (K)	1940		100	ma/ka	03-OCT-16	03-00T-16	R3562810
Selenium (Se)	<0.20		0.20	ma/ka	03-OCT-16	03-OCT-16	R3562810
Silver (Ag)	<0.10		0.10	ma/ka	03-OCT-16	03-OCT-16	R3562810
Sodium (Na)	192		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Strontium (Sr)	50.2		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Thallium (TI)	0.204		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Tin (Sn)	<1.0		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Titanium (Ti)	137		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Uranium (U)	0.784		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Vanadium (V)	40.3		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zinc (Zn)	48.5		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zirconium (Zr)	3.0		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Available N,P,K & S plus pH, EC(AG) & B							
Available Boron, Hot Water Boron (B) Hot Water Ext	1 20		0.20	malka	03-007 46	03-007 16	Dapeaaza
	1.20		0.20	mg/kg	03-001-16	03-001-10	K3003273
Available Nitrate-N	27		1.0	ma/ka	04-OCT-16	04-OCT-16	R3563810
Available Phosphate-P by Olsen	2.7		1.0	mg/ng	0100110		1.0000010
Available Phosphate-P	20.3		1.0	mg/kg	04-OCT-16	04-OCT-16	R3564786
Available Potassium							
Available Potassium	268		20	mg/kg	04-OCT-16	04-OCT-16	R3564737
Available Sulfate-S							
Available Sulfate-S	22.7		4.0	mg/kg	04-OCT-16	04-OCT-16	R3564368
pH & EC 1:2 soil to water (Ag. Method)	_						<u>-</u>
pH (1:2 soil:water)	7.68		0.10	pH	03-OCT-16	03-0CT-16	R3562690
	0.353		0.050	as m-1	03-001-16	03-001-16	K3562690
L1836271-2 1437294 - FIELD #2							
Sampled By: CLIENT on 27-SEP-16							
Matrix: SOIL							
		. I					·'

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
11836271 2 1427204 EIELD #2							
Sampled By: CLIENT on 27-SEP-16							
Matrix: SOIL Miscellaneous Parameters							
Moreury (Hg)	0.0257		0.0050	ma/ka	02 OCT 16	04 007 16	D2562570
Metals in Soil by CPC ICPMS	0.0357		0.0050	iiig/kg	03-001-10	04-001-10	K3003079
Aluminum (Al)	17600		50	ma/ka	03-OCT-16	03-OCT-16	R3562810
Antimony (Sb)	0.26		0.10	ma/ka	03-OCT-16	03-OCT-16	R3562810
Arsenic (As)	6.70		0.10	ma/ka	03-OCT-16	03-OCT-16	R3562810
Barium (Ba)	216		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Beryllium (Be)	0.74		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Boron (B)	14.1		5.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Bismuth (Bi)	<0.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cadmium (Cd)	0.411		0.020	mg/kg	03-OCT-16	03-OCT-16	R3562810
Calcium (Ca)	16000		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Chromium (Cr)	32.1		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cobalt (Co)	9.93		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Copper (Cu)	20.2		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Iron (Fe)	24600		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lead (Pb)	9.71		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lithium (Li)	13.8		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Magnesium (Mg)	11200		20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Manganese (Mn)	807		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Molybdenum (Mo)	0.28		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
	27.5		0.50	mg/кg	03-0CT-16	03-0CT-16	R3562810
Priosphorus (P)	609		50	mg/kg	03-0CT-16	03-0CT-16	R3562810
Foldsslutti (N) Selenium (Se)	2860		0.20	mg/kg	03-0CT-16	03-0CT-16	R3002010
Silver (Ag)	0.24		0.20	mg/kg	03-0CT-16	03-0CT-16	R3302010
Sodium (Na)	269		50	ma/ka	03-OCT-16	03-OCT-16	R3562810
Strontium (Sr)	35.7		0.50	ma/ka	03-OCT-16	03-OCT-16	R3562810
Thallium (TI)	0.295		0.050	ma/ka	03-OCT-16	03-OCT-16	R3562810
Tin (Sn)	<1.0		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Titanium (Ti)	91.3		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Uranium (U)	0.906		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Vanadium (V)	58.9		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zinc (Zn)	82.0		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zirconium (Zr)	4.6		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Available N,P,K & S plus pH, EC(AG) & B							
Available Boron, Hot Water							
Boron (B), Hot Water Ext.	1.31		0.20	mg/kg	03-OCT-16	03-OCT-16	R3563273
Available Nitrate-N	0.7		1.0		04 OOT 40	04 OOT 40	D0500040
	2.7		1.0	mg/ĸg	04-001-16	04-001-16	R3563810
Available Phosphate-P by Olsen	7 2		1.0	ma/ka	04-OCT-16	04-007-16	D2564796
	7.5		1.0	iiig/kg	04-001-10	04-001-10	K3504780
Available Potassium	328		20	ma/ka	04-OCT-16	04-OCT-16	R3564737
Available Sulfate-S	020				5.001.10	5. 551 10	
Available Sulfate-S	23.9		4.0	mg/kg	04-OCT-16	04-OCT-16	R3564368
pH & EC 1:2 soil to water (Ag. Method)							
pH (1:2 soil:water)	8.04		0.10	рН	03-OCT-16	03-OCT-16	R3562690
Conductivity (1:2)	0.323		0.050	dS m-1	03-OCT-16	03-OCT-16	R3562690
L1836271-3 1437295 - FIELD #3							
Sampled By: CLIENT on 27-SEP-16							
Matrix: SOIL							

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1836271-3 1437295 - FIELD #3							
Sampled By: CLIENT on 27-SEP-16							
Matrix: SOIL							
	0.0010		0.0050		00.007.40	04 007 40	D0500570
Mercury (Hg)	0.0312		0.0050	mg/ĸg	03-001-16	04-001-16	R3563579
Metals in Soil by CRC ICPMS	0000		50	malka	02 007 16	02 007 16	D2562940
Antimony (Sh)	9990		50	mg/kg	03-0CT-16	03-0CT-16	R3562810
Arsenic (As)	6.10		0.10	mg/kg	03-OCT-16	03-OCT-16	R3302010
Barium (Ba)	0.19		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Bervilium (Be)	0.44		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Boron (B)	0.44 11 0		5.0	ma/ka	03-00T-10	03-00T-16	R3562810
Bismuth (Bi)	-0.20		0.20	ma/ka	03-00T-10	03-00T-16	R3562810
Cadmium (Cd)	0.289		0.20	ma/ka	03-OCT-16	03-OCT-16	R3562810
Calcium (Ca)	40900		50	ma/ka	03-OCT-16	03-OCT-16	R3562810
Chromium (Cr)	24.0		0.50	ma/ka	03-OCT-16	03-OCT-16	R3562810
Cobalt (Co)	5.97		0.10	ma/ka	03-OCT-16	03-OCT-16	R3562810
Copper (Cu)	11.1		0.50	ma/ka	03-OCT-16	03-OCT-16	R3562810
Iron (Fe)	13800		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lead (Pb)	5.70		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lithium (Li)	9.8		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Magnesium (Mg)	11400		20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Manganese (Mn)	633		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Molybdenum (Mo)	0.65		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Nickel (Ni)	20.6		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Phosphorus (P)	397		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Potassium (K)	1790		100	mg/kg	03-OCT-16	03-OCT-16	R3562810
Selenium (Se)	0.21		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Silver (Ag)	<0.10		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Sodium (Na)	201		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Strontium (Sr)	44.7		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Thallium (TI)	0.232		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Tin (Sn)	<1.0		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Titanium (Ti)	168		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Uranium (U)	0.882		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Vanadium (V)	40.9		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zinc (Zn)	41.0		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zirconium (Zr)	2.8		1.0	mg/ĸg	03-001-16	03-001-16	R3562810
Available N,P,K & S plus pH, EC(AG) & B							
Boron (B) Hot Water Ext	1.24		0.20	ma/ka	03-OCT-16	03-OCT-16	P3563273
	1.24		0.20	iiig/kg	03-001-10	03-001-10	13303273
Available Nitrate-N	2.7		1.0	ma/ka	04-OCT-16	04-OCT-16	R3563810
Available Phosphate-P by Olsen	2.7		1.0	iiig/itg			
Available Phosphate-P	5.1		1.0	mg/kg	04-OCT-16	04-OCT-16	R3564786
Available Potassium			-	0 0			
Available Potassium	293		20	mg/kg	04-OCT-16	04-OCT-16	R3564737
Available Sulfate-S							
Available Sulfate-S	57.9		4.0	mg/kg	04-OCT-16	04-OCT-16	R3564368
pH & EC 1:2 soil to water (Ag. Method)							
pH (1:2 soil:water)	7.88		0.10	рН	03-OCT-16	03-OCT-16	R3562690
Conductivity (1:2)	0.290		0.050	dS m-1	03-OCT-16	03-OCT-16	R3562690
L1836271-4 1437296 - FIELD #4							
Sampled By: CLIENT on 27-SEP-16							
Matrix: SOIL							

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
1836271-4 1437296 - FIFLD #4							
Sampled By: CLIENT on 27-SEP-16							
Matrix: SOIL							
Miscellaneous Parameters							
Mercury (Hg)	0.0196		0.0050	mg/kg	03-OCT-16	04-OCT-16	R3563579
Metals in Soil by CRC ICPMS							
Aluminum (Al)	7640		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Antimony (Sb)	0.17		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Arsenic (As)	3.91		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Barium (Ba)	89.0		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Beryllium (Be)	0.33		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Boron (B)	7.6		5.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Bismuth (Bi)	<0.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cadmium (Ca)	0.224		0.020	mg/kg	03-OCT-16	03-OCT-16	R3562810
Calcium (Ca)	25000		50	mg/кg mg/kg	03-0CT-16	03-0CT-16	R3562810
Cobalt (Co)	17.1		0.50	mg/kg	03-0CT-16	03-0CT-16	R3562810
Copper (Cu)	ວ.∠ອ 7 ໑ຉ		0.10	mg/kg	03-001-10 03-00T-16	03-001-10 03-00T-16	R3562910
Iron (Ee)	11400		0.50 50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lead (Pb)	4 69		0.50	ma/ka	03-00T-10	03-00T-16	R3562810
Lithium (Li)	6.3		2.0	ma/ka	03-OCT-16	03-OCT-16	R3562810
Magnesium (Mg)	7010		20	ma/ka	03-OCT-16	03-OCT-16	R3562810
Manganese (Mn)	405		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Molybdenum (Mo)	0.30		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Nickel (Ni)	15.3		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Phosphorus (P)	341		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Potassium (K)	1600		100	mg/kg	03-OCT-16	03-OCT-16	R3562810
Selenium (Se)	<0.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Silver (Ag)	<0.10		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Sodium (Na)	104		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Strontium (Sr)	26.9		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Thallium (TI)	0.151		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Tin (Sn)	<1.0		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Titanium (Ti)	148		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Uranium (U)	0.542		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Vanadium (V)	28.6		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Ziriconium (Zr)	36.6		2.0	mg/kg	03-0CT-16	03-0CT-16	R3562810
	1.9		1.0	шу/ку	03-001-16	03-001-10	K3002010
Available Roron Hot Water							
Boron (B), Hot Water Ext.	1.07		0.20	ma/ka	03-OCT-16	03-OCT-16	R3563273
Available Nitrate-N				5.5			
Available Nitrate-N	2.9		1.0	mg/kg	04-OCT-16	04-OCT-16	R3563810
Available Phosphate-P by Olsen							
Available Phosphate-P	10.2		1.0	mg/kg	04-OCT-16	04-OCT-16	R3564786
Available Potassium							
Available Potassium	315		20	mg/kg	04-OCT-16	04-OCT-16	R3564737
Available Sulfate-S Available Sulfate-S	49.8		40	ma/ka	04-OCT-16	04-OCT-16	R3564368
pH & EC 1:2 soil to water (Ag. Method)	10.0				5.00110	5.00110	
pH (1:2 soil:water)	7.80		0.10	pН	03-OCT-16	03-OCT-16	R3562690
Conductivity (1:2)	0.300		0.050	dS m-1	03-OCT-16	03-OCT-16	R3562690

Reference Information

	Matrix	Test Description	Method Reference**
B-HOTW-SK	Soil	Available Boron, Hot Water	CSSS (2008) Ch.9
Hot water is used to extra	ct the plant-a	available and potentially plant-available boron f	rom soil. Boron in the extract is determined by ICP-OES.
HG-200.2-CVAF-SK	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)
Soil samples are digested	I with nitric a	nd hydrochloric acids, followed by analysis by	CVAFS.
K-AVAIL-SK	Soil	Available Potassium	Comm. Soil Sci. Plant, 25 (5&6)
Plant available potassium 770 nm.	is extracted	from the soil using Modified Kelowna solution.	Potassium in the soil extract is determined by flame emission at
MET-200.2-CCMS-SK	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
Soil samples are digested	I with nitric a	nd hydrochloric acids, followed by analysis by	CRC ICPMS.
Method Limitation: This n be environmentally availal for some metals, including	nethod is no ble. This me g, but not lim	t a total digestion technique. It is a very strong thod does not dissolve all silicate materials and ited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.	acid digestion that is intended to dissolve those metals that may d may result in a partial extraction. depending on the sample matrix
NO3-AVAIL-SK	Soil	Available Nitrate-N	Method = Alberta Ag (1988)
NO3-AVAIL-SK Available Nitrate and Nitri Nitrate is quantitatively re- cadmium column. The nit diazotizing with sulfanilam color which is measured a	Soil te are extrac duced to nitr trite (reduced nide followed at colorimetri	Available Nitrate-N sted from the soil using a dilute calcium chloride ite by passage of the sample through a copper d nitrate plus original nitrite) is then determined by coupling with N-(1-naphthyl) ethylenediami ically at 520nm.	Method = Alberta Ag (1988) e solution. ized l by ne dihydrochloride. The resulting water soluble dye has a magenta
NO3-AVAIL-SK Available Nitrate and Nitri Nitrate is quantitatively re- cadmium column. The nit diazotizing with sulfanilam color which is measured a Reference: Recommended Methods of	Soil te are extrac duced to nitr trite (reduced nide followed at colorimetri of Soil Analy	Available Nitrate-N sted from the soil using a dilute calcium chloride ite by passage of the sample through a copper d nitrate plus original nitrite) is then determined I by coupling with N-(1-naphthyl) ethylenediami ically at 520nm.	Method = Alberta Ag (1988) e solution. ized l by ne dihydrochloride. The resulting water soluble dye has a magenta erta Agriculture (1988) p. 19 and 28
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NO3-AVAIL-SK Available Nitrate and Nitri Nitrate is quantitatively re- cadmium column. The nit diazotizing with sulfanilam color which is measured a Reference: Recommended Methods o PH,EC-AG-SK PO4-AVAIL-OLSEN-SK Plant available phosphoru 3O4-AVAIL-SK Plant available sulfate in t may also produce organic	Soil te are extrac duced to nitr trite (reduced nide followed at colorimetri of Soil Analy Soil Soil sis extracte Soil he soil is ext sulfur in the	Available Nitrate-N ted from the soil using a dilute calcium chloride ite by passage of the sample through a copper d nitrate plus original nitrite) is then determined l by coupling with N-(1-naphthyl) ethylenediami ically at 520nm. tesis for Canadian Prairie Agricultural Soils. Alber pH & EC 1:2 soil to water (Ag. Method) Available Phosphate-P by Olsen ted from the sample with sodium bicarbonate. F Available Sulfate-S tracted using a weak calcium chloride solution. e extracts when organic soils are analyzed.	Method = Alberta Ag (1988) e solution. ized I by ne dihydrochloride. The resulting water soluble dye has a magenta erta Agriculture (1988) p. 19 and 28 CSSS 16.3,18.3.1 - 1:2 water extract CSSS (1993) 7.2,7.3.1 PO4-P in the filtered extract is determined colorimetrically at 880 nm REC METH SOIL ANAL - AB. AG(1988) Sulfate in the extract is determined by ICP-OES. This extraction

 Laboratory Definition Code
 Laboratory Location

 SK
 ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

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