MMM Group Limited
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October 2, 2015 Ref.: 3315438-000.710

Manitoba Conservation and Water Stewardship Via: Email
Environmental Approval Branch
123 Main Street, Suite 160
Winnipeg, MB R3C 1A5

Dear Ms. Tracy Braun;

RE: Environmental Act Licence No. 3136

MMM Group Limited (MMM) was retained by the City of Steinbach – Water and Wastewater Department to manage the execution of Environmental Act Licence No. 3136 – being the removal of biosolids and sludge solids from the aeration cells one and two of the City of Steinbach aerated wastewater treatment lagoon located in SE08-07-06EPM, the transportation and the land application of the biosolids and sludge solids to agricultural land.

According to EAL 3136 clause 22, the licencee is to submit to the Director the analytical results of the biosolids sludge, the application fields and the land application prescription rates for the program. Attached are summary tables for the analysis for the biosolids, soil and the prescription rates based on nitrogen and phosphorous recommendations for each field being utilized in the program.

Cooperating farm producers have reconfirmed their participation in the land application program. Due to crop rotation, not all fields are included for this application event. The following fields are being applied to in order of available product;

- SE09-07-06 EPM, 62 Ha
- SE08-07-06EPM, 27 Ha
- NE08-07-06EPM, 25 Ha
- NW10-07-06EPM, 23 Ha

It is anticipated that SE09-07-06EPM will receive the majority of the volume of material and that SE08-07-06EPM will receive the balance of the biosolids material. Both NE08 and NW10-07-06EPM are back up fields should they be required. Note that NW11-07-06EPM is included in the soil analysis reporting but not in the prescription package since it is anticipated that it will not be required.

It is anticipated that land application will initiate on October 15 or 16 and continue for the following five to seven days by Assiniboine Injections. Follow-up reporting and monitoring will then be provided to MCWS in accordance with EAL 3136.

I hope that MCWS finds the information provide appropriate and in accordance with EAL 3136 and the Directors expectations. Should there be any questions or concerns regarding the material provided, it would be greatly appreciated if these requests for clarification can be delivered prior to October 13, 2015 so that items may be resolved prior to land application occurring. If there are any questions or concerns please contact the undersigned directly at; 204-272-2020 or keamd@mmm.ca.

Yours truly,

MMM Group

Darren Keam, M.Sc., P.Ag.

Senior Soil Scientist

Environmental Management

cc. Mr. Mike Heppner (City of Steinbach)
Mr. Rob Boswick (Manitoba Conservation and Water Stewardship)
Mr. Curt Bueckert (Manitoba Conservation and Water Stewardship)

Attachments

Field Prescription Application Rates

October 2, 2015

Field ID:	SE09-07-06EPM	
Land Area Available (ha):		62
2016 Crop	Grain Corn	
2016 Target Yield:	130 bu/ac	
	lb/ac	kg/ha
Target Nitrogen recommended :	110	123.2
Fertilizer Phosphate (P2O5) Recommended:	40	44.8
1 x P2O5 Crop Removal @ target Yield:	55	61.6
2 x P2O5 Crop Removal @ target Yield:	110	123.2

Plant Available Nutrients Soil Test Data			
	SE-9 005 0-6N	SE-9 005 6-24N	
Sample Depth	0-15 cm	15-60 cm	Total Available
Units	mg kg^{-1}		kg ha-1
Available Nitrate-N	11.0	7.1	65
Available Phosphate-P	04.9		10
Available Potassium	281		562
Available Sulfate-S	1000	1000	8,000

Steinbach Biosolids Characteristics and Analysis

Parameter Name	Parameter Description	Unit	Biosolid Analysis (Cell 2)
Estimated Biosolid Volume (+ 10% safety volume)	In-field	m^3	8,800
Specific Gravity	As Received	kg L^{-1}	1.03
Estimated Biosolids		tonnes	9,064
Dry tonnes biosolids available (=wet tonnes x %solids)	Dried Basis	tonnes	774
Moisture	As Received	**%**	89.80
Total Solids	As Received	**%**	8.80
Total Volatile Solids	Dry Basis	%	29.7
Organic Matter	Dry Basis	%	17.00
Inorganic Content	Dry Basis	%	83.00
Total Organic Carbon	Dry Basis	%	2.00
C:N Ratio	Dry Basis	x:1	17.24
C:P Ratio	Dry Basis	x:1	4.34
N:P Ratio	Dry Basis	x:1	0.25
pH	Saturated Paste		6.87
Total Kjeldahl N	% Dried Basis	%	0.116
Total Kjeldahl N	Dried Basis	mg kg^{-1}	1,160
Total Kjeldahl N	Dried Basis	kg $Tonne^{-1}$	1.16
Ammonium - N	Dried Basis	mg kg^{-1}	397.00
Ammonium - N	Dried Basis	kg $Tonne^{-1}$	0.3970
Available Nitrate	Dried Basis	mg kg^{-1}	-
Available Nitrate-N	Dried Basis	mg kg^{-1}	-
Available Nitrate-N		kg $Tonne^{-1}$	-
Total Phosphorous	Dried Basis	mg kg^{-1}	4,610

Amount of Biosolids Nutrient Available to Crop

Organic N (=TKN-ammonium N)	Dried Basis	mg kg^{-1}	763.00
Organic N	Dried Basis	kg $Tonne^{-1}$	0.763
Method of Application:			Injections
Anticipated Weather			Cool/dry
Anticipated Volatilization (%)	incorp within 1 days		15
Available Organic N	Dried Basis	kg $Tonne^{-1}$	0.191
Ammonium nitrogen available	Dried Basis	kg $Tonne^{-2}$	0.34
Total available nitrogen (Year 1) (@25%)	Dried Basis	kg $Tonne^{-1}$	0.53
Mineralization N Year 2 (@12%)	Dried Basis	kg $Tonne^{-1}$	0.09
Mineralization N Year 3 (@6%)	Dried Basis	kg $Tonne^{-1}$	0.05
Phosphorus	Dried Basis	kg $Tonne^{-1}$	4.61
$P_2O_{5\ equivalent}$	Dried Basis	kg $Tonne^{-1}$	10.60
Total Available P2O5	Dried Basis	kg $Tonne^{-1}$	5.30

Application Rate based on Nitrogen				Land Area Required (Ha)
Nitrogen Based Application Rate	Dried Basis	tonnes ha^{-1}	233.24	**3**
Amount of Available P2O5 applied	Dried Basis	kg ha^{-1}	1,236.55	
P2O5 Application check		%	2,760.15	
Application Rate based on Phosphorous (1xCR)				**Land Area Required (Ha)**
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	12	**67**
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	6	
Additional Nitrogen required		kg ha^{-1}	117	
Application Rate based on Phosphorous (2xCR)				**Land Area Required (Ha)**
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	**23.24**	**33**
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	12.27	
Additional Nitrogen required		kg ha^{-1}	110.93	

Selected Application rate based on:		**2xCR**	**P2O5**
Selected Application rate based on P2O5	Dried Basis	tonnes ha^{-1}	**12**
		tons ac^{-1}	**5**
	Wet	tonnes ha^{-1}	132
		L ha^{-1}	135,999
		tons ac^{-1}	59
		igal ac^{-1}	**12,104**
Estimated Biosolids Volume Applied	Wet	Tonnnes	8,186
Estimated Biosolids Volume Remaining	Wet	Tonnes	878

Notes

Available Ammonium N - Volatilization loss associated with different application methods (0% with Injection)

Organic N - TKN - Ammonium N

Available Organic N - Organic N x 0.25year 1

Mineralization of Year 2 = 12%, Year 3 = 6%

Plant Available Nitrogen= (NO3-N)+Volatilization factor (NH4-N)+Organic N Mineralization

Phosphorous Total and Olsen methods.

* See Estimates of Ammonium-N Retained After Biosolids applicatior

C:N exceeds 30:1, N becomes a limiting nutrient for decomposer organisms, and this can reduce the rate of decomposition and results in N immobilization

C:P ratio between 200:1 and 300:1, mineralization and immobilization balance each other to result in no net release of P from the decomposing manure. When C:P is below this range, P is released.

When animal and municipal wastes have N:P ratios ranging from 1:1 to 1:2 are applied based on N rates on soils, over time P will accumulate

Field Prescription Application Rates

October 2, 2015

Field ID:	SE08-07-06EPM	
Land Area Available (ha):		27
2016 Crop	Winter Wheat	
2016 Target Yield:	80 bu/ac	
	lb/ac	kg/ha
Target Nitrogen recommended :	50	56
Fertilizer Phosphate (P2O5) Recommended:	20	22.4
1 x P2O5 Crop Removal @ target Yield:	25	28
2 x P2O5 Crop Removal @ target Yield:	50	56

Plant Available Nutrients Soil Test Data			
Sample ID	**SE-8 003 N 0-6N**	**SE-8 003 6-24N**	
Sample Depth	0-15 cm	15-60 cm	Total Available
Units	mg kg^{-1}		kg ha-1
Available Nitrate-N	10.0	7.5	65
Available Phosphate-P (Olsen)	22.7		45
Available Potassium	232		464
Available Sulfate-S	1000	800	6,800

Steinbach Biosolids Characteristics and Analysis

Parameter Name	**Parameter Description**	**Unit**	**Biosolid Analysis (Cell 2)**
Estimated Biosolid Volume (+ 10% safety volume)	In-field	m^3	878
Specific Gravity	As Received	kg L^{-1}	1.03
Estimated Biosolids		tonnes	904
Dry tonnes biosolids available (=wet tonnes x %solids)	Dried Basis	tonnes	77
Moisture	As Received	**%**	89.80
Total Solids	As Received	**%**	8.80
Total Volatile Solids	Dry Basis	%	30
Organic Matter	Dry Basis	%	17.00
Mineral Content	Dry Basis	%	83.00
Total Organic Carbon	Dry Basis	%	2.00
C:N Ratio	Dry Basis	x:1	17.24
C:P Ratio	Dry Basis	x:1	4.34
N:P Ratio	Dry Basis	x:1	0.25
pH	Saturated Paste		6.87
Total Kjeldahl N	% Dried Basis	%	0.12
Total Kjeldahl N	Dried Basis	mg kg^{-1}	1,160
Total Kjeldahl N	Dried Basis	kg $Tonne^{-1}$	1.16
Ammonium - N	Dried Basis	mg kg^{-1}	397.00
Ammonium - N	Dried Basis	kg $Tonne^{-1}$	0.3970
Available Nitrate	Dried Basis	mg kg^{-1}	-
Available Nitrate-N	Dried Basis	mg kg^{-1}	-
Available Nitrate-N		kg $Tonne^{-1}$	-
Total Phosphorous	Dried Basis	mg kg^{-1}	4,610

Amount of Biosolids Nutrient Available to Crop

Organic N (=TKN-ammonium N)	Dried Basis	mg kg^{-1}	763.00
Organic N	Dried Basis	kg $Tonne^{-1}$	0.76
Method of Application:			Injections
Anticipated Weather			Cool/dry
Anticipated Volatilization (%)	incorp within 1 days		15
Available Organic N	Dried Basis	kg $Tonne^{-1}$	0.19
Ammonium nitrogen available	Dried Basis	kg $Tonne^{-2}$	0.34
Total available nitrogen (Year 1) (@25%)	Dried Basis	kg $Tonne^{-1}$	0.53
Mineralization N Year 2 (@12%)	Dried Basis	kg $Tonne^{-1}$	0.09
Mineralization N Year 3 (@6%)	Dried Basis	kg $Tonne^{-1}$	0.05
Total Phosphorus	Dried Basis	kg $Tonne^{-1}$	4.61
$P_2O_{5\ equivalent}$	Dried Basis	kg $Tonne^{-1}$	10.60
Total Available P2O5	Dried Basis	kg $Tonne^{-1}$	5.30

Application Rate based on Nitrogen				**Land Area Required (Ha)**
Nitrogen Based Application Rate	Dried Basis	tonnes ha^{-1}	106.02	**1**
Amount of Available P2O5 applied	Dried Basis	kg ha^{-1}	562.07	
P2O5 Application check		%	2,509.23	
Application Rate based on Phosphorous (1xCR)				**Land Area Required (Ha)**
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	5.28	**15**
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	2.79	
Additional Nitrogen required		kg ha^{-1}	53.21	
Application Rate based on Phosphorous (2xCR)				**Land Area Required (Ha)**
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	**10.56**	**7**
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	5.58	
Additional Nitrogen required		kg ha^{-1}	50.42	

Selected Application rate based on:		**2xCR**	**P2O5**
Selected Application rate based on P2O5	Dried Basis	tonnes ha^{-1}	**5.28**
		tons ac^{-1}	**2.38**
	Wet	tonnes ha^{-1}	60.02
		tons ac^{-1}	27.01
		L ha^{-1}	27,818
		igal ac^{-1}	**2,476**
Estimated Biosolids Volume Applied	Wet	Tonnnes	1,620
Estimated Biosolids Volume Remaining	Wet	Tonnes	- 717

Notes

Available Ammonium N - Volatilization loss associated with different application methods (0% with Injection)

Organic N - TKN - Ammonium N

Available Organic N - Organic N x 0.25year 1

Mineralization of Year 2 = 12%, Year 3 = 6%

Plant Available Nitrogen= (NO3-N)+Volatilization factor (NH4-N)+Organic N Mineralization

Phosphorous Total and Olsen methods.

* See Estimates of Ammonium-N Retained After Biosolids application

C:N exceeds 30:1, N becomes a limiting nutrient for decomposer organisms, and this can reduce the rate of decomposition and results in N immobilization

C:P ratio between 200:1 and 300:1, mineralization and immobilization balance each other to result in no net release of P from the decomposing manure. When C:P is below this range, P is released.

When animal and municipal wastes have N:P ratios ranging from 1:1 to 1:2 are applied based on N rates on soils, over time P will accumulate

Field Prescription Application Rates

October 2, 2015

Field ID:	NE08-07-06EPM	
Land Area Available (ha):		25
2016 Crop	Winter Wheat	
2016 Target Yield:	80 bu/ac	
	lb/ac	kg/ha
Target Nitrogen recommended :	20	22.4
Fertilizer Phosphate (P2O5) Recommended:	15	16.8
1 x P2O5 Crop Removal @ target Yield:	25	28
2 x P2O5 Crop Removal @ target Yield:	50	56

Plant Available Nutrients Soil Test Data			
Sample Depth	0-15 cm	15-60 cm	Total Available
Units	mg kg^{-1}		kg ha-1
Available Nitrate-N	12.0	10.5	87
Available Phosphate-P	65.0		130
Available Potassium	305		610
Available Sulfate-S	900	1000	7,800

Steinbach Biosolids Characteristics and Analysis

Parameter Name	Parameter Description	Unit	Biosolid Analysis (Cell 2)
Estimated Biosolid Volume (+ 10% safety volume)	In-field	m^3	(717)
Specific Gravity	As Received	kg L^{-1}	1.03
Estimated Biosolids		tonnes	- 738
Dry tonnes biosolids available (=wet tonnes x %solids)	Dried Basis	tonnes	(63)
Moisture	As Received	%	89.80
Total Solids	As Received	%	8.80
Total Volatile Solids	Dry Basis	%	30
Organic Matter	Dry Basis	%	17.00
Mineral Content	Dry Basis	%	83.00
Total Organic Carbon	Dry Basis	%	2.00
C:N Ratio	Dry Basis	x:1	17.24
C:P Ratio	Dry Basis	x:1	4.34
N:P Ratio	Dry Basis	x:1	0.25
pH	Saturated Paste		6.87
Total Kjeldahl N	% Dried Basis	%	0.12
Total Kjeldahl N	Dried Basis	mg kg^{-1}	1,160
Total Kjeldahl N	Dried Basis	kg $Tonne^{-1}$	1.16
Ammonium - N	Dried Basis	mg kg^{-1}	397.00
Ammonium - N	Dried Basis	kg $Tonne^{-1}$	0.3970
Available Nitrate	Dried Basis	mg kg^{-1}	-
Available Nitrate-N	Dried Basis	mg kg^{-1}	-
Available Nitrate-N		kg $Tonne^{-1}$	-
Total Phosphorous	Dried Basis	mg kg^{-1}	4,610

Amount of Biosolids Nutrient Available to Crop

Organic N (=TKN-ammonium N)	Dried Basis	mg kg^{-1}	763.00
Organic N	Dried Basis	kg $Tonne^{-1}$	0.76
Method of Application:			Injections
Anticipated Weather			Cool/dry
Anticipated Volatilization (%)	incorp within 1 days		15
Available Organic N	Dried Basis	kg $Tonne^{-1}$	0.19
Ammonium nitrogen available	Dried Basis	kg $Tonne^{-2}$	0.34
Total available nitrogen (Year 1) (@25%)	Dried Basis	kg $Tonne^{-1}$	0.53
Mineralization N Year 2 (@12%)	Dried Basis	kg $Tonne^{-1}$	0.09
Mineralization N Year 3 (@6%)	Dried Basis	kg $Tonne^{-1}$	0.05
Phosphorus	Dried Basis	kg $Tonne^{-1}$	4.61
$P_2O_{5\ equivalent}$	Dried Basis	kg $Tonne^{-1}$	10.60
Total Available P2O5	Dried Basis	kg $Tonne^{-1}$	5.30

Application Rate based on Nitrogen				Land Area Required (Ha)
Nitrogen Based Application Rate	Dried Basis	tonnes ha^{-1}	42.41	-1
Amount of Available P2O5 applied	Dried Basis	kg ha^{-1}	224.83	
P2O5 Application check		%	1,338.26	
Application Rate based on Phosphorous (1xCR)				**Land Area Required (Ha)**
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	5.28	-12
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	2.79	
Additional Nitrogen required		kg ha^{-1}	19.61	
Application Rate based on Phosphorous (2xCR)				**Land Area Required (Ha)**
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	**10.56**	-6
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	5.58	
Additional Nitrogen required		kg ha^{-1}	16.82	

Selected Application rate based on:		2xCR	P2O5
Selected Application rate based on P2O5	Dried Basis	tonnes ha^{-1}	**10.56**
		tons ac^{-1}	**4.75**
	Wet	tonnes ha^{-1}	120.03
		tons ac^{-1}	54.02
Estimated Biosolids Volume Applied	Wet	Tonnnes	3,001
Estimated Biosolids Volume Remaining	Wet	Tonnes	- 3,739

Notes

Available Ammonium N - Volatilization loss associated with different application methods (0% with Injection)
Organic N - TKN - Ammonium N
Available Organic N - Organic N x 0.25year 1
Mineralization of Year 2 = 12%, Year 3 = 6%
Plant Available Nitrogen= (NO3-N)+Volatilization factor (NH4-N)+Organic N Mineralization
Phosphorous Total and Olsen methods.
* See Estimates of Ammonium-N Retained After Biosolids application

C:N exceeds 30:1, N becomes a limiting nutrient for decomposer organisms, and this can reduce the rate of decomposition and
C:P ratio between 200:1 and 300:1, mineralization and immobilization balance each other to result in no net release of P from
When animal and municipal wastes have N:P ratios ranging from 1:1 to 1:2 are applied based on N rates on soils, over time P will

Field Prescription Application Rates

October 2, 2015

Field ID:	NW10-07-06EPM	
Land Area Available (ha):		23
2016 Crop	Soybeans	
2016 Target Yield:	35 bu/ac	
	lb/ac	kg/ha
Target Nitrogen recommended :	50	56
Fertilizer Phosphate (P2O5) Recommended:	35	39.2
1 x P2O5 Crop Removal @ target Yield:	30	33.6
2 x P2O5 Crop Removal @ target Yield:	60	67.2

Plant Available Nutrients Soil Test Data			
Sample Depth	0-15 cm	15-60 cm	Total Available
Units	mg kg^{-1}		kg ha-1
Available Nitrate-N	17.5	15.7	129
Available Phosphate-P	06.4		13
Available Potassium	368		736
Available Sulfate-S	800	1800	12,400

Steinbach Biosolids Characteristics and Analysis

Parameter Name	Parameter Description	Unit	Biosolid Analysis (Cell 2)
Estimated Biosolid Volume (+ 10% safety volume)	In-field	m^3	(3,739)
Specific Gravity	As Received	kg L^{-1}	1.03
Estimated Biosolids		tonnes	- 3,851
Dry tonnes biosolids available (=wet tonnes x %solids)	Dried Basis	tonnes	(329)
Moisture	As Received	**%**	89.80
Total Solids	As Received	**%**	8.80
Total Volatile Solids	Dry Basis	%	30
Organic Matter	Dry Basis	%	17.00
Mineral Content	Dry Basis	%	83.00
Total Organic Carbon	Dry Basis	%	2.00
C:N Ratio	Dry Basis	x:1	17.24
C:P Ratio	Dry Basis	x:1	4.34
N:P Ratio	Dry Basis	x:1	0.25
pH	Saturated Paste		6.87
Total Kjeldahl N	% Dried Basis	%	0.12
Total Kjeldahl N	Dried Basis	mg kg^{-1}	1,160
Total Kjeldahl N	Dried Basis	kg $Tonne^{-1}$	1.16
Ammonium - N	Dried Basis	mg kg^{-1}	397.00
Ammonium - N	Dried Basis	kg $Tonne^{-1}$	0.3970
Available Nitrate	Dried Basis	mg kg^{-1}	-
Available Nitrate-N	Dried Basis	mg kg^{-1}	-
Available Nitrate-N		kg $Tonne^{-1}$	-
Total Phosphorous	Dried Basis	mg kg^{-1}	4,610

Amount of Biosolids Nutrient Available to Crop

Organic N (=TKN-ammonium N)	Dried Basis	mg kg^{-1}	763.00
Organic N	Dried Basis	kg $Tonne^{-1}$	0.76
Method of Application:			Injections
Anticipated Weather			Cool/dry
Anticipated Volatilization (%)	incorp within 1 days		15
Available Organic N	Dried Basis	kg $Tonne^{-1}$	0.19
Ammonium nitrogen available	Dried Basis	kg $Tonne^{-2}$	0.34
Total available nitrogen (Year 1) (@25%)	Dried Basis	kg $Tonne^{-1}$	0.53
Mineralization N Year 2 (@12%)	Dried Basis	kg $Tonne^{-1}$	0.09
Mineralization N Year 3 (@6%)	Dried Basis	kg $Tonne^{-1}$	0.05
Phosphorus	Dried Basis	kg $Tonne^{-1}$	4.61
$P_2O_{5\ equivalent}$	Dried Basis	kg $Tonne^{-1}$	10.60
Total Available P2O5	Dried Basis	kg $Tonne^{-1}$	5.30

Application Rate based on Nitrogen				**Land Area Required (Ha)**
Nitrogen Based Application Rate	Dried Basis	tonnes ha^{-1}	106.02	**-3**
Amount of Available P2O5 applied	Dried Basis	kg ha^{-1}	562.07	
P2O5 Application check		%	1,433.85	
Application Rate based on Phosphorous (1xCR)				**Land Area Required (Ha)**
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	6.34	**-52**
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	3.35	
Additional Nitrogen required		kg ha^{-1}	52.65	
Application Rate based on Phosphorous (2xCR)				**Land Area Required (Ha)**
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	**12.68**	**-26**
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	6.70	
Additional Nitrogen required		kg ha^{-1}	49.30	

Selected Application rate based on:		**2xCR**	**P2O5**
Selected Application rate based on P2O5	Dried Basis	tonnes ha^{-1}	**12.68**
		tons ac^{-1}	**5.70**
	Wet	tonnes ha^{-1}	144.04
		tons ac^{-1}	64.82
Estimated Biosolids Volume Applied	Wet	Tonnnes	3,313
Estimated Biosolids Volume Remaining	Wet	Tonnes	- 7,164

Notes

Available Ammonium N - Volatilization loss associated with different application methods (0% with Injection)
Organic N - TKN - Ammonium N
Available Organic N - Organic N x 0.25year 1
Mineralization of Year 2 = 12%, Year 3 = 6%
Plant Available Nitrogen= (NO3-N)+Volatilization factor (NH4-N)+Organic N Mineralization
Phosphorous Total and Olsen methods.
* See Estimates of Ammonium-N Retained After Biosolids application

C:N exceeds 30:1, N becomes a limiting nutrient for decomposer organisms, and this can reduce the rate of decomposition and
C:P ratio between 200:1 and 300:1, mineralization and immobilization balance each other to result in no net release of P from
When animal and municipal wastes have N:P ratios ranging from 1:1 to 1:2 are applied based on N rates on soils, over time P will

Table 1.0. Application Fields Soil Metal Analysis, Steinbach, MB

Field Location		SE08-07-06EPM	NE08-07-06EPM	SE09-07-06EPM	SE09-07-06EPM	NW10-07-06EPM	NW11-07-06EPM
Sample ID*		SW-8 003	SW-8 004	SW-9 005	SW-9 006	NE-10 007	NE-11 008
GPS UTM (14U)		663781.51 m E 5490797.01 m N	663744.65 m E 5491694.91 m N	664961.61 m E 5490892.51 m N	665426.85 m E 5491081.76 m N	665895.44 m E 5491634.99 m N	667880.20 m E 5491878.44 m N
Sample Depth		0-15 cm	0-15 cm	0-15 cm	0-15 cm	0-15 cm	0-15 cm
ALS Sample ID		L1677910	L1677910	L1677910	L1677910	L1677910	L1677910
Matrix		Soil	Soil	Soil	Soil	Soil	Soil
Metals	**Units**						
Antimony (Sb)	mg kg^{-1}	0.18	0.30	0.31	0.48	0.44	0.12
Arsenic (As)		3.14	5.39	4.78	6.54	7.86	1.18
Barium (Ba)		164	130	238	149	166	096
Beryllium (Be)		0.64	0.89	1.21	1.64	1.32	0.40
Cadmium (Cd)		0.34	0.39	0.43	0.37	0.39	0.263
Chromium (Cr)		26.8	33.6	49.2	49.0	50.2	16.7
Cobalt (Co)		7.2	9.9	12.1	14.0	14.0	04.2
Copper (Cu)		15.1	25.0	25.2	28.9	30.9	08.6
Lead (Pb)		13.1	13.7	14.8	21.1	16.2	07.6
Mercury (Hg)		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Molybdenum (Mo)		0.25	0.324	0.248	0.529	0.487	0.120
Nickel (Ni)		17.8	26.4	33.0	38.0	39.5	10.4
Selenium (Se)		<0.50	<0.50	<0.50	0.52	<0.50	<0.50
Silver (Ag)		0.11	0.12	0.17	0.18	0.13	<0.10
Thallium (Tl)		0.17	0.22	0.27	0.39	0.31	0.10
Tin (Sn)		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Uranium (U)		1.37	1.63	1.17	7.02	1.12	0.73
Vanadium (V)		51.7	70.7	93.6	103.0	108.0	28.3
Zinc (Zn)		77.0	93.0	100	112.0	182	48
Date Sampled		24-Sep-15	24-Sep-15	24-Sep-15	24-Sep-15	24-Sep-15	24-Sep-15

Notes:
< = less than detection
*Sample ID quarter sections labelled in error

Table 2.1 Biosolid Trace Elements (Metal) Sample Results for Cell 2, Field Specific Soil Metal Concentrations and Cumulative Metal Concentrations

Trace Element	Laboratory Detection Limit	Steinbach Lagoon Cell 2		SE08-07-06EPM (Sample ID: SW-08 003) (0-15 CM)		NE08-07-06EPM (Sample ID: SW-08 004) (0-15 CM)		Mean	Loading Rate Application Rate 5 T ha-1 (dry)	Cumulative Metal Concentration	Cumulative Weight Allowed by Guideline[2]
	mg kg^{-1}	mg kg^{-1}	kg $tonne^{-1}$	mg kg^{-1}	kg ha^{-1}	mg kg^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}
Antimony (Sb)	0.1	1.34	0.001	0.18	0.01	0.30	0.01	0.01	0.007	0.02	-
Arsenic (As)	0.1	3.93	0.004	3.14	0.13	5.39	0.22	0.18	0.020	0.20	21.6
Barium (Ba)	0.5	683	0.683	164	6.79	130	5.38	6.09	3.415	9.50	-
Beryllium (Be)	0.1	0.28	0.000	0.64	0.03	0.89	0.04	0.03	0.000	0.03	-
Cadmium (Cd)	0.02	1.21	0.001	0.34	0.01	0.39	0.02	0.02	0.006	0.02	2.5
Chromium (Cr)	1	26.4	0.026	26.8	1.11	33.6	1.39	1.25	0.132	1.38	115.2
Cobalt (Co)	0.02	4.52	0.005	7.2	0.30	9.9	0.41	0.35	0.023	0.38	-
Copper (Cu)	1	694	0.694	15.1	0.63	25.0	1.04	0.83	3.470	4.30	113.4
Lead (Pb)	0.2	17.2	0.017	13.1	0.54	13.7	0.57	0.55	0.086	0.64	126
Mercury (Hg)-Total[1]	0.05	1.19	0.001	<0.050	-	<0.050	-	-	0.006	-	11.9
Molybdenum (Mo)	0.02	17.9	0.018	0.25	0.01	0.324	0.01	0.01	0.090	0.10	-
Nickel (Ni)	0.5	15.4	0.015	17.8	0.74	26.4	1.09	0.91	0.077	0.99	90
Selenium (Se)[1]	0.5	3.42	0.003	<0.50	-	<0.50	-	-	0.017	-	-
Silver (Ag)[2]	0.1	09.7	0.010	0.11	0.00	0.12	0.00	0.00	0.048	0.05	-
Thallium (Tl)	0.1	0.12	0.000	0.17	0.01	0.22	0.01	0.01	0.001	0.01	-
Tin (Sn)[2]	5	12.9	0.013	<5.0	-	<5.0	-	-	0.065	-	-
Uranium (U)	0.02	8.47	0.008	1.37	0.06	1.63	0.07	0.06	0.042	0.10	-
Vanadium (V)	0.5	24	0.024	51.7	2.14	70.7	2.93	2.53	0.120	2.65	-
Zinc (Zn)	10	422	0.422	77.0	3.19	93.0	3.85	3.52	2.110	5.63	360

Notes:

[1] = Soil concentrations less than detection

[2] = Cumulative Weight Allowed by Guideline includes the metals in soils.

*Sample ID quarter sections labelled in error

Table 2.2 Biosolid Trace Elements (Metal) Sample Results for Cell 2, Field Specific Soil Metal Concentrations and Cumulative Metal Concentrations

Trace Element	Laboratory Detection Limit	Steinbach Lagoon Cell 2		SE09-07-06EPM (Sample ID: SW-09 005) (0-15 CM)		SE09-07-06 EPM (Sample ID: SW-09 006) (0-15 CM)		Mean	Loading Rate Application Rate 12 T ha-1 (dry)	Cumulative Metal Concentration	Cumulative Weight Allowed by Guideline[2]
	mg kg^{-1}	mg kg^{-1}	kg $tonne^{-1}$	mg kg^{-1}	kg ha^{-1}	mg kg^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}
Antimony (Sb)	0.1	1.34	0.001	0.31	0.01	0.48	0.02	0.02	0.016	0.03	-
Arsenic (As)	0.1	3.93	0.004	4.78	0.20	6.54	0.27	0.23	0.047	0.28	21.6
Barium (Ba)	0.5	683	0.683	238	9.85	149	6.17	8.01	8.196	16.21	-
Beryllium (Be)	0.1	0.28	0.000	1.21	0.05	1.64	0.07	0.06	0.000	0.06	-
Cadmium (Cd)	0.02	1.21	0.001	0.43	0.02	0.37	0.02	0.02	0.015	0.03	2.5
Chromium (Cr)	1	26.4	0.026	49.2	2.04	49.0	2.03	2.03	0.317	2.35	115.2
Cobalt (Co)	0.02	4.52	0.005	12.1	0.50	14.0	0.58	0.54	0.054	0.59	-
Copper (Cu)	1	694	0.694	25.2	1.04	28.9	1.20	1.12	8.328	9.45	113.4
Lead (Pb)	0.2	17.2	0.017	14.8	0.61	21.1	0.87	0.74	0.206	0.95	126
Mercury (Hg)-Total[1]	0.05	1.19	0.001	<0.050	-	<0.050	-	-	0.014	-	11.9
Molybdenum (Mo)	0.02	17.9	0.018	0.248	0.01	0.529	0.02	0.02	0.215	0.23	-
Nickel (Ni)	0.5	15.4	0.015	33.0	1.37	38.0	1.57	1.47	0.185	1.65	90
Selenium (Se)[1]	0.5	3.42	0.003	<0.50	-	0.52	0.02	0.02	0.041	0.06	-
Silver (Ag)	0.1	09.7	0.010	0.17	0.01	0.18	0.01	0.01	0.116	0.12	-
Thallium (Tl)	0.1	0.12	0.000	0.27	0.01	0.39	0.02	0.01	0.001	0.02	-
Tin (Sn)[1]	5	12.9	0.013	<5.0	-	<5.0	-	-	0.155	-	-
Uranium (U)	0.02	8.47	0.008	1.17	0.05	7.02	0.29	0.17	0.102	0.27	-
Vanadium (V)	0.5	24	0.024	93.6	3.88	103.0	4.26	4.07	0.288	4.36	-
Zinc (Zn)	10	422	0.422	100	4.14	112.0	4.64	4.39	5.064	9.45	360

Notes:

[1] = Soil concentrations less than detection

[2] = Cumulative Weight Allowed by Guideline includes the metals in soils.

*Sample ID quarter sections labelled in error

Table 2.3 Biosolid Trace Elements (Metal) Sample Results for Cell 2, Field Specific Soil Metal Concentrations and Cumulative Metal Concentrations

Trace Element	Laboratory Detection Limit	Steinbach Lagoon Cell 2		NW10-07-06 EPM (Sample ID: NE-10 007) (0-15 CM)		Loading Rate Application Rate 11 T ha-1 (dry)	Cumulative Metal Concentration	Cumulative Weight Allowed by Guideline[2]
	mg kg^{-1}	mg kg^{-1}	kg $tonne^{-1}$	mg kg^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}
Antimony (Sb)	0.1	1.34	0.001	0.44	0.02	0.015	0.03	-
Arsenic (As)	0.1	3.93	0.004	7.86	0.33	0.043	0.37	21.6
Barium (Ba)	0.5	683	0.683	166	6.87	7.513	14.39	-
Beryllium (Be)	0.1	0.28	0.000	1.32	0.05	0.000	0.05	-
Cadmium (Cd)	0.02	1.21	0.001	0.39	0.02	0.013	0.03	2.5
Chromium (Cr)	1	26.4	0.026	50.2	2.08	0.290	2.37	115.2
Cobalt (Co)	0.02	4.52	0.005	14.0	0.58	0.050	0.63	-
Copper (Cu)	1	694	0.694	30.9	1.28	7.634	8.91	113.4
Lead (Pb)	0.2	17.2	0.017	16.2	0.67	0.189	0.86	126
Mercury (Hg)-Total[1]	0.05	1.19	0.001	<0.050	-	0.013	-	11.9
Molybdenum (Mo)	0.02	17.9	0.018	0.487	0.02	0.197	0.22	-
Nickel (Ni)	0.5	15.4	0.015	39.5	1.64	0.169	1.80	90
Selenium (Se)[1]	0.5	3.42	0.003	<0.50	-	0.038	-	-
Silver (Ag)	0.1	09.7	0.010	0.13	0.01	0.107	0.11	-
Thallium (Tl)	0.1	0.12	0.000	0.31	0.01	0.001	0.01	-
Tin (Sn)[1]	5	12.9	0.013	<5.0	-	0.142	-	-
Uranium (U)	0.02	8.47	0.008	1.12	0.05	0.093	0.14	-
Vanadium (V)	0.5	24	0.024	108.0	4.47	0.264	4.74	-
Zinc (Zn)	10	422	0.422	182	7.53	4.642	12.18	360

Notes:

[1] = Soil concentrations less than detection

[2] = Cumulative Weight Allowed by Guideline includes the metals in soils.

*Sample ID quarter sections labelled in error

Table 2.4 Biosolid Trace Elements (Metal) Sample Results for Cell 2, Field Specific Soil Metal Concentrations and Cumulative Metal Concentrations

Trace Element	Laboratory Detection Limit	Steinbach Lagoon Cell 2		NW11-07-06 EPM (Sample ID: NE-11 008) (0-15 CM)		Loading Rate Application Rate 11 T ha-1 (dry)	Cumulative Metal Concentration	Cumulative Weight Allowed by Guideline[2]
	mg kg^{-1}	mg kg^{-1}	kg $tonne^{-1}$	mg kg^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}
Antimony (Sb)	0.1	1.34	0.001	0.12	0.00	0.015	0.02	-
Arsenic (As)	0.1	3.93	0.004	1.18	0.05	0.043	0.09	21.6
Barium (Ba)	0.5	683	0.683	096	3.96	7.513	11.47	-
Beryllium (Be)	0.1	0.28	0.000	0.40	0.02	0.000	0.02	-
Cadmium (Cd)	0.02	1.21	0.001	0.263	0.01	0.013	0.02	2.5
Chromium (Cr)	1	26.4	0.026	16.7	0.69	0.290	0.98	115.2
Cobalt (Co)	0.02	4.52	0.005	04.2	0.17	0.050	0.22	-
Copper (Cu)	1	694	0.694	08.6	0.36	7.634	7.99	113.4
Lead (Pb)	0.2	17.2	0.017	07.6	0.32	0.189	0.50	126
Mercury (Hg)-Total[1]	0.05	1.19	0.001	<0.050	-	0.013	-	11.9
Molybdenum (Mo)	0.02	17.9	0.018	0.120	0.00	0.197	0.20	-
Nickel (Ni)	0.5	15.4	0.015	10.4	0.43	0.169	0.60	90
Selenium (Se)[1]	0.5	3.42	0.003	<0.50	-	0.038	-	-
Silver (Ag)[1]	0.1	09.7	0.010	<0.10	-	0.107	-	-
Thallium (Tl)	0.1	0.12	0.000	0.10	0.00	0.001	0.01	-
Tin (Sn)[1]	5	12.9	0.013	<5.0	-	0.142	-	-
Uranium (U)	0.02	8.47	0.008	0.73	0.03	0.093	0.12	-
Vanadium (V)	0.5	24	0.024	28.3	1.17	0.264	1.44	-
Zinc (Zn)	10	422	0.422	48	1.99	4.642	6.63	360

Notes:

[1] = Soil concentrations less than detection

[2] = Cumulative Weight Allowed by Guideline includes the metals in soils.

*Sample ID quarter sections labelled in error

Table 3.1. Application Fields Soil Nutrient Analysis 0-15 cm, Steinbach, MB

Field Location		SE08-07-06EPM	NE08-07-06EPM	SE09-07-06EPM	SE09-07-06EPM	NW10-07-06EPM	NW11-07-06EPM
Sample ID*		SW-8 003	SW-8 004	SW-9 005	SW-9 006	NE-10 007	NE-11 008
GPS UTM (14U)		663781.51 m E 5490797.01 m N	663744.65 m E 5491694.91 m N	664961.61 m E 5490892.51 m N	665426.85 m E 5491081.76 m N	665895.44 m E 5491634.99 m N	667880.20 m E 5491878.44 m N
Sample Depth		0-15 cm	0-15 cm	0-15 cm	0-15 cm	0-15 cm	0-15 cm
ALS Sample ID		L1677910	L1677910	L1677910	L1677910	L1677910	L1677910
Matrix		Soil	Soil	Soil	Soil	Soil	Soil
Nutrients	**Units**						
Available Ammonium-N	mg/kg	4.30	6.50	5.70	8.70	8.20	5.50
Total Available Nitrogen		10.00	12.00	11.00	15.70	17.40	13.70
Nitrite-N		001	001	001	<0.50	<0.50	001
Nitrate+Nitrite-N		5.60	5.50	5.20	7.00	9.20	8.20
Nitrate-N		5.00	4.90	4.70	7.00	9.20	7.400
Available Phosphate-P		22.7	65.0	04.9	10.5	06.4	10.1
Available Potassium		232.0	305.0	281.0	369.0	368.0	126.0
Sulfur (S)-Total		1000.0	900.0	1000.0	1600.0	800.0	700.0
Total Kjeldahl Nitrogen	%	00.3	00.3	00.4	00.3	00.3	00.3
Conductivity (1:2)	$dS\ m^{-1}$	0.5890	0.6360	0.8230	1.6300	0.4090	0.2610
pH (1:2 soil:water)	pH	8.34	8.23	8.47	7.3	7.58	8.240
Date Sampled		24-Sep-15	24-Sep-15	24-Sep-15	24-Sep-15	24-Sep-15	24-Sep-15

Table 3.2. Application Fields Soil Nutrient Analysis 15-60 cm, Steinbach, MB

Field Location		SE08-07-06EPM	NE08-07-06EPM	SE09-07-06EPM	SE09-07-06EPM	NW10-07-06EPM	NW11-07-06EPM
Sample ID*		SW-8 003	SW-8 004	SW-9 005	SW-9 006	NE-10 007	NE-11 008
GPS UTM (14U)		663781.51 m E 5490797.01 m N	663744.65 m E 5491694.91 m N	664961.61 m E 5490892.51 m N	665426.85 m E 5491081.76 m N	665895.44 m E 5491634.99 m N	667880.20 m E 5491878.44 m N
Sample Depth		15-60 cm	15-60 cm	15-60 cm	15-60 cm	15-60 cm	15-60 cm
ALS Sample ID		L1677910	L1677910	L1677910	L1677910	L1677910	L1677910
Matrix		Soil	Soil	Soil	Soil	Soil	Soil
Nutrients	**Units**						
Available Ammonium-N	mg/kg	3.50	6.50	4.40	8.60	8.00	3.40
Total Available Nitrogen		7.50	10.50	7.10	11.10	15.70	10.40
Nitrite-N		001	001	001	001	001	001
Nitrate+Nitrite-N		4.00	4.10	2.70	2.50	7.80	7.00
Nitrate-N		3.40	3.20	2.10	<2.0	7.00	6.400
Sulfur (S)-Total		800.0	1000.0	1000.0	4400.0	1800.0	800.0
Total Kjeldahl Nitrogen	%	00.1	00.2	00.2	00.1	00.2	00.1
Date Sampled		24-Sep-15	24-Sep-15	24-Sep-15	24-Sep-15	24-Sep-15	24-Sep-15

*Sample ID quarter sections labelled in error

MMM Group Ltd.
ATTN: BRIAN MOONS
111-93 Lombard Ave
Winnipeg MB R3B 3B1

Date Received: 24-SEP-15
Report Date: 30-SEP-15 14:21 (MT)
Version: FINAL

Client Phone: 204-943-3178

Certificate of Analysis

Lab Work Order #: L1677910

Project P.O. #: 3315438
Job Reference:
C of C Numbers:
Legal Site Desc:

Gail Hill, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1677910-1 SW-8 003 0-6M									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
CCME Metals									
Mercury in Soil by CVAFS									
Mercury (Hg)	<0.050	-		0.050	mg/kg	-	25-SEP-15	29-SEP-15	R3279153
Metals									
Antimony (Sb)	0.18	+/-0.04		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Arsenic (As)	3.14	+/-0.40		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Barium (Ba)	164	+/-45		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Beryllium (Be)	0.64	+/-0.20		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cadmium (Cd)	0.341	+/-0.061		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Chromium (Cr)	26.8	+/-4.8		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cobalt (Co)	7.18	+/-0.99		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Copper (Cu)	15.1	+/-2.3		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Lead (Pb)	13.1	+/-2.5		0.20	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Molybdenum (Mo)	0.250	+/-0.046		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Nickel (Ni)	17.8	+/-2.2		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Selenium (Se)	<0.50	-		0.50	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Silver (Ag)	0.11	+/-0.03		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Thallium (Tl)	0.17	+/-0.07		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Tin (Sn)	<5.0	-		5.0	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Uranium (U)	1.37	+/-0.28		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Vanadium (V)	51.7	+/-12		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Zinc (Zn)	77	+/-10		10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
L1677910-2 SW-08 004 0-6M									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
CCME Metals									
Mercury in Soil by CVAFS									
Mercury (Hg)	<0.050	-		0.050	mg/kg	-	25-SEP-15	29-SEP-15	R3279153
Metals									
Antimony (Sb)	0.30	+/-0.07		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Arsenic (As)	5.39	+/-0.69		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Barium (Ba)	130	+/-36		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Beryllium (Be)	0.89	+/-0.27		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cadmium (Cd)	0.388	+/-0.069		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Chromium (Cr)	33.6	+/-6.1		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cobalt (Co)	9.86	+/-1.4		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Copper (Cu)	25.0	+/-3.7		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Lead (Pb)	13.7	+/-2.7		0.20	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Molybdenum (Mo)	0.324	+/-0.060		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Nickel (Ni)	26.4	+/-3.3		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Selenium (Se)	<0.50	-		0.50	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Silver (Ag)	0.12	+/-0.03		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Thallium (Tl)	0.22	+/-0.09		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Tin (Sn)	<5.0	-		5.0	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Uranium (U)	1.63	+/-0.33		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Vanadium (V)	70.7	+/-16		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Zinc (Zn)	93	+/-12		10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
L1677910-3 SW-9 005 0-6M									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1677910-3 SW-9 005 0-6M									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
CCME Metals									
Mercury in Soil by CVAFS									
Mercury (Hg)	<0.050	-		0.050	mg/kg	-	25-SEP-15	29-SEP-15	R3279153
Metals									
Antimony (Sb)	0.31	+/-0.07		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Arsenic (As)	4.78	+/-0.61		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Barium (Ba)	238	+/-65		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Beryllium (Be)	1.21	+/-0.37		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cadmium (Cd)	0.428	+/-0.076		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Chromium (Cr)	49.2	+/-8.9		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cobalt (Co)	12.1	+/-1.7		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Copper (Cu)	25.2	+/-3.8		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Lead (Pb)	14.8	+/-2.9		0.20	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Molybdenum (Mo)	0.248	+/-0.046		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Nickel (Ni)	33.0	+/-4.1		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Selenium (Se)	<0.50	-		0.50	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Silver (Ag)	0.17	+/-0.04		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Thallium (Tl)	0.27	+/-0.11		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Tin (Sn)	<5.0	-		5.0	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Uranium (U)	1.17	+/-0.24		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Vanadium (V)	93.6	+/-21		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Zinc (Zn)	100	+/-13		10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
L1677910-4 SW-9 006 0-6M									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
CCME Metals									
Mercury in Soil by CVAFS									
Mercury (Hg)	<0.050	-		0.050	mg/kg	-	25-SEP-15	29-SEP-15	R3279153
Metals									
Antimony (Sb)	0.48	+/-0.11		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Arsenic (As)	6.54	+/-0.83		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Barium (Ba)	149	+/-41		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Beryllium (Be)	1.64	+/-0.50		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cadmium (Cd)	0.367	+/-0.065		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Chromium (Cr)	49.0	+/-8.9		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cobalt (Co)	14.0	+/-1.9		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Copper (Cu)	28.9	+/-4.3		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Lead (Pb)	21.1	+/-4.1		0.20	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Molybdenum (Mo)	0.529	+/-0.097		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Nickel (Ni)	38.0	+/-4.8		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Selenium (Se)	0.52	+/-0.10		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Silver (Ag)	0.18	+/-0.04		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Thallium (Tl)	0.39	+/-0.16		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Tin (Sn)	<5.0	-		5.0	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Uranium (U)	7.02	+/-1.4		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Vanadium (V)	103	+/-23		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Zinc (Zn)	112	+/-14		10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
L1677910-5 NE-10 007 0-6M									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1677910-5 NE-10 007 0-6M									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
CCME Metals									
Mercury in Soil by CVAFS									
Mercury (Hg)	<0.050	-		0.050	mg/kg	-	25-SEP-15	29-SEP-15	R3279153
Metals									
Antimony (Sb)	0.44	+/-0.10		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Arsenic (As)	7.86	+/-1.0		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Barium (Ba)	166	+/-46		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Beryllium (Be)	1.32	+/-0.41		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cadmium (Cd)	0.386	+/-0.069		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Chromium (Cr)	50.2	+/-9.1		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cobalt (Co)	14.0	+/-1.9		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Copper (Cu)	30.9	+/-4.6		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Lead (Pb)	16.2	+/-3.2		0.20	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Molybdenum (Mo)	0.487	+/-0.089		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Nickel (Ni)	39.5	+/-5.0		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Selenium (Se)	<0.50	-		0.50	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Silver (Ag)	0.13	+/-0.03		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Thallium (Tl)	0.31	+/-0.12		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Tin (Sn)	<5.0	-		5.0	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Uranium (U)	1.12	+/-0.23		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Vanadium (V)	108	+/-24		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Zinc (Zn)	182	+/-23		10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
L1677910-6 NE-11 008 0-6M									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
CCME Metals									
Mercury in Soil by CVAFS									
Mercury (Hg)	<0.050	-		0.050	mg/kg	-	25-SEP-15	29-SEP-15	R3279153
Metals									
Antimony (Sb)	0.12	+/-0.03		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Arsenic (As)	1.18	+/-0.15		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Barium (Ba)	95.6	+/-26		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Beryllium (Be)	0.40	+/-0.12		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cadmium (Cd)	0.263	+/-0.047		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Chromium (Cr)	16.7	+/-3.0		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Cobalt (Co)	4.17	+/-0.58		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Copper (Cu)	8.6	+/-1.3		1.0	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Lead (Pb)	7.61	+/-1.5		0.20	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Molybdenum (Mo)	0.120	+/-0.023		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Nickel (Ni)	10.4	+/-1.3		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Selenium (Se)	<0.50	-		0.50	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Silver (Ag)	<0.10	-		0.10	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Thallium (Tl)	0.10	+/-0.04		0.10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Tin (Sn)	<5.0	-		5.0	mg/kg	-	26-SEP-15	28-SEP-15	R3278270
Uranium (U)	0.726	+/-0.15		0.020	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Vanadium (V)	28.3	+/-6.3		0.50	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
Zinc (Zn)	48	+/-6		10	mg/kg	0	26-SEP-15	28-SEP-15	R3278270
L1677910-7 SW-8 003 0-6N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1677910-7 SW-8 003 0-6N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Available Phosphate-P	22.7	-		1.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278418
Available Potassium	232	+/-31		20	mg/kg	-11.8%	28-SEP-15	28-SEP-15	R3278440
Total Kjeldahl Nitrogen	0.28	+/-0.06	DLA	0.10	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	1000	+/-600		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
pH and EC (1:2 Soil:Water Extraction)									
Conductivity (1:2)	0.589	-		0.050	dS m-1	-	28-SEP-15	28-SEP-15	R3278089
pH (1:2 soil:water)	8.34	-		0.10	pH	-	28-SEP-15	28-SEP-15	R3278089
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	4.3	+/-0.8		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	10.0	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	0.69	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	5.6	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	5.0	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-8 SW-8 004 0-6N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Available Phosphate-P	65	-	DLA	15	mg/kg	-	28-SEP-15	28-SEP-15	R3278418
Available Potassium	305	+/-39		20	mg/kg	-11.8%	28-SEP-15	28-SEP-15	R3278440
Total Kjeldahl Nitrogen	0.32	+/-0.06	DLA	0.10	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	900	+/-500		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
pH and EC (1:2 Soil:Water Extraction)									
Conductivity (1:2)	0.636	-		0.050	dS m-1	-	28-SEP-15	28-SEP-15	R3278089
pH (1:2 soil:water)	8.23	-		0.10	pH	-	28-SEP-15	28-SEP-15	R3278089
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	6.5	+/-1.1		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	12.0	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	0.62	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	5.5	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	4.9	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-9 SW-9 005 0-6N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Available Phosphate-P	4.9	-		1.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278418
Available Potassium	281	+/-37		20	mg/kg	-11.8%	28-SEP-15	28-SEP-15	R3278440
Total Kjeldahl Nitrogen	0.375	+/-0.073		0.020	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	1000	+/-600		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
pH and EC (1:2 Soil:Water Extraction)									
Conductivity (1:2)	0.823	-		0.050	dS m-1	-	28-SEP-15	28-SEP-15	R3278089
pH (1:2 soil:water)	8.47	-		0.10	pH	-	28-SEP-15	28-SEP-15	R3278089
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	5.7	+/-1.0		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1677910-9 SW-9 005 0-6N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Available Ammonium-N - Calculation									
Total Available Nitrogen	11.0	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	0.56	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	5.2	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	4.7	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-10 SW-9 006 0-6N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Available Phosphate-P	10.5	-		1.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278418
Available Potassium	369	+/-47		20	mg/kg	-11.8%	28-SEP-15	28-SEP-15	R3278440
Total Kjeldahl Nitrogen	0.334	+/-0.065		0.020	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	1600	+/-700		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
pH and EC (1:2 Soil:Water Extraction)									
Conductivity (1:2)	1.63	-		0.050	dS m-1	-	28-SEP-15	28-SEP-15	R3278089
pH (1:2 soil:water)	7.30	-		0.10	pH	-	28-SEP-15	28-SEP-15	R3278089
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	8.7	+/-1.4		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	15.7	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	<0.50	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	7.0	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	7.0	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-11 NE-10 007 0-6N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Available Phosphate-P	6.4	-		1.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278418
Available Potassium	368	+/-46		20	mg/kg	-11.8%	28-SEP-15	28-SEP-15	R3278440
Total Kjeldahl Nitrogen	0.341	+/-0.066		0.020	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	800	+/-500		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
pH and EC (1:2 Soil:Water Extraction)									
Conductivity (1:2)	0.409	-		0.050	dS m-1	-	28-SEP-15	28-SEP-15	R3278089
pH (1:2 soil:water)	7.58	-		0.10	pH	-	28-SEP-15	28-SEP-15	R3278089
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	8.2	+/-1.3		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	17.4	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	<0.50	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	9.2	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	9.2	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-12 NE-11 008 0-6N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Available Phosphate-P	10.1	-		1.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278418

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1677910-12 NE-11 008 0-6N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Available Potassium	126	+/-20		20	mg/kg	-11.8%	28-SEP-15	28-SEP-15	R3278440
Total Kjeldahl Nitrogen	0.284	+/-0.056		0.020	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	700	+/-500		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
pH and EC (1:2 Soil:Water Extraction)									
Conductivity (1:2)	0.261	-		0.050	dS m-1	-	28-SEP-15	28-SEP-15	R3278089
pH (1:2 soil:water)	8.24	-		0.10	pH	-	28-SEP-15	28-SEP-15	R3278089
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	5.5	+/-0.9		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	13.7	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	0.72	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	8.2	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	7.4	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-13 SW-8 003 6-24N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Total Kjeldahl Nitrogen	0.109	+/-0.022		0.020	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	800	+/-500		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	3.5	+/-0.7		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	7.5	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	0.57	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	4.0	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	3.4	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-14 SW-8 004 6-24N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Total Kjeldahl Nitrogen	0.191	+/-0.037		0.020	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	1000	+/-500		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	6.5	+/-1.1		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	10.5	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	0.93	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	4.1	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	3.2	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-15 SW-9 005 6-24N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Total Kjeldahl Nitrogen	0.153	+/-0.030		0.020	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	1000	+/-600		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1677910-15 SW-9 005 6-24N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	4.4	+/-0.8		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	7.1	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	0.54	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	2.7	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	2.1	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-16 SW-9 006 6-24N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Total Kjeldahl Nitrogen	0.138	+/-0.027		0.020	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	4400	+/-1300		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	8.6	+/-1.4		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	11.1	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	0.56	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	2.5	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	<2.0	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-17 NE-10 007 6-24N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Total Kjeldahl Nitrogen	0.150	+/-0.030		0.020	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	1800	+/-700		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	8.0	+/-1.3		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	15.7	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	0.71	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	7.8	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	7.0	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
L1677910-18 NE-11 008 6-24N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Miscellaneous Parameters									
Total Kjeldahl Nitrogen	0.056	+/-0.012		0.020	%	0	28-SEP-15	29-SEP-15	R3278865
Sulfur (S)-Total	800	+/-500		500	mg/kg	-6.4%	29-SEP-15	29-SEP-15	R3279475
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	3.4	+/-0.6		1.0	mg/kg	0	28-SEP-15	28-SEP-15	R3278433
Available Ammonium-N - Calculation									
Total Available Nitrogen	10.4	-		2.2	mg/kg	-		29-SEP-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1677910-18 NE-11 008 6-24N									
Sampled By: B MOONS on 23-SEP-15									
Matrix: SOIL									
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	0.58	-		0.50	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate+Nitrite-N	7.0	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432
Nitrate-N	6.4	-		2.0	mg/kg	-	28-SEP-15	28-SEP-15	R3278432

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Total Kjeldahl Nitrogen	DLA	

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
ETL-N-TOT-AVAIL-SK	Soil	Available Ammonium-N - Calculation		Soil Methods of Analysis (1993) CSSS
HG-200.2-CVAF-WP	Soil	Mercury in Soil by CVAFS		EPA 200.2/1631E (mod)
Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.				
K-AVAIL-SK	Soil	Available Potassium		Comm. Soil Sci. Plant, 25 (5&6)
Plant available potassium is extracted from the soil using Modified Kelowna solution. Potassium in the soil extract is determined by flame emission at 770 nm.				
MET-200.2-MS-WP	Soil	Metals		EPA 200.2/6020A
Samples for analysis are homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested by block digester (EPA 200.2). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).				
Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.				
N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen		CSSS (1993) 22.2.3
The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.				
N2/N3-AVAIL-KCL-SK	Soil	Nitrate, Nitrite & Nitrate+Nitrite-N(KCL		CSSS (1993) p. 26-28
Plant available nitrate and nitrite are extracted from the sample with 2N KCl. Nitrate and Nitrite in the filtered extract are determined colorimetrically by Technicon auto-analyzer or flow injection analyzer at 520 nm.				
NH4-AVAIL-SK	Soil	Available Ammonium-N		CSSS(1993) 4.2/COMM SOIL SCI 19(6)
Ammonium (NH4-N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.				
PH,EC-1:2-SK	Soil	pH and EC (1:2 Soil:Water Extraction)		CSSC 3.13/CSSS 18.3.1
1 part dry soil and 2 parts de-ionized water (by volume) is mixed. The slurry is allowed to stand with occasional stirring for 30 - 60 minutes. After equilibration, pH of the slurry is measured using a pH meter. Conductivity of the filtered extract is measured by a conductivity meter.				
PO4-AVAIL-OLSEN-SK	Soil	Available Phosphate-P by Olsen		CSSS (1993) 7.2,7.3.1
Plant available phosphorus is extracted from the sample with sodium bicarbonate. PO4-P in the filtered extract is determined colorimetrically at 880 nm.				
S-TOT-LECO-SK	Soil	Total Sulphur by combustion method		ISO 15178:2000
The sample is ignited in a combustion analyzer where sulfur in the reduced SO2 gas is determined using a thermal conductivity detector.				

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surr - 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.
MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.
Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent. Zero values indicate no detectable method bias.

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.

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-200.2-CVAF-WP	**Soil**							
Batch R3279153								
WG2182126-3 CRM		**CANMET TILL-1**						
Mercury (Hg)			0.113		mg/kg		0.048-0.148	29-SEP-15
WG2182126-4 CRM		**PACS-3**						
Mercury (Hg)			117.7		%		70-130	29-SEP-15
WG2182126-5 DUP		**L1677910-6**						
Mercury (Hg)		<0.050	<0.050	RPD-NA	mg/kg	N/A	40	29-SEP-15
WG2182126-2 LCS								
Mercury (Hg)			104.9		%		80-120	29-SEP-15
WG2182126-1 MB								
Mercury (Hg)			<0.050		mg/kg		0.05	29-SEP-15
K-AVAIL-SK	**Soil**							
Batch R3278440								
WG2179948-1 DUP		**L1677910-11**						
Available Potassium		368	406		mg/kg	10	30	28-SEP-15
WG2179948-3 IRM		**FARM2005**						
Available Potassium			99.1		%		70-130	28-SEP-15
WG2179948-2 MB								
Available Potassium			<20		mg/kg		20	28-SEP-15
MET-200.2-MS-WP	**Soil**							
Batch R3278270								
WG2179848-3 CRM		**CANMET TILL-1**						
Antimony (Sb)			104.9		%		70-130	28-SEP-15
Arsenic (As)			100.9		%		70-130	28-SEP-15
Barium (Ba)			99.8		%		70-130	28-SEP-15
Beryllium (Be)			101.7		%		70-130	28-SEP-15
Cadmium (Cd)			91.0		%		70-130	28-SEP-15
Chromium (Cr)			101.0		%		70-130	28-SEP-15
Cobalt (Co)			98.4		%		70-130	28-SEP-15
Copper (Cu)			95.7		%		70-130	28-SEP-15
Lead (Pb)			101.0		%		70-130	28-SEP-15
Molybdenum (Mo)			100.2		%		70-130	28-SEP-15
Nickel (Ni)			99.3		%		70-130	28-SEP-15
Selenium (Se)			90.3		%		70-130	28-SEP-15
Silver (Ag)			114.2		%		70-130	28-SEP-15
Thallium (Tl)			0.14		mg/kg		0.03-0.23	28-SEP-15
Tin (Sn)			94.2		%		70-130	28-SEP-15

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-MS-WP	**Soil**							
Batch R3278270								
WG2179848-3 CRM		**CANMET TILL-1**						
Uranium (U)			119.7		%		70-130	28-SEP-15
Vanadium (V)			103.4		%		70-130	28-SEP-15
Zinc (Zn)			99.4		%		70-130	28-SEP-15
WG2179848-4 CRM		**PACS-3**						
Antimony (Sb)			108.7		%		70-130	28-SEP-15
Arsenic (As)			92.0		%		70-130	28-SEP-15
Barium (Ba)			92.7		%		70-130	28-SEP-15
Beryllium (Be)			115.9		%		70-130	28-SEP-15
Cadmium (Cd)			92.7		%		70-130	28-SEP-15
Chromium (Cr)			101.1		%		70-130	28-SEP-15
Cobalt (Co)			100.0		%		70-130	28-SEP-15
Copper (Cu)			99.5		%		70-130	28-SEP-15
Lead (Pb)			104.1		%		70-130	28-SEP-15
Molybdenum (Mo)			102.6		%		70-130	28-SEP-15
Nickel (Ni)			102.2		%		70-130	28-SEP-15
Selenium (Se)			0.84		mg/kg		0.51-1.51	28-SEP-15
Silver (Ag)			110.7		%		70-130	28-SEP-15
Thallium (Tl)			0.42		mg/kg		0.23-0.43	28-SEP-15
Tin (Sn)			96.1		%		70-130	28-SEP-15
Uranium (U)			112.0		%		70-130	28-SEP-15
Vanadium (V)			105.0		%		70-130	28-SEP-15
Zinc (Zn)			99.9		%		70-130	28-SEP-15
WG2179848-5 CRM		**OGGEO08**						
Antimony (Sb)			101.7		%		70-130	28-SEP-15
Arsenic (As)			99.3		%		70-130	28-SEP-15
Barium (Ba)			85.1		%		70-130	28-SEP-15
Beryllium (Be)			129.2		%		70-130	28-SEP-15
Cadmium (Cd)			87.4		%		70-130	28-SEP-15
Chromium (Cr)			98.4		%		70-130	28-SEP-15
Cobalt (Co)			94.4		%		70-130	28-SEP-15
Copper (Cu)			92.4		%		70-130	28-SEP-15
Lead (Pb)			92.4		%		70-130	28-SEP-15
Molybdenum (Mo)			107.6		%		70-130	28-SEP-15
Nickel (Ni)			97.1		%		70-130	28-SEP-15

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-MS-WP	**Soil**							
Batch R3278270								
WG2179848-5 CRM		**OGGEO08**						
Selenium (Se)			82.6		%		70-130	28-SEP-15
Silver (Ag)			104.2		%		70-130	28-SEP-15
Thallium (Tl)			102.2		%		70-130	28-SEP-15
Tin (Sn)			95.4		%		70-130	28-SEP-15
Uranium (U)			103.9		%		70-130	28-SEP-15
Vanadium (V)			99.7		%		70-130	28-SEP-15
Zinc (Zn)			98.1		%		70-130	28-SEP-15
WG2179848-7 DUP		**WG2179848-6**						
Antimony (Sb)		0.12	0.11		mg/kg	14	30	28-SEP-15
Arsenic (As)		1.18	1.07		mg/kg	9.5	30	28-SEP-15
Barium (Ba)		95.6	99.3		mg/kg	3.8	40	28-SEP-15
Beryllium (Be)		0.40	0.39		mg/kg	2.2	30	28-SEP-15
Cadmium (Cd)		0.263	0.261		mg/kg	0.5	30	28-SEP-15
Chromium (Cr)		16.7	16.4		mg/kg	1.4	30	28-SEP-15
Cobalt (Co)		4.17	4.13		mg/kg	0.9	30	28-SEP-15
Copper (Cu)		8.6	8.5		mg/kg	1.6	30	28-SEP-15
Lead (Pb)		7.61	7.39		mg/kg	2.9	40	28-SEP-15
Molybdenum (Mo)		0.120	0.104		mg/kg	14	40	28-SEP-15
Nickel (Ni)		10.4	10.2		mg/kg	1.6	30	28-SEP-15
Selenium (Se)		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	28-SEP-15
Silver (Ag)		<0.10	<0.10	RPD-NA	mg/kg	N/A	40	28-SEP-15
Thallium (Tl)		0.10	<0.10	RPD-NA	mg/kg	N/A	30	28-SEP-15
Tin (Sn)		<5.0	<5.0	RPD-NA	mg/kg	N/A	40	28-SEP-15
Uranium (U)		0.726	0.729		mg/kg	0.5	30	28-SEP-15
Vanadium (V)		28.3	28.4		mg/kg	0.3	30	28-SEP-15
Zinc (Zn)		48	45		mg/kg	6.9	30	28-SEP-15
WG2179848-2 LCS								
Antimony (Sb)			99.5		%		80-120	28-SEP-15
Arsenic (As)			91.7		%		80-120	28-SEP-15
Barium (Ba)			100.2		%		80-120	28-SEP-15
Beryllium (Be)			101.1		%		80-120	28-SEP-15
Cadmium (Cd)			96.9		%		80-120	28-SEP-15
Chromium (Cr)			97.8		%		80-120	28-SEP-15

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-MS-WP	**Soil**							
Batch R3278270								
WG2179848-2 LCS								
Cobalt (Co)			95.3		%		80-120	28-SEP-15
Copper (Cu)			94.1		%		80-120	28-SEP-15
Lead (Pb)			100.5		%		80-120	28-SEP-15
Molybdenum (Mo)			103.4		%		80-120	28-SEP-15
Nickel (Ni)			95.2		%		80-120	28-SEP-15
Selenium (Se)			99.0		%		80-120	28-SEP-15
Silver (Ag)			104.5		%		80-120	28-SEP-15
Thallium (Tl)			95.9		%		80-120	28-SEP-15
Tin (Sn)			96.0		%		80-120	28-SEP-15
Uranium (U)			105.4		%		80-120	28-SEP-15
Vanadium (V)			100.6		%		80-120	28-SEP-15
Zinc (Zn)			95.5		%		80-120	28-SEP-15
WG2179848-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	28-SEP-15
Arsenic (As)			<0.10		mg/kg		0.1	28-SEP-15
Barium (Ba)			<0.50		mg/kg		0.5	28-SEP-15
Beryllium (Be)			<0.10		mg/kg		0.1	28-SEP-15
Cadmium (Cd)			<0.020		mg/kg		0.02	28-SEP-15
Chromium (Cr)			<1.0		mg/kg		1	28-SEP-15
Cobalt (Co)			<0.020		mg/kg		0.02	28-SEP-15
Copper (Cu)			<1.0		mg/kg		1	28-SEP-15
Lead (Pb)			<0.20		mg/kg		0.2	28-SEP-15
Molybdenum (Mo)			<0.020		mg/kg		0.02	28-SEP-15
Nickel (Ni)			<0.50		mg/kg		0.5	28-SEP-15
Selenium (Se)			<0.50		mg/kg		0.5	28-SEP-15
Silver (Ag)			<0.10		mg/kg		0.1	28-SEP-15
Thallium (Tl)			<0.10		mg/kg		0.1	28-SEP-15
Tin (Sn)			<5.0		mg/kg		5	28-SEP-15
Uranium (U)			<0.020		mg/kg		0.02	28-SEP-15
Vanadium (V)			<0.50		mg/kg		0.5	28-SEP-15
Zinc (Zn)			<10		mg/kg		10	28-SEP-15
N-TOTKJ-COL-SK	**Soil**							

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
N-TOTKJ-COL-SK	**Soil**							
Batch R3278865								
WG2179894-2 DUP		**L1676461-3**						
Total Kjeldahl Nitrogen		0.73	0.685		%	6.5	20	29-SEP-15
WG2179894-3 IRM		**08-109_SOIL**						
Total Kjeldahl Nitrogen			99.2		%		80-120	29-SEP-15
WG2179894-4 MB								
Total Kjeldahl Nitrogen			<0.020		%		0.02	29-SEP-15
WG2179894-5 RB								
Total Kjeldahl Nitrogen			<0.020		%			29-SEP-15
N2/N3-AVAIL-KCL-SK	**Soil**							
Batch R3278432								
WG2179947-1 DUP		**L1677910-10**						
Nitrite-N		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	28-SEP-15
Nitrate+Nitrite-N		7.0	6.8		mg/kg	2.6	30	28-SEP-15
WG2179947-3 IRM		**SAL814**						
Nitrate+Nitrite-N			92.5		%		70-130	28-SEP-15
WG2179947-2 MB								
Nitrite-N			<0.50		mg/kg		0.5	28-SEP-15
Nitrate+Nitrite-N			<2.0		mg/kg		2	28-SEP-15
NH4-AVAIL-SK	**Soil**							
Batch R3278433								
WG2179946-1 DUP		**L1677910-10**						
Available Ammonium-N		8.7	8.8		mg/kg	0.9	20	28-SEP-15
WG2179946-3 IRM		**SAL814**						
Available Ammonium-N			106.8		%		70-130	28-SEP-15
WG2179946-2 MB								
Available Ammonium-N			<1.0		mg/kg		1	28-SEP-15
PH,EC-1:2-SK	**Soil**							
Batch R3278089								
WG2179950-1 DUP		**L1677910-12**						
Conductivity (1:2)		0.261	0.241		dS m-1	8.0	20	28-SEP-15
pH (1:2 soil:water)		8.24	8.30	J	pH	0.06	0.3	28-SEP-15
WG2179950-3 IRM		**SAL814**						
Conductivity (1:2)			92.3		%		80-120	28-SEP-15
pH (1:2 soil:water)			8.04		pH		7.65-8.25	28-SEP-15
WG2179950-2 MB								
Conductivity (1:2)			<0.050		dS m-1		0.05	28-SEP-15
PO4-AVAIL-OLSEN-SK	**Soil**							

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PO4-AVAIL-OLSEN-SK	**Soil**							
Batch R3278418								
WG2179949-1 DUP		**L1677910-12**						
Available Phosphate-P		10.1	9.7		mg/kg	4.0	30	28-SEP-15
WG2179949-3 IRM		**FARM2005**						
Available Phosphate-P			87.4		%		70-130	28-SEP-15
WG2179949-2 MB								
Available Phosphate-P			<1.0		mg/kg		1	28-SEP-15
S-TOT-LECO-SK	**Soil**							
Batch R3279475								
WG2179753-1 DUP		**L1677910-14**						
Sulfur (S)-Total		1000	1200		mg/kg	19	30	29-SEP-15
WG2179753-2 IRM		**1646A_SOIL**						
Sulfur (S)-Total			3000		mg/kg		2500-4600	29-SEP-15
WG2179753-3 MB								
Sulfur (S)-Total			<500		mg/kg		500	29-SEP-15

Quality Control Report

Workorder: L1677910 Report Date: 30-SEP-15

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1677910-COFC

COC Number: 14 - 455529

Page 1 of 2

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Inmin Group	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	R ☐ Regular (Standard TAT if received by 3pm)
Contact:	Brian Moons	Quality Control (QC) Report with Report	☐ Yes ☐ No	P ☒ Priority (2-4 business days if received by 3pm)
Address:	111-93 Lombard Ave.	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
Phone:	204 943 3178	Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
		Email 1 or Fax		Specify Date Required for E2,E or P: Sept. 28
		Email 2		

Invoice To		Invoice Distribution	
	Same as Report To ☒ Yes ☐ No	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ Yes ☐ No	Email 1 or Fax	accountspayable@mmm.ca
Company:		Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q37455	Approver ID:	Cost Center:
Job #:		GL Account:	Routing Code:
PO / AFE:	3315438	Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler: B Moons

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	metals	Number of Containers
1	SW-8 003 0-6 M	23-Sep-15		Soil	X	1
2	SW-8 004 0-6. M				X	1
3	SW-9 005 0-6 M				X	1
4	SW-9 006 0-6. M				X	1
5	NE-10 007 0-6. M				X	1
6	NE-11 008 0-6 M				X	1

RL

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☐ No	When applicable use sample label on exterior bag
Are samples for human drinking water use? ☐ Yes ☐ No	CCME guidelines

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice packs	Yes ☐	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☐				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by: CJB	Date: 09/24/15	Time: 10:40	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

4°C

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1677910-COFC

COC Number: 14 - 455530

Page 2 of 2

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	MMM Group	Select Report Format:	PDF EXCEL EDD (DIGITAL)	R Regular (Standard TAT if received by 3pm)
Contact:	Brian Moons	Quality Control (QC) Report with Report	Yes No	P Priority (2-4 business days if received by 3pm)
Address:	111-93 Lombard Ave.	Criteria on Report - provide details below if box checked		E Emergency (1-2 business days if received by 3pm)
Phone:	204 943 3178	Select Distribution:	EMAIL MAIL FAX	E2 Same day or weekend emergency if received by 10am – contact ALS for surcharge.
		Email 1 or Fax	KeanD@mmm.ca	Specify Date Required for E2,E or P: Sept 28
		Email 2	MoonsB@mmm.ca	

Invoice To	Same as Report To	Yes No	Invoice Distribution		
	Copy of Invoice with Report	Yes No	Select Invoice Distribution:	EMAIL MAIL FAX	
Company:			Email 1 or Fax	accountspayable@mmm.ca	
Contact:			Email 2		

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q37455	Approver ID:	Cost Center:
Job #:		GL Account:	Routing Code:
PO / AFE:	3315438	Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only):

ALS Contact:

Sampler: BMoons

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ISH

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TKN	Ammonium - N	Nitrate - N	Nitrite - N	Oxen phosphorus	Avail. potassium	Avail. Sulphur	pH	E.C.					Number of Containers
9	SW-8 003 0-6 N	23-Sep-15		Soil	X	X	X	X	X	X	X	X	X					1
8	SW-8 004 0-6 N				X	X	X	X	X	X	X	X	X					1
9	SW-9 005 0-6 N				X	X	X	X	X	X	X	X	X					1
10	SW-9 006 0-6 N				X	X	X	X	X	X	X	X	X					1
11	NE-10 007 0-6 N				X	X	X	X	X	X	X	X	X					1
12	NE-11 008 0-6 N				X	X	X	X	X	X	X	X	X					1
13	SW-8 003 6-24 N	23-Sep-15		Soil	X	X	X				X							1
14	SW-8 004 6-24 N				X	X	X				X							1
15	SW-9 005 6-24 N				X	X	X				X							1
16	SW-9 006 6-24 N				X	X	X				X							1
17	NE-10 007 6-24 N				X	X	X				X							1
18	NE-11 008 6-24 N				X	X	X				X							1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? Yes No	When applicable use sample label on exterior bag
Are samples for human drinking water use? Yes No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen		SIF Observations	Yes	No	
Ice packs	Yes No	Custody seal intact	Yes	No	
Cooling Initiated					

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by: OB	Date: 09/24/15	Time: 10:40	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS FM-0326e v08 Front03 October 2013

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

4°C

MMM Group Ltd.
ATTN: BRIAN MOONS
111-93 Lombard Ave
Winnipeg MB R3B 3B1

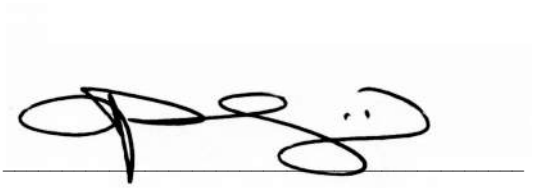
Date Received: 22-JUL-15
Report Date: 11-AUG-15 09:40 (MT)
Version: FINAL

Client Phone: 204-803-9488

Certificate of Analysis

Lab Work Order #: L1646440

Project P.O. #: STEINBACH BIOSOLIDS
Job Reference:
C of C Numbers:
Legal Site Desc:



Judy Dalmaijer
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1646440-1 CELL 2									
Sampled By: CLIENT on 22-JUL-15 @ 11:00									
Matrix: sludge									
Miscellaneous Parameters									
Boron (B), Hot Water Ext.	8.9	+/-1.6	DLM	2.6	mg/kg	0	28-JUL-15	28-JUL-15	R3234247
Note: Sample was analyzed on as received sample - reported on dry matter									
Available Phosphate-P	135	-		1.0	mg/kg	-	28-JUL-15	28-JUL-15	R3234717
Note: Done as Rec'd, back calc to dry									
Available Potassium	397	+/-50		30	mg/kg	-11.8%	27-JUL-15	27-JUL-15	R3235034
Note: Done as Rec'd, Back Calculated to Dry									
Available Sulfate-S	137	+/-25	DLM	39	mg/kg	0	28-JUL-15	28-JUL-15	R3234988
Note: Sample was analyzed on as received sample - reported on dry matter									
Mercury (Hg)	1.19	-	DLA	0.20	mg/kg	-	27-JUL-15	28-JUL-15	R3234750
% Moisture	89.8	+/-10		0.10	%	0	28-JUL-15	28-JUL-15	R3233737
% Saturation	Oversat	-		1.0	%	-	28-JUL-15	28-JUL-15	R3233966
Special Request	See Attached	-				-		07-AUG-15	R3242184
Specific Gravity	1.03	-		0.010	kg/L	-		31-JUL-15	R3236644
Total Carbon by Combustion	2.0	+/-0.2		0.1	%	0	27-JUL-15	27-JUL-15	R3234100
Note: Sample analyzed on as received, sample reported on as received.									
Total Kjeldahl Nitrogen	0.116	+/-0.023		0.020	%	0	28-JUL-15	29-JUL-15	R3234952
Note: Sample Ran As Rec'd, Results Back Calculated As Dry									
Organic Matter by LOI at 375 deg C.									
Organic Matter	17.0	+/-3.1		1.0	%	0	28-JUL-15	28-JUL-15	R3234721
Loss on Ignition @ 375 C	21.4	+/-3.6		1.0	%	0	28-JUL-15	28-JUL-15	R3234721
Total Solids and Total Volatile Solids									
Total Solids	8.80	-		0.10	%	-	29-JUL-15	29-JUL-15	R3235013
Total Volatile Solids (dry basis)	29.7	-		0.10	%	-	29-JUL-15	29-JUL-15	R3235013
pH and EC (1:2 Soil:Water Extraction)									
Conductivity (1:2)	4.05	-		0.050	dS m-1	-	07-AUG-15	07-AUG-15	R3234180
pH (1:2 soil:water)	7.59	-		0.10	pH	-	07-AUG-15	07-AUG-15	R3234180
Detailed Salinity in dry-weight mg/kg									
Chloride (Cl)	2340	-		35	mg/kg dwt	-		28-JUL-15	
Calcium (Ca)	859	-		35	mg/kg dwt	-		28-JUL-15	
Magnesium (Mg)	633	-		35	mg/kg dwt	-		28-JUL-15	
Potassium (K)	149	-		18	mg/kg dwt	-		28-JUL-15	
Sodium (Na)	1900	-		70	mg/kg dwt	-		28-JUL-15	
Sulfur (as SO4)	157	-		88	mg/kg dwt	-		28-JUL-15	
Detailed Salinity in wet-weight mg/kg									
Chloride (Cl)	239	-		3.6	mg/kg wwt	-		28-JUL-15	
Calcium (Ca)	87.6	-		3.6	mg/kg wwt	-		28-JUL-15	
Magnesium (Mg)	64.6	-		3.6	mg/kg wwt	-		28-JUL-15	
Potassium (K)	15.2	-		1.8	mg/kg wwt	-		28-JUL-15	
Sodium (Na)	194	-		7.2	mg/kg wwt	-		28-JUL-15	
Sulfur (as SO4)	16.0	-		9.0	mg/kg wwt	-		28-JUL-15	
Metals									
Aluminum (Al)	9680	+/-2400		5.0	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Antimony (Sb)	1.34	+/-0.30		0.10	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Arsenic (As)	3.93	+/-0.50		0.10	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Barium (Ba)	683	+/-190		0.50	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Beryllium (Be)	0.28	+/-0.09		0.10	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Bismuth (Bi)	11.4	+/-2.2		0.020	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Boron (B)	16	+/-5		10	mg/kg	0	27-JUL-15	27-JUL-15	R3233554

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1646440-1 CELL 2									
Sampled By: CLIENT on 22-JUL-15 @ 11:00									
Matrix: sludge									
Metals									
Cadmium (Cd)	1.21	+/-0.22		0.020	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Calcium (Ca)	77300	+/-14000		100	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Chromium (Cr)	26.4	+/-4.8		1.0	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Cobalt (Co)	4.52	+/-0.63		0.020	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Copper (Cu)	694	+/-100		1.0	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Iron (Fe)	16700	+/-2100		25	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Lead (Pb)	17.2	+/-3.4		0.20	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Magnesium (Mg)	34900	+/-6600		10	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Manganese (Mn)	189	+/-32		0.50	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Molybdenum (Mo)	17.9	+/-3.2		0.020	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Nickel (Ni)	15.4	+/-1.9		0.50	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Phosphorus (P)	4610	+/-800		100	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Potassium (K)	1590	+/-340		25	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Selenium (Se)	3.42	+/-0.61		0.50	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Silver (Ag)	9.69	+/-2.2		0.10	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Sodium (Na)	1440	+/-260		10	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Strontium (Sr)	113	+/-22		0.10	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Thallium (Tl)	0.12	+/-0.05		0.10	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Tin (Sn)	12.9	+/-2.5		5.0	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Titanium (Ti)	57.9	+/-11		0.50	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Uranium (U)	8.47	+/-1.7		0.020	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Vanadium (V)	24.0	+/-5.4		0.50	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Zinc (Zn)	422	+/-53		10	mg/kg	0	27-JUL-15	27-JUL-15	R3233554
Total Available N & NO3-N, NO2-N & NH4									
Available Ammonium-N									
Available Ammonium-N	397	+/-56	DLM	44	mg/kg	0	28-JUL-15	28-JUL-15	R3234532
Note: Done as rec'd, back caclulated to dry									
Available Ammonium-N - Calculation									
Total Available Nitrogen	397	-		48	mg/kg	-		29-JUL-15	
Nitrate, Nitrite & Nitrate+Nitrite-N(KCL									
Nitrite-N	<4.0	-	DLM	4.0	mg/kg	-	28-JUL-15	28-JUL-15	R3233911
Nitrate+Nitrite-N	<20	-	DLM	20	mg/kg	-	28-JUL-15	28-JUL-15	R3233911
Nitrate-N	<20	-	DLM	20	mg/kg	-	28-JUL-15	28-JUL-15	R3233911
Detailed Salinity -over sat'd waste									
Chloride (Cl)									
Chloride (Cl)	266	-	DLA	4.0	mg/L	-	28-JUL-15	28-JUL-15	R3233833
SAR and Cations (over sat'd)									
Calcium (Ca)	97.6	-	DLA	4.0	mg/L	-	28-JUL-15	28-JUL-15	R3233954
Potassium (K)	16.9	-	DLA	2.0	mg/L	-	28-JUL-15	28-JUL-15	R3233954
Magnesium (Mg)	71.9	-	DLA	4.0	mg/L	-	28-JUL-15	28-JUL-15	R3233954
Sodium (Na)	216	-	DLA	8.0	mg/L	-	28-JUL-15	28-JUL-15	R3233954
Sulfur (as SO4)	18	-	DLA	10	mg/L	-	28-JUL-15	28-JUL-15	R3233954
SAR	4.04	-		0.10	SAR	-	28-JUL-15	28-JUL-15	R3233954
pH and Conductivity									
pH	7.24	-		0.10	pH	-	28-JUL-15	28-JUL-15	R3233966
Conductivity (EC)	2.28	-		0.010	dS m-1	-	28-JUL-15	28-JUL-15	R3233966

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Conductivity (EC)	B	
Duplicate	Total Kjeldahl Nitrogen	DLA	

Sample Parameter Qualifier Key:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
DLA	Detection Limit adjusted for required dilution
DLM	Detection Limit Adjusted due to sample matrix effects.

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-HOTW-SK	Soil	Available Boron, Hot Water		SSSA (1996) P. 610-611
Hot water is used to extract the plant-available and potentially plant-available boron from soil. Boron in the extract is determined by ICP-OES.				
C-TOT-LECO-SK	Soil	Total Carbon by combustion method		SSSA (1996) P. 973-974
The sample is ignited in a combustion analyzer where carbon in the reduced CO2 gas is determined using a thermal conductivity detector.				
CL-COL-SK	Waste	Chloride (Cl)		APHA 4110B
ETL-N-TOT-AVAIL-SK	Soil	Available Ammonium-N - Calculation		Soil Methods of Analysis (1993) CSSS
HG-200.2-CVAF-WP	Soil	Mercury in Soil by CVAFS		EPA 200.2/1631E (mod)
Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.				
K-AVAIL-SK	Soil	Available Potassium		Comm. Soil Sci. Plant, 25 (5&6)
Plant available potassium is extracted from the soil using Modified Kelowna solution. Potassium in the soil extract is determined by flame emission at 770 nm.				
MET-200.2-MS-WP	Soil	Metals		EPA 200.2/6020A
Samples for analysis are homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested by block digester (EPA 200.2). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A). Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.				
MOIST-SK	Soil	Moisture Content		ASTM D2216-80
The weighed portion of soil is placed in a 105°C oven overnight. The dried soil is allowed to cooled to room temperature, weighed and the % moisture is calculated. Reference: ASTM D2216-80				
N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen		CSSS (1993) 22.2.3
The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.				
N2/N3-AVAIL-KCL-SK	Soil	Nitrate, Nitrite & Nitrate+Nitrite-N(KCL		CSSS (1993) p. 26-28
Plant available nitrate and nitrite are extracted from the sample with 2N KCl. Nitrate and Nitrite in the filtered extract are determined colorimetrically by Technicon auto-analyzer or flow injection analyzer at 520 nm.				
NH4-AVAIL-SK	Soil	Available Ammonium-N		CSSS(1993) 4.2/COMM SOIL SCI 19(6)
Ammonium (NH4-N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.				
OM-LOI-SK	Soil	Organic Matter by LOI at 375 deg C.		CSSS (1978) p. 160

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**

The dry-ash method involves the removal of organic matter by combustion at 375 degrees C for a minimum of 16 hours. Samples are dried prior to combustion.

Reference: McKeague, J.A. Soil Sampling and Methods of Analysis. Can. Soc. Soil Sci.(1978) method 4.23

PH,EC-1:2-SK	Soil	pH and EC (1:2 Soil:Water Extraction)	CSSC 3.13/CSSS 18.3.1

1 part dry soil and 2 parts de-ionized water (by volume) is mixed. The slurry is allowed to stand with occasional stirring for 30 - 60 minutes. After equilibration, pH of the slurry is measured using a pH meter. Conductivity of the filtered extract is measured by a conductivity meter.

PH/EC-SK	Waste	pH and Conductivity	APHA 4500-H,2510
PO4-AVAIL-OLSEN-SK	Soil	Available Phosphate-P by Olsen	CSSS (1993) 7.2,7.3.1

Plant available phosphorus is extracted from the sample with sodium bicarbonate. PO4-P in the filtered extract is determined colorimetrically at 880 nm.

SAL-D50-DRYCALC-SK	Waste	Detailed Salinity in dry-weight mg/kg	Calculation

Conversion of Saturation Extract soluble ions from units of mg/L to dry-weight mg/kg.
For over-saturated wastes:
mg/kg dwt = mg/L * % Moisture / (100% - % Moisture)
For under-saturated wastes:
mg/kg dwt = mg/L * (% Saturation / 100%)

SAL-D50-WETCALC-SK	Waste	Detailed Salinity in wet-weight mg/kg	Calculation

Conversion of Saturation Extract soluble ions from units of mg/L to wet-weight mg/kg.
For over-saturated wastes:
mg/kg wwt = mg/L * % Moisture / 100%
For under-saturated wastes:
mg/kg wwt = mg/L * (% Saturation / 100%) * (100% - % Moisture) / 100%

SALINITY-INTCHECK-SK	Soil		CSSS 18.4-Calculation
SAR-CALC-SK	Waste	SAR and Cations (over sat'd)	APHA 3120B
SAT-PCNT-SK	Soil	Saturated Paste	CSSS (1993) 18.2.2
SO4-AVAIL-SK	Soil	Available Sulfate-S	REC METH SOIL ANAL - AB. AG(1988)

Plant available sulfate in the soil is extracted using a weak calcium chloride solution. Sulfate in the extract is determined by ICP-OES.

SOLIDS-TOT/TOTVOL-SK	Manure	Total Solids and Total Volatile Solids	APHA 2540G

A well-mixed sample is evaporated in a weighed dish and dried to constant weight in an oven at 103-105"C. The increase in weight over that of the empty dish represents the Total Solids. The crucible is then ignited at 550"–10"C for 1 hour. The remaining solids represent the Total Fixed Solids, while the weight lost on ignition represents the Total Volatile Solids.

SPECGRAV-CL	Soil	Specific Gravity	ASTM D 5057 - 90

A portion of sample is weighed in a container that is calibrated for volume. Specific Gravity is reported as the mass of sample per mass of an equal volume of pure water, where the density of pure water is taken to be 1.00 g/mL.

SPECIAL REQUEST-SK	Misc.	Special Request Sask Lab	SEE SUBLET LAB RESULTS

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surr - 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.
MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.
Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent. Zero values indicate no detectable method bias.

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.

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-HOTW-SK	**Soil**							
Batch R3234247								
WG2136173-1 DUP		**L1647598-2**						
Boron (B), Hot Water Ext.		1.40	1.47		mg/kg	5.1	30	28-JUL-15
WG2136173-3 IRM		**SAL814**						
Boron (B), Hot Water Ext.			105.3		%		70-130	28-JUL-15
WG2136173-2 MB								
Boron (B), Hot Water Ext.			<0.20		mg/kg		0.2	28-JUL-15
C-TOT-LECO-SK	**Soil**							
Batch R3234100								
WG2136651-2 DUP		**L1647562-2**						
Total Carbon by Combustion		1.6	1.6		%	2.7	20	27-JUL-15
WG2136651-3 IRM		**08-109_SOIL**						
Total Carbon by Combustion			102.6		%		80-120	27-JUL-15
WG2136651-5 MB								
Total Carbon by Combustion			<0.1		%		0.1	27-JUL-15
HG-200.2-CVAF-WP	**Soil**							
Batch R3234750								
WG2138700-3 CRM		**CANMET TILL-1**						
Mercury (Hg)			0.102		mg/kg		0.048-0.148	28-JUL-15
WG2138700-4 CRM		**PACS-3**						
Mercury (Hg)			105.0		%		70-130	28-JUL-15
WG2138700-5 DUP		**L1645935-1**						
Mercury (Hg)		0.081	0.080		mg/kg	0.7	40	28-JUL-15
WG2138700-2 LCS								
Mercury (Hg)			100.9		%		80-120	28-JUL-15
WG2138700-1 MB								
Mercury (Hg)			<0.050		mg/kg		0.05	28-JUL-15
K-AVAIL-SK	**Soil**							
Batch R3235034								
WG2137421-2 IRM		**FARM2005**						
Available Potassium			92.6		%		70-130	27-JUL-15
WG2137421-1 MB								
Available Potassium			<20		mg/kg		20	27-JUL-15
MET-200.2-MS-WP	**Soil**							
Batch R3233554								
WG2137408-3 CRM		**CANMET TILL-1**						
Aluminum (Al)			105.6		%		70-130	27-JUL-15
Antimony (Sb)			106.8		%		70-130	27-JUL-15

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-MS-WP	**Soil**							
Batch R3233554								
WG2137408-3 CRM		**CANMET TILL-1**						
Arsenic (As)			112.4		%		70-130	27-JUL-15
Barium (Ba)			100.6		%		70-130	27-JUL-15
Beryllium (Be)			101.3		%		70-130	27-JUL-15
Bismuth (Bi)			101.0		%		70-130	27-JUL-15
Cadmium (Cd)			103.8		%		70-130	27-JUL-15
Calcium (Ca)			108.0		%		70-130	27-JUL-15
Chromium (Cr)			110.3		%		70-130	27-JUL-15
Cobalt (Co)			108.3		%		70-130	27-JUL-15
Copper (Cu)			103.4		%		70-130	27-JUL-15
Iron (Fe)			104.2		%		70-130	27-JUL-15
Lead (Pb)			94.2		%		70-130	27-JUL-15
Magnesium (Mg)			113.6		%		70-130	27-JUL-15
Manganese (Mn)			109.0		%		70-130	27-JUL-15
Molybdenum (Mo)			95.6		%		70-130	27-JUL-15
Nickel (Ni)			107.0		%		70-130	27-JUL-15
Phosphorus (P)			108.4		%		70-130	27-JUL-15
Potassium (K)			116.2		%		70-130	27-JUL-15
Selenium (Se)			105.0		%		70-130	27-JUL-15
Silver (Ag)			121.0		%		70-130	27-JUL-15
Sodium (Na)			113.6		%		70-130	27-JUL-15
Strontium (Sr)			109.5		%		70-130	27-JUL-15
Thallium (Tl)			0.15		mg/kg		0.03-0.23	27-JUL-15
Tin (Sn)			93.1		%		70-130	27-JUL-15
Titanium (Ti)			108.0		%		70-130	27-JUL-15
Uranium (U)			110.5		%		70-130	27-JUL-15
Vanadium (V)			112.5		%		70-130	27-JUL-15
Zinc (Zn)			102.1		%		70-130	27-JUL-15
WG2137408-4 CRM		**PACS-3**						
Aluminum (Al)			113.9		%		70-130	27-JUL-15
Antimony (Sb)			108.7		%		70-130	27-JUL-15
Arsenic (As)			105.8		%		70-130	27-JUL-15
Barium (Ba)			99.0		%		70-130	27-JUL-15
Beryllium (Be)			109.1		%		70-130	27-JUL-15
Boron (B)			99.7		%		70-130	27-JUL-15

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-MS-WP	**Soil**							
Batch R3233554								
WG2137408-4 CRM		**PACS-3**						
Cadmium (Cd)			103.6		%		70-130	27-JUL-15
Calcium (Ca)			105.2		%		70-130	27-JUL-15
Chromium (Cr)			108.2		%		70-130	27-JUL-15
Cobalt (Co)			106.6		%		70-130	27-JUL-15
Copper (Cu)			110.2		%		70-130	27-JUL-15
Iron (Fe)			106.0		%		70-130	27-JUL-15
Lead (Pb)			97.9		%		70-130	27-JUL-15
Magnesium (Mg)			125.2		%		70-130	27-JUL-15
Manganese (Mn)			105.2		%		70-130	27-JUL-15
Molybdenum (Mo)			95.6		%		70-130	27-JUL-15
Nickel (Ni)			109.4		%		70-130	27-JUL-15
Phosphorus (P)			111.4		%		70-130	27-JUL-15
Potassium (K)			110.0		%		70-130	27-JUL-15
Selenium (Se)			1.00		mg/kg		0.51-1.51	27-JUL-15
Silver (Ag)			103.8		%		70-130	27-JUL-15
Sodium (Na)			114.5		%		70-130	27-JUL-15
Strontium (Sr)			92.7		%		70-130	27-JUL-15
Thallium (Tl)			0.39		mg/kg		0.23-0.43	27-JUL-15
Tin (Sn)			98.3		%		70-130	27-JUL-15
Titanium (Ti)			111.8		%		70-130	27-JUL-15
Uranium (U)			101.5		%		70-130	27-JUL-15
Vanadium (V)			113.1		%		70-130	27-JUL-15
Zinc (Zn)			103.3		%		70-130	27-JUL-15
WG2137408-5 CRM		**OGGEO08**						
Aluminum (Al)			110.7		%		70-130	27-JUL-15
Antimony (Sb)			105.6		%		70-130	27-JUL-15
Arsenic (As)			110.1		%		70-130	27-JUL-15
Barium (Ba)			88.5		%		70-130	27-JUL-15
Beryllium (Be)			117.8		%		70-130	27-JUL-15
Bismuth (Bi)			101.1		%		70-130	27-JUL-15
Cadmium (Cd)			93.3		%		70-130	27-JUL-15
Calcium (Ca)			96.7		%		70-130	27-JUL-15
Chromium (Cr)			102.4		%		70-130	27-JUL-15
Cobalt (Co)			96.6		%		70-130	27-JUL-15

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-MS-WP	**Soil**							
Batch R3233554								
WG2137408-5 CRM		**OGGEO08**						
Copper (Cu)			98.3		%		70-130	27-JUL-15
Iron (Fe)			106.5		%		70-130	27-JUL-15
Lead (Pb)			89.7		%		70-130	27-JUL-15
Magnesium (Mg)			109.8		%		70-130	27-JUL-15
Manganese (Mn)			100.1		%		70-130	27-JUL-15
Molybdenum (Mo)			100.9		%		70-130	27-JUL-15
Nickel (Ni)			105.0		%		70-130	27-JUL-15
Phosphorus (P)			95.9		%		70-130	27-JUL-15
Potassium (K)			109.2		%		70-130	27-JUL-15
Selenium (Se)			97.9		%		70-130	27-JUL-15
Silver (Ag)			98.1		%		70-130	27-JUL-15
Sodium (Na)			122.4		%		70-130	27-JUL-15
Strontium (Sr)			99.3		%		70-130	27-JUL-15
Thallium (Tl)			98.3		%		70-130	27-JUL-15
Tin (Sn)			94.7		%		70-130	27-JUL-15
Titanium (Ti)			102.2		%		70-130	27-JUL-15
Uranium (U)			93.6		%		70-130	27-JUL-15
Vanadium (V)			102.6		%		70-130	27-JUL-15
Zinc (Zn)			100.8		%		70-130	27-JUL-15
WG2137408-7 DUP		**WG2137408-6**						
Aluminum (Al)		20000	18300		mg/kg	8.7	40	27-JUL-15
Antimony (Sb)		0.34	0.36		mg/kg	4.8	30	27-JUL-15
Arsenic (As)		10.8	9.76		mg/kg	9.8	30	27-JUL-15
Barium (Ba)		179	155		mg/kg	15	40	27-JUL-15
Beryllium (Be)		0.69	0.67		mg/kg	2.9	30	27-JUL-15
Bismuth (Bi)		0.274	0.270		mg/kg	1.3	30	27-JUL-15
Boron (B)		11	11		mg/kg	0.8	30	27-JUL-15
Cadmium (Cd)		0.405	0.417		mg/kg	2.8	30	27-JUL-15
Calcium (Ca)		7160	6940		mg/kg	3.2	30	27-JUL-15
Chromium (Cr)		45.6	41.3		mg/kg	9.8	30	27-JUL-15
Cobalt (Co)		15.9	14.6		mg/kg	8.1	30	27-JUL-15
Copper (Cu)		32.8	29.5		mg/kg	11	30	27-JUL-15
Iron (Fe)		26300	25200		mg/kg	4.2	30	27-JUL-15

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-MS-WP	**Soil**							
Batch R3233554								
WG2137408-7 DUP		**WG2137408-6**						
Lead (Pb)		14.6	14.8		mg/kg	1.1	40	27-JUL-15
Magnesium (Mg)		9710	9380		mg/kg	3.5	30	27-JUL-15
Manganese (Mn)		1080	1000		mg/kg	7.6	30	27-JUL-15
Molybdenum (Mo)		0.453	0.454		mg/kg	0.1	40	27-JUL-15
Nickel (Ni)		44.0	40.4		mg/kg	8.3	30	27-JUL-15
Phosphorus (P)		960	930		mg/kg	3.6	30	27-JUL-15
Potassium (K)		4110	3730		mg/kg	9.7	40	27-JUL-15
Selenium (Se)		0.65	0.64		mg/kg	2.4	30	27-JUL-15
Silver (Ag)		0.15	0.16		mg/kg	3.1	40	27-JUL-15
Sodium (Na)		300	270		mg/kg	10	40	27-JUL-15
Strontium (Sr)		34.0	34.1		mg/kg	0.2	40	27-JUL-15
Thallium (Tl)		0.29	0.30		mg/kg	3.1	30	27-JUL-15
Tin (Sn)		<5.0	<5.0	RPD-NA	mg/kg	N/A	40	27-JUL-15
Titanium (Ti)		677	649		mg/kg	4.2	40	27-JUL-15
Uranium (U)		2.48	2.51		mg/kg	1.2	30	27-JUL-15
Vanadium (V)		66.5	61.4		mg/kg	8.0	30	27-JUL-15
Zinc (Zn)		74	68		mg/kg	8.5	30	27-JUL-15
WG2137408-2 LCS								
Aluminum (Al)			108.0		%		80-120	27-JUL-15
Antimony (Sb)			100.6		%		80-120	27-JUL-15
Arsenic (As)			103.3		%		80-120	27-JUL-15
Barium (Ba)			102.6		%		80-120	27-JUL-15
Beryllium (Be)			102.8		%		80-120	27-JUL-15
Bismuth (Bi)			92.0		%		80-120	27-JUL-15
Boron (B)			98.7		%		80-120	27-JUL-15
Cadmium (Cd)			104.1		%		80-120	27-JUL-15
Calcium (Ca)			100.7		%		80-120	27-JUL-15
Chromium (Cr)			102.8		%		80-120	27-JUL-15
Cobalt (Co)			103.4		%		80-120	27-JUL-15
Copper (Cu)			104.7		%		80-120	27-JUL-15
Iron (Fe)			97.1		%		80-120	27-JUL-15
Lead (Pb)			95.8		%		80-120	27-JUL-15
Magnesium (Mg)			112.6		%		80-120	27-JUL-15

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-MS-WP	**Soil**							
Batch R3233554								
WG2137408-2 LCS								
Manganese (Mn)			104.3		%		80-120	27-JUL-15
Molybdenum (Mo)			99.0		%		80-120	27-JUL-15
Nickel (Ni)			103.2		%		80-120	27-JUL-15
Phosphorus (P)			101.1		%		80-120	27-JUL-15
Potassium (K)			106.3		%		80-120	27-JUL-15
Selenium (Se)			101.3		%		80-120	27-JUL-15
Silver (Ag)			94.5		%		80-120	27-JUL-15
Sodium (Na)			116.1		%		80-120	27-JUL-15
Strontium (Sr)			98.8		%		80-120	27-JUL-15
Thallium (Tl)			95.5		%		80-120	27-JUL-15
Tin (Sn)			101.1		%		80-120	27-JUL-15
Titanium (Ti)			100.7		%		80-120	27-JUL-15
Uranium (U)			95.4		%		80-120	27-JUL-15
Vanadium (V)			106.6		%		80-120	27-JUL-15
Zinc (Zn)			97.0		%		80-120	27-JUL-15
WG2137408-1 MB								
Aluminum (Al)			<5.0		mg/kg		5	27-JUL-15
Antimony (Sb)			<0.10		mg/kg		0.1	27-JUL-15
Arsenic (As)			<0.10		mg/kg		0.1	27-JUL-15
Barium (Ba)			<0.50		mg/kg		0.5	27-JUL-15
Beryllium (Be)			<0.10		mg/kg		0.1	27-JUL-15
Bismuth (Bi)			<0.020		mg/kg		0.02	27-JUL-15
Boron (B)			<10		mg/kg		10	27-JUL-15
Cadmium (Cd)			<0.020		mg/kg		0.02	27-JUL-15
Calcium (Ca)			<100		mg/kg		100	27-JUL-15
Chromium (Cr)			<1.0		mg/kg		1	27-JUL-15
Cobalt (Co)			<0.020		mg/kg		0.02	27-JUL-15
Copper (Cu)			<1.0		mg/kg		1	27-JUL-15
Iron (Fe)			<25		mg/kg		25	27-JUL-15
Lead (Pb)			<0.20		mg/kg		0.2	27-JUL-15
Magnesium (Mg)			<10		mg/kg		10	27-JUL-15
Manganese (Mn)			<0.50		mg/kg		0.5	27-JUL-15
Molybdenum (Mo)			<0.020		mg/kg		0.02	27-JUL-15
Nickel (Ni)			<0.50		mg/kg		0.5	27-JUL-15

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-MS-WP	**Soil**							
Batch R3233554								
WG2137408-1 MB								
Phosphorus (P)			<100		mg/kg		100	27-JUL-15
Potassium (K)			<25		mg/kg		25	27-JUL-15
Selenium (Se)			<0.50		mg/kg		0.5	27-JUL-15
Silver (Ag)			<0.10		mg/kg		0.1	27-JUL-15
Sodium (Na)			<10		mg/kg		10	27-JUL-15
Strontium (Sr)			<0.10		mg/kg		0.1	27-JUL-15
Thallium (Tl)			<0.10		mg/kg		0.1	27-JUL-15
Tin (Sn)			<5.0		mg/kg		5	27-JUL-15
Titanium (Ti)			<0.50		mg/kg		0.5	27-JUL-15
Uranium (U)			<0.020		mg/kg		0.02	27-JUL-15
Vanadium (V)			<0.50		mg/kg		0.5	27-JUL-15
Zinc (Zn)			<10		mg/kg		10	27-JUL-15
MOIST-SK	**Soil**							
Batch R3233737								
WG2137339-1 DUP		**L1646440-1**						
% Moisture		89.8	89.2		%	0.6	20	28-JUL-15
N-TOTKJ-COL-SK	**Soil**							
Batch R3234952								
WG2138037-2 DUP		**L1647201-1**						
Total Kjeldahl Nitrogen		1.67	1.69		%	1.3	20	29-JUL-15
WG2138037-3 IRM		**08-109_SOIL**						
Total Kjeldahl Nitrogen			104.4		%		80-120	29-JUL-15
WG2138037-4 MB								
Total Kjeldahl Nitrogen			<0.020		%		0.02	29-JUL-15
WG2138037-5 RB								
Total Kjeldahl Nitrogen			<0.020		%			29-JUL-15
N2/N3-AVAIL-KCL-SK	**Soil**							
Batch R3233911								
WG2136178-3 IRM		**SAL814**						
Nitrate+Nitrite-N			90.4		%		70-130	28-JUL-15
WG2136178-2 MB								
Nitrite-N			<0.50		mg/kg		0.5	28-JUL-15
Nitrate+Nitrite-N			<2.0		mg/kg		2	28-JUL-15
NH4-AVAIL-SK	**Soil**							

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH4-AVAIL-SK	**Soil**							
Batch R3234532								
WG2137369-2 IRM		**SAL814**						
Available Ammonium-N			103.8		%		70-130	28-JUL-15
WG2137369-1 MB								
Available Ammonium-N			<1.0		mg/kg		1	28-JUL-15
OM-LOI-SK	**Soil**							
Batch R3234721								
WG2137282-1 DUP		**L1646600-1**						
Organic Matter		18.9	19.1		%	1.2	20	28-JUL-15
Loss on Ignition @ 375 C		23.9	24.1		%	1.2	25	28-JUL-15
WG2137282-3 IRM		**SAL2001**						
Loss on Ignition @ 375 C			91.4		%		80-120	28-JUL-15
WG2137282-2 MB								
Organic Matter			<1.0		%		1	28-JUL-15
Loss on Ignition @ 375 C			<1.0		%		1	28-JUL-15
PH,EC-1:2-SK	**Soil**							
Batch R3234180								
WG2138174-2 IRM		**SAL814**						
Conductivity (1:2)			115.9		%		80-120	07-AUG-15
pH (1:2 soil:water)			8.16		pH		7.65-8.25	07-AUG-15
WG2138174-1 MB								
Conductivity (1:2)			<0.050		dS m-1		0.05	07-AUG-15
PO4-AVAIL-OLSEN-SK	**Soil**							
Batch R3234717								
WG2138143-2 IRM		**FARM2005**						
Available Phosphate-P			76.0		%		70-130	28-JUL-15
WG2138143-1 MB								
Available Phosphate-P			<1.0		mg/kg		1	28-JUL-15
SO4-AVAIL-SK	**Soil**							
Batch R3234988								
WG2136181-3 IRM		**SAL814**						
Available Sulfate-S			95.0		%		70-130	28-JUL-15
WG2136181-2 MB								
Available Sulfate-S			<3.0		mg/kg		3	28-JUL-15
SPECGRAV-CL	**Soil**							

Quality Control Report

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SPECGRAV-CL	**Soil**							
Batch R3236644								
WG2141116-2 DUP		**L1646440-1**						
Specific Gravity		1.03	1.02		kg/L	1.0	20	31-JUL-15
WG2141116-3 IRM		**DI_H2O**						
Specific Gravity			100.0		%		90-110	31-JUL-15
CL-COL-SK	**Waste**							
Batch R3233833								
WG2137331-1 MB								
Chloride (Cl)			<1.0		mg/L		1	28-JUL-15
PH/EC-SK	**Waste**							
Batch R3233966								
WG2137331-1 MB								
Conductivity (EC)			0.014	B	dS m-1		0.01	28-JUL-15
SAR-CALC-SK	**Waste**							
Batch R3233954								
WG2137331-1 MB								
Calcium (Ca)			<2.0		mg/L		2	28-JUL-15
Potassium (K)			<1.0		mg/L		1	28-JUL-15
Magnesium (Mg)			<2.0		mg/L		2	28-JUL-15
Sodium (Na)			<4.0		mg/L		4	28-JUL-15
Sulfur (as SO4)			<5.0		mg/L		5	28-JUL-15
SOLIDS-TOT/TOTVOL-SK	**Manure**							
Batch R3235013								
WG2137178-1 DUP		**L1646440-1**						
Total Solids		8.80	8.83		%	0.4	25	29-JUL-15
Total Volatile Solids (dry basis)		29.7	28.7		%	3.1	25	29-JUL-15

Quality Control Report

Workorder: L1646440 Report Date: 11-AUG-15

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
DLA	Detection Limit adjusted for required dilution
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1646440 Report Date: 11-AUG-15

Client: MMM Group Ltd.
111-93 Lombard Ave
Winnipeg MB R3B 3B1
Contact: BRIAN MOONS

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Leachable Metals							
Available Boron, Hot Water							
	1	22-JUL-15 11:00	28-JUL-15	5	6	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1646440 were received on 22-JUL-15 12:15.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Product	Work Order	Sample	Client ID	Analyte	Result (Dry)	Result (Wet)	Qualifier	Units	LOR (dry)
PH/EC-SK	L1646440	L1646440-1	CELL 2	Conductivity (Oversaturated)		2.28		dS m-1	0.010
PH,EC-1:2-SK	L1646440	L1646440-1	CELL 2	Conductivity (1:2)	4.05			dS m-1	0.050
OM-LOI-SK	L1646440	L1646440-1	CELL 2	Loss on Ignition @ 375 C	21.4			%	1.0
MOIST-SK	L1646440	L1646440-1	CELL 2	% Moisture		89.8		%	0.10
OM-LOI-SK	L1646440	L1646440-1	CELL 2	Organic Matter	17.0			%	1.0
PH/EC-SK	L1646440	L1646440-1	CELL 2	pH (Oversaturated)		7.24		pH	0.10
PH,EC-1:2-SK	L1646440	L1646440-1	CELL 2	pH (1:2 soil:water)	7.56			pH	0.10
SOLIDS-TOT/TOTVOL-SK	L1646440	L1646440-1	CELL 2	Total Volatile Solids (dry basis)	29.7	2.6		%	0.10
SOLIDS-TOT/TOTVOL-SK	L1646440	L1646440-1	CELL 2	Total Solids		8.80		%	0.10
N-TOTKJ-COL-SK	L1646440	L1646440-1	CELL 2	Total Kjeldahl Nitrogen	0.116	0.012		%	0.020
ETL-N-TOT-AVAIL-SK	L1646440	L1646440-1	CELL 2	Total Available Nitrogen	397	40.5		mg/kg	48
C-TOT-LECO-SK	L1646440	L1646440-1	CELL 2	Total Carbon by Combustion	19.6	2.0		%	0.1
NH4-AVAIL-SK	L1646440	L1646440-1	CELL 2	Available Ammonium-N	397	40.5	DLM	mg/kg	44
N2/N3-AVAIL-KCL-SK	L1646440	L1646440-1	CELL 2	Nitrate+Nitrite-N	<20	<2	DLM	mg/kg	20
N2/N3-AVAIL-KCL-SK	L1646440	L1646440-1	CELL 2	Nitrate-N	<20	<2	DLM	mg/kg	20
N2/N3-AVAIL-KCL-SK	L1646440	L1646440-1	CELL 2	Nitrite-N	<4.0	<0.4	DLM	mg/kg	4.0
PO4-AVAIL-OLSEN-SK	L1646440	L1646440-1	CELL 2	Available Phosphate-P	135	13.8		mg/kg	1.0
K-AVAIL-SK	L1646440	L1646440-1	CELL 2	Available Potassium	397	40.5		mg/kg	30
SO4-AVAIL-SK	L1646440	L1646440-1	CELL 2	Available Sulfate-S	137	14.0	DLM	mg/kg	39
SAR-CALC-SK	L1646440	L1646440-1	CELL 2	SAR	NA	4.04		SAR	0.10
SAL-D50-WETCALC-SK	L1646440	L1646440-1	CELL 2	Calcium (Ca)	859	87.6		mg/kg	3.6
SAL-D50-WETCALC-SK	L1646440	L1646440-1	CELL 2	Chloride (Cl)	2340	239		mg/kg	3.6
SAL-D50-WETCALC-SK	L1646440	L1646440-1	CELL 2	Magnesium (Mg)	633	64.6		mg/kg	3.6
SAL-D50-DRYCALC-SK	L1646440	L1646440-1	CELL 2	Potassium (K)	149	15.2		mg/kg	18
SAT-PCNT-SK	L1646440	L1646440-1	CELL 2	% Saturation	oversaturated	oversaturated		%	1.0
SAL-D50-DRYCALC-SK	L1646440	L1646440-1	CELL 2	Sodium (Na)	1900	194		mg/kg	70
SAL-D50-DRYCALC-SK	L1646440	L1646440-1	CELL 2	Sulfur (as SO4)	157	16.0		mg/kg	88
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Aluminum (Al)	9680	987		mg/kg	5.0
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Antimony (Sb)	1.34	0.137		mg/kg	0.10
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Arsenic (As)	3.93	0.401		mg/kg	0.10
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Barium (Ba)	683	70		mg/kg	0.50
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Beryllium (Be)	0.28	0.03		mg/kg	0.10
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Bismuth (Bi)	11.4	1.16		mg/kg	0.020
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Boron (B)	16	1.63		mg/kg	10
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Cadmium (Cd)	1.21	0.12		mg/kg	0.020
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Calcium (Ca)	77300	7885		mg/kg	100
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Chromium (Cr)	26.4	2.69		mg/kg	1.0
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Cobalt (Co)	4.52	0.46		mg/kg	0.020
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Copper (Cu)	694	71		mg/kg	1.0

MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Iron (Fe)	16700	1703		mg/kg	25
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Lead (Pb)	17.2	1.75		mg/kg	0.20
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Magnesium (Mg)	34900	3560		mg/kg	10
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Manganese (Mn)	189	19		mg/kg	0.50
HG-200.2-CVAF-WP	L1646440	L1646440-1	CELL 2	Mercury (Hg)	1.19	1.19	DLA	mg/kg	0.20
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Molybdenum (Mo)	17.9	1.83		mg/kg	0.020
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Nickel (Ni)	15.4	1.57		mg/kg	0.50
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Phosphorus (P)	4610	470		mg/kg	100
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Potassium (K)	1590	162		mg/kg	25
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Selenium (Se)	3.42	0.35		mg/kg	0.50
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Silver (Ag)	9.69	0.99		mg/kg	0.10
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Sodium (Na)	1440	147		mg/kg	10
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Strontium (Sr)	113	11.53		mg/kg	0.10
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Thallium (Tl)	0.12	0.012		mg/kg	0.10
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Tin (Sn)	12.9	1.32		mg/kg	5.0
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Titanium (Ti)	57.9	5.91		mg/kg	0.50
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Uranium (U)	8.47	0.86		mg/kg	0.020
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Vanadium (V)	24.0	2.45		mg/kg	0.50
MET-200.2-MS-WP	L1646440	L1646440-1	CELL 2	Zinc (Zn)	422	43.0		mg/kg	10
B-HOTW-SK	L1646440	L1646440-1	CELL 2	Boron (B), Hot Water Ext.	8.9	0.91	DLM	mg/kg	2.6

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1646440-COFC

COC Number: 14 - 454252

Page 1 of 1

Report To		Report Format / Distribution		Turnaround Time (TAT) (Rush TAT is not available for all tests)	
Company:	MMM GROUP	Select Report Format:	PDF, EXCEL, EDD (DIGITAL)	R	Regular (Standard TAT if received by 3pm)
Contact:	BRIAN MOONS	Quality Control (QC) Report with Report	Yes / No	P	Priority (2-4 business days if received by 3pm)
Address:	111-93 LOMBARD AVE, WPG	Criteria on Report - provide details below if box checked		E	Emergency (1-2 business days if received by 3pm)
Phone:	204 - 803 - 9488	Select Distribution:	EMAIL / MAIL / FAX	E2	Same day or weekend emergency if received by 10am - contact ALS for surcharge.
		Email 1 or Fax	KEAMD@mmm.ca.	Specify Date Required for E2,E or P:	
		Email 2	MOONSB@mmm.ca.		

Invoice To		Invoice Distribution	
	Same as Report To: Yes / No	Select Invoice Distribution:	EMAIL / MAIL / FAX
	Copy of Invoice with Report: Yes / No	Email 1 or Fax	accountspayable@mmm.ca
Company:		Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q37455	Approver ID:	Cost Center:
Job #:		GL Account:	Routing Code:
PO / AFE:	Steinbach Biosolids	Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only):

ALS Contact:

Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TKN	Nitrate - N	Nitrite - N	Avail. Ammonium N	Total avail. Nitrogen	Total Phosphorus	Total solids - total volatile solids	Moisture	Total carbon	Avail. Potassium	Avail. Sulphate	Dissolved Salinity	Specific gravity	Number of Containers
	Cell 2	22/JUL/15	11:00	Sludge	X	X	X	X	X	X	X	X	X	X	X	X	X	4

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? Yes / No	Lagoon sludge 7°C.
Are samples for human drinking water use? Yes / No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen		SIF Observations	Yes	No	
Ice packs	Yes / No	Custody seal intact	Yes	No	
Cooling Initiated					

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	22/JUL/15	12:15		7/22/15	12:15			

[1] REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.