



Conservation and Water Stewardship

Environmental Stewardship Division
Environmental Approvals Branch
123 Main Street, Suite 160, Winnipeg, Manitoba R3C 1A5
T 204 945-8321 F 204 945-5229
www.gov.mb.ca/conservation/eal

File: 5757.00

July 21, 2015

Brian Wiebe, Ph.D., P. Ag.
Water Science and Management Branch
Manitoba Conservation and Water Stewardship
Suite 160 – 123 Main Street
Winnipeg, MB R3C 1A5

Dear Mr. Wiebe:

**Re: Granny's Poultry Cooperative Ltd. – Lagoon Sludge Land Application –
Environment Act Proposal**

The responses from the Technical Advisory Committee (TAC) that contained requests for additional information regarding the Environment Act Proposal (EAP) for the Granny's Poultry Cooperative Ltd. land application of lagoon sludge were forwarded to the proponent. The proponent was asked to address and respond to the comments contained in the responses and to provide additional information for the environmental review that is continuing.

Attached you will find the proponent's consultant's July 7, 2015 letter responding to the comments and requests for additional information presented by the TAC. Please review the response to determine if your comments and requests for additional information have been satisfactorily addressed.

Your comments, if any, are required not later than two weeks after the date of this letter. No response on your part will be assumed to indicate no concern.

If you have any questions, please contact me at 945-6030.

Yours truly,

“original signed by”

Robert Boswick, P. Eng.
Environmental Engineer

Attachment

- c. Darren Keam, M.Sc., P.Ag., Senior Soil Scientist – MMM Group (letter only)
Don Labossiere, Director – Environmental Compliance and Enforcement, Manitoba
Conservation and Water Stewardship
Public Registries



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July 21, 2015

Diane Smith
Environmental Approvals Branch
Manitoba Conservation and Water Stewardship
Suite 160 – 123 Main Street
Winnipeg, MB R3C 1A5

Dear Ms. Smith:

**Re: Granny's Poultry Cooperative Ltd. – Lagoon Sludge Land Application –
Environment Act Proposal**

The responses from the Technical Advisory Committee (TAC) that contained requests for additional information regarding the Environment Act Proposal (EAP) for the Granny's Poultry Cooperative Ltd. land application of lagoon sludge were forwarded to the proponent. The proponent was asked to address and respond to the comments contained in the responses and to provide additional information for the environmental review that is continuing.

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Environmental Engineer

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File: 5757.00

July 21, 2015

Larry Markwart
Environmental Compliance and Enforcement
Manitoba Conservation and Water Stewardship
Unit B 282 Reimer Avenue
Steinbach, MB R5G 0R5

Dear Mr. Markwart:

**Re: Granny's Poultry Cooperative Ltd. – Lagoon Sludge Land Application –
Environment Act Proposal**

The responses from the Technical Advisory Committee (TAC) that contained requests for additional information regarding the Environment Act Proposal (EAP) for the Granny's Poultry Cooperative Ltd. land application of lagoon sludge were forwarded to the proponent. The proponent was asked to address and respond to the comments contained in the responses and to provide additional information for the environmental review that is continuing.

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If you have any questions, please contact me at 945-6030.

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Environmental Engineer

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File: 5757.00

July 21, 2015

Ryan Coulter, M. Sc., P. Eng.
Manager of Environmental Services
Manitoba Infrastructure and Transportation
14200 – 215 Garry Street
Winnipeg, MB R3C 3P3

Dear Mr. Coulter:

**Re: Granny's Poultry Cooperative Ltd. – Lagoon Sludge Land Application –
Environment Act Proposal**

The responses from the Technical Advisory Committee (TAC) that contained requests for additional information regarding the Environment Act Proposal (EAP) for the Granny's Poultry Cooperative Ltd. land application of lagoon sludge were forwarded to the proponent. The proponent was asked to address and respond to the comments contained in the responses and to provide additional information for the environmental review that is continuing.

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If you have any questions, please contact me at 945-6030.

Yours truly,

“original signed by”

Robert Boswick, P. Eng.
Environmental Engineer

Attachment

- c. Darren Keam, M.Sc., P.Ag., Senior Soil Scientist – MMM Group (letter only)
Don Labossiere, Director – Environmental Compliance and Enforcement, Manitoba
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July 7, 2015

Ref.: 3314347-000-100.710

Mr. Robert Boswick
Manitoba Conservation and Water Stewardship
Environmental Stewardship Division
Environmental Approvals Branch
123 Main Street, Suite 160
Winnipeg MB R3C 1A5

Dear Mr. Boswick:

**RE: Granny's Poultry Cooperative Ltd. Land Application of Lagoon Sludge
Environment Act Proposal Technical Advisory Committee Response (File 5757.00)**

On behalf of the project Proponent (Granny's Poultry Cooperative Ltd.), MMM Group Limited (MMM) is providing this letter in response to the comments that your office received from the Technical Advisory Committee (TAC) regarding the Granny's Poultry Cooperative Ltd. Land Application of Lagoon Sludge Environment Act Proposal (EAP). The responses to each TAC member's comments/requests for additional information as outlined in the letter received June 5, 2015 are provided below.

Email message from Water Science and Management Branch – Manitoba Conservation and Water Stewardship, dated April 23, 2015.

Comment 1a: The "dry tonnes available" calculated field in Tables 5.5, 5.6 and 5.7 has failed to take into account the density of the material sampled so the value for cell one needs to be multiplied by 1.18 and the value for cell two by 1.13.

Response: Density was assumed to be 1.0 kg/L following the method applied by Environmental Protection Agency (EPA) Biosolids Management Handbook, Part 3, Section 3.3 C Dry Weight Basis. Tables 5.5, 5.6 and 5.7 (attached) have now been revised to account for the appropriate densities listed above (1.18 for cell one and 1.13 for cell two).

Comment 1b: The blended nutrient value in Table 5.7 appears to be a simple average for most parameters. However, cell two contains roughly three times the material as that in cell one and hence a weighted average calculation is needed to more accurately represent the nutrient content of the blended material.

Response: This is accurate; Table 5.7 did determine a simple average for the "blended" rate. The revised Table 5.7a presents the weighted average value for all parameters. Weighted Average Value differs from an average in that a weighted average returns a number that depends on the variables of both value and weight. In this case the weighted value is based on the dry tonnes biosolids available (corrected for density).

The following is an example calculation for Total Kjeldahl Nitrogen (TKN):

Weighted Average Value = $((6.80 \text{ kg/tonne} \times 566 \text{ tonnes}) + (22.70 \text{ kg/tonne} \times 1693 \text{ tonnes})) / (566 \text{ tonnes} + 1693 \text{ tonnes}) = 18.72 \text{ TKN kg/tonne}$

Comment 1c: Since Cell 2 has a much higher nitrogen concentration; these two errors will result in a much higher land requirement for a Nitrogen based application rate and a moderately higher land base requirement for P based application rates. The land requirement will need to be recalculated and new spread agreements arranged, if necessary.

Response: Yes, based on the 2016 crop target nitrogen recommendations as indicated in the revised Table 5.7a (which now has accounted for density and weighted average values) does require a total of 82 ha (202 acres). The cooperating farm producer has approved a higher nutrient land application rate via email communication (attached). The anticipated prescription rate will be nitrogen based for 56 kg nitrogen / ha providing approximately 57% of the P₂O₅ requirement.

Comment 2: Dewatering of the biosolids is mentioned but no details are given. The water will be nutrient rich so both the method of dewatering and management of the water must be detailed in the proposal before it can be properly reviewed.

Response: Currently, under EAL 2583 Granny's is permitted to discharge to the forcemain connection to the Rural Municipality of Hanover – Blumenort aerated wastewater treatment lagoon. Cell 1 (West) where the surface water that is located, is being pumped and discharged into the forcemain connection as allowed under the EAL 2583 and the agreement between Granny's and the RM. No water will be released outside of the licenced system. The solids will then be mechanically stockpiled within Cell 1 and 2 and allowed to gravity drain. Stormwater and leached water will be drained away from the stockpiles and also be pumped into the forcemain connection.

Comment 3a: The material has a very high water content and there is a potential for environmental impact during blending due to runoff or leaching of nutrient rich water. This process will need to be detailed and include any mitigation measures planned to prevent environmental impacts.

Comment 3b: Uniform blending is also critical for accurate application of nutrients. Detailed description of the blending process is needed to properly evaluate the proposed method of applying a blended product.

Response: As indicated the biosolids will be dewatered within the cells and the water runoff or leachate will be discharged into the forcemain connection. The physical process of blending the material is anticipated to occur as follows: 1) Solids from one of the cells will be physically bucketed and stockpiled on the bank of the berm to the second cell. The solids of the second cell will be then stockpiled parallel to the stockpile of the first cell. All materials will remain within the licenced premises of the lagoon cells. Then at the time of loading and transport to the application Site, the material will be bucketed at appropriate ratios (approximately 3:1), mechanically manipulated to blend as best as possible, loaded, transported and spread at the prescribed application rate. The air dry material will be land applied from specially equipped solid materials end spin spread trucks. The equipment will be calibrated for the prescribed application rate based on mass per load, spread width, and spread length. Qualified applicators are anticipated to be retained to complete the application of material.

Comment 4: Follow-up soil sampling (Olsen P, 0-15 cm, and nitrate-N, 0-60 cm), one and two years post application is necessary to demonstrate compliance with the Nutrient Management Regulation.

Response: The proponent will comply with all requirements of the Environmental Act Licence granted.

Comment 5: Tables 5.5, 5.6 and 5.7 all reference a 2015 soybean crop as the planned crop upon which nutrient application rates are based. With a fall 2015 application as is proposed, the 2016 crop should be used. The proponent needs to clarify if soybeans are planned on the spread field for 2016 or if another crop is planned and application rates will need to be revisited. Therefore, either the year or the crop (and associated rates) needs to be corrected in the tables.

Response: The cropping year is to be 2016. The crop and target rates are confirmed with the cooperating farm producer. Tables 5.5a, 5.6a and 5.7a are all revised accordingly.

Email message from Environmental Approval Branch – Manitoba Conservation and Water Stewardship, dated April 22, 2015.

Comment 1: The nutrient content and application rate of the blended contents of Cell 1 and Cell 2 (Table 5.7) should be recalculated using a weighted average. Cell 2 contains a greater quantity of material than Cell 1 and using a weighted average will provide a more appropriate approximation of nutrients and a more appropriate application rate.

Response: Please see the response outlined for the Water Science and Management Branch – Manitoba Conservation and Water Stewardship Comments 1a, b and c above.

Comment 2: Provide further information on the drying bed location.

Response: Please see the response outlined for the Water Science and Management Branch – Manitoba Conservation and Water Stewardship Comment 2 above. Drying beds will be within the licenced lagoon cells on-site.

Comment 3: Provide detailed information on the dewatering process and how any liquid from the dewatering process will be managed.

Response: Please see the response outlined for the Water Science and Management Branch – Manitoba Conservation and Water Stewardship Comment 2 above.

Comment 4: Provide further information on how the material from each cell will be thoroughly mixed to ensure a well-blended product prior to application?

Response: Please see the response outlined for the Water Science and Management Branch – Manitoba Conservation and Water Stewardship Comments 3a and b above.

Comment 5: It is recommended Olsen phosphorous be included in the soil analysis for the 15-60 cm soil sample prior to application.

Response: As outlined in Section 1.4 of the EAP, the proponent will adhere to the following Acts and Regulations that apply to the project and will be adhered to throughout the project, including any requirements assigned in the subsequent EAL:

1. The Environment Act C.C.S.M. c. E125 (1987)
 - a. Licensing Procedures Regulations 163/88
 - b. Classes of Development Regulation 164/88
 - c. Environment Act Fees Regulation 168/96
 - d. Livestock Manure and Mortalities Management Regulation 42/98
 - i. Designation of Red River Valley Special Management Area
 - e. Environmental Regulations for Treatment and Disposal of Biosolids in Manitoba, Mike Van Den Bosch, P.Eng., Municipalities & Industrial Approvals, Manitoba Environment
2. The Water Protection Act C.C.S.M. c. W65 (2005)
 - a. Nutrient Management Regulation 62/2008

Comment 6: It is recommended soil samples from the lands receiving biosolids be taken 1 year post application and submitted to Manitoba Conservation and Water Stewardship to ensure unacceptable nutrient loading or other environmental impact has not occurred as a result of biosolids application.

Response: As outlined in Section 1.4 of the EAP, the proponent will adhere to the following Acts and Regulations that apply to the project and will be adhered to throughout the project, including any requirements assigned in the subsequent EAL:

1. The Environment Act C.C.S.M. c. E125 (1987)
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2. The Water Protection Act C.C.S.M. c. W65 (2005)
 - a. Nutrient Management Regulation 62/2008

Comments: The spread field is within the Red River Valley Special Management Area and the application of biosolids must comply with the restriction on fall spreading as outlined in the Section 14.2(1) of the Livestock Manure and Mortalities Management Regulation (M.R. 42/98).

Response: As outlined in Section 1.4 of the EAP, the proponent will adhere to the following Acts and Regulations that apply to the project and will be adhered to throughout the project, including any requirements assigned in the subsequent EAL:

1. The Environment Act C.C.S.M. c. E125 (1987)
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2. The Water Protection Act C.C.S.M. c. W65 (2005)
 - a. Nutrient Management Regulation 62/2008

Letter from Highway Planning and Design Branch – Manitoba Infrastructure and Transportation, dated April 14, 2015.

Comment: If pumps and hoses will be used within any Provincial Trunk Highway's or Provincial Road's right-of-way, a permit will be required from MIT.

Response: At this time it is not anticipated that any pumps or hoses will be used within Provincial Trunk Highway's or Provincial Road's right-of-way as the material will be trucked from the lagoon site to the application field.

Memorandum from Environmental Compliance and Enforcement Branch – Manitoba Conservation and Water Stewardship, dated April 11, 2015.

Comment: In Section 8.1 Final Objectives for the Site it states that a portion of the current lagoon area would be redeveloped into a new emergency cell. Compliance and Enforcement Branch would like clarification as to the intended use of the "emergency cell".

Response: Currently the Granny's wastewater from the processing of poultry is received by the force-main that is connected to the RM of Hanover and Blumenort aerated wastewater treatment lagoon. In the unlikely event that the RM of Hanover and Blumenort lagoon could not receive wastewater due to a pipeline disruption or pump station malfunction, the processing plant would be required to stop operations for the duration of repairs. The re-development of an emergency lagoon on-site is for temporary, short duration storage to manage the risk of stopping operations and impacting the lineage of operations from the farm to the retail distribution centres. The intent is to purge the temporary wastewater back to the RM of Hanover and Blumenort lagoon when appropriate to do so.

Email message (w/ attachment) from Water Control Works and Drainage Licensing Section – Manitoba Conservation and Water Stewardship, dated March 25, 2015.

Comment: Any water control works (drains, culverts, dykes, dams, etc.) associated with this project will require licensing under the Water Rights Act – an application is attached for the proponent's convenience.

Response: At this time it is not anticipated that any water control works are required with this project.

Concluding Remarks

On behalf of Granny's Poultry Cooperative Ltd., MMM feels that the comments submitted by the TAC have been appropriately addressed in this letter. If there are any remaining questions regarding this EAP submission please contact the undersigned directly and at your convenience.

Yours truly,

MMM Group Limited



Darren Keam, M.Sc., P.Ag.
Senior Soil Scientist
Environmental Management

DK/cs

Letter_TACresponse_2July2015

From: Arnold Reimer <acreimer@yahoo.ca>
Sent: July-02-15 2:57 PM
To: Darren Keam
Subject: Re: Sludge Land application

Hi Darren
I just finished talking with Terry and we're good to go with the higher nutrient amount.

Arnold

Sent from my iPhone

On Jul 1, 2015, at 9:36 AM, Darren Keam <KeamD@mmm.ca> wrote:

Arnold,

I hope that the summer season is going well for you and that your crops look as good as they appear from the road side! I have been asked to review my calculations for nitrogen and phosphorous and land area required, there is a concern that more land will be required than we currently have with you (NW09-08-06E, ~ 132 acres).

I have based the calculation on the assumption that 2016 will be soybeans with a target nitrogen of 30lb/ac and P2O5 of 35 lb/ac this leaves me with a need for 200 acres, based on new assumptions. There are essentially two methods to mitigate this problem 1) source an additional 70 acres of land and 2) apply a higher nitrogen and phosphorous nutrient load and then need to likely alter the 2016 crop to a higher nutrient user (i.e. Canola).

Therefore my questions to you are:

OR

- 1) Could we increase the land application of nitrogen to between 45 lb/ac N (available P2O5 to 18 lb/ac) up to 50 lb/ac N (available P2O5 to 20 lb/ac) ? This keeps my required land to the current land base with as even of application as possible. This would be a preferred option.

OR

- 2) Do you have an additional 70 acres of suitable land?

Your current cooperation in this program is appreciated,

Best regards,

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

Senior Soil Scientist, Environmental Management
Associate

MMM Group Limited

111 - 93 Lombard Avenue

Winnipeg, MB Canada R3B 3B1

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Table 5.5a. Field Prescription Application Rates for Cell 1 West Sludge

Field ID:	NW09-8-6E	
2016 Crop:	Soybeans	
2016 Target Yield (Bu):	40	
	lb/ac	kg/ha
Target Nitrogen recommended :	50	56
Fertilizer Phosphate (P ₂ O ₅) Recommended:	35	39
1 x P ₂ O ₅ Crop Removal @ target Yield:	33	37
2 x P ₂ O ₅ Crop Removal @ target Yield:	66	74

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	03.0	3.5	27
Available Phosphate-P	17.0		34
Available Potassium	401		802
Available Sulfate-S			-

Cell 1 West Sludge Characteristics and Analysis

Parameter Name	Parameter Description	Unit	Biosolid Analysis (Cell 1)
Reported Volume (plus 10% safety volume)	In-field	m ³	1,335
Specific Gravity	As Received	kg L ⁻¹	1.18
Dry tonnes biosolids available	As Received	tonnes	566
Moisture	As Received	%	65.50
Total Solids	As Received	%	35.90
Total Volatile Solids	Dry Basis	%	12
Organic Matter	Dry Basis	%	21.70
Total Organic Carbon	Dry Basis	%	7.40
C:N Ratio	Dry Basis	x:1	10.88
C:P Ratio	Dry Basis	x:1	44.05
N:P Ratio	Dry Basis	x:1	4.05
pH	Saturated Paste		
Total Kjeldahl N	% Dried Basis	%	0.68
Total Kjeldahl N	Dried Basis	mg kg ⁻¹	6,800
Total Kjeldahl N	Dried Basis	kg Tonne ⁻¹	6.80
Ammonium - N	Dried Basis	mg kg ⁻¹	111.00
Ammonium - N	Dried Basis	kg Tonne ⁻¹	0.1110
Available Nitrate	Dried Basis	mg kg ⁻¹	-
Available Nitrate-N	Dried Basis	mg kg ⁻¹	-
Total Phosphorous	Dried Basis	mg kg ⁻¹	1,680

Amount of Sludge Nitrogen Available to Crop

Organic N (=TKN-ammonium N)	Dried Basis	mg kg ⁻¹	6,689.00
Organic N	Dried Basis	kg Tonne ⁻¹	6.69
Method of Application:			Surface/Incorp.
Anticipated Weather			Warm/Dry
Anticipated Volatilization (%)	Incorp. within 48 hrs		15
Available Organic N	Dried Basis	kg Tonne ⁻¹	1.67
Ammonium nitrogen available	Dried Basis	kg Tonne ⁻²	0.09
Total available nitrogen (Year 1) (@25%)	Dried Basis	kg Tonne ⁻¹	1.77
Mineralization N Year 2 (@12%)	Dried Basis	kg Tonne ⁻¹	0.80
Mineralization N Year 3 (@6%)	Dried Basis	kg Tonne ⁻¹	0.40
Phosphorus	Dried Basis	kg Tonne ⁻¹	1.68
P ₂ O ₅ equivalent	Dried Basis	kg Tonne ⁻¹	3.86
Total Available P2O5	Dried Basis	kg Tonne ⁻¹	1.93
Phosphorous (Olsen)			
Phosphorous	Dried Basis	mg kg ⁻¹	49.20
Phosphorous	Dried Basis	kg Tonne ⁻¹	0.05
P ₂ O ₅ equivalent	Dried Basis	kg Tonne ⁻¹	0.11
Total Available P ₂ O ₅	Dried Basis	kg Tonne ⁻¹	0.06

Application Rate based on Nitrogen Target			56	Land Area Required (Ha)
Nitrogen based application rate	Dried Basis	tonnes ha ⁻¹	32	18
Amount of Available P ₂ O ₅ applied	Dried Basis	kg ha ⁻¹	61	
P ₂ O ₅ Application check		%	156	
Application Rate based on Phosphorous (1xCR)			37	Land Area Required (Ha)
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha ⁻¹	19	30
Amount of Nitrogen applied	Dried Basis	kg ha ⁻¹	34	
Additional Nitrogen required		kg ha ⁻¹	22	
Application Rate based on Phosphorous (2xCR)			74	Land Area Required (Ha)
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha ⁻¹	38	15
Amount of Nitrogen applied	Dried Basis	kg ha ⁻¹	68	
Additional Nitrogen required		kg ha ⁻¹	12	
Selected Application rate based on:		2xCR	P2O5	
Selected Application Rate:	Dried Basis	tonnes ha ⁻¹	38	
		tons ac⁻¹	17	
	Wet	tonnes ha ⁻¹	106.58	
		tons ac ⁻¹	47.96	

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 0.25/year 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

Table 5.6a. Field Prescription Application Rates for Cell 2 East Sludge

Field ID:	NW09-8-6E	
2016 Crop:	Soybeans	
2016 Target Yield:	40	
	lb/ac	kg/ha
Target Nitrogen recommended :	50	56
Fertilizer Phosphate (P ₂ O ₅) Recommended:	35	39
1 x P2O5 Crop Removal @ target Yield:	33	37
2 x P2O5 Crop Removal @ target Yield:	66	74

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	03.0	3.5	27
Available Phosphate-P	17.0		34
Available Potassium	401		802
Available Sulfate-S			-

Cell 2 West Sludge Characteristics and Analysis

Parameter Name	Parameter Description	Unit	Biosolids Analysis (Cell 2)
Reported Volume plus (10% safety volume)	In-field	m ³	6,842
Specific Gravity	As Received	kg L ⁻¹	1.13
Dry tonnes biosolids available	Dried Basis	tonnes	1,693
Moisture	As Received	%	78.30
Total Solids	As Received	%	21.90
Total Volatile Solids	Dry Basis	%	31
Organic Matter	Dry Basis	%	6.10
Total Organic Carbon	Dry Basis	%	18.30
C:N Ratio	Dry Basis	x:1	8.06
C:P Ratio	Dry Basis	x:1	123.65
N:P Ratio	Dry Basis	x:1	15.34
pH	Saturated Paste		
Total Kjeldahl N	% Dried Basis	%	2.27
Total Kjeldahl N	Dried Basis	mg kg ⁻¹	22,700
Total Kjeldahl N	Dried Basis	kg Tonne ⁻¹	22.70
Ammonium - N	Dried Basis	mg kg ⁻¹	337.00
Ammonium - N	Dried Basis	kg Tonne ⁻¹	0.3370
Available Nitrate	Dried Basis	mg kg ⁻¹	-
Available Nitrate-N	Dried Basis	mg kg ⁻¹	-
		kg Tonne ⁻¹	-
Total Phosphorous	Dried Basis	mg kg ⁻¹	1,480

Amount of Biosolids Nutrient Available to Crop

Organic N	Dried Basis	mg kg ⁻¹	22,363.00
Organic N	Dried Basis	kg Tonne ⁻¹	22.36
Method of Application:			Surface/Incorp.
Anticipated Weather			Warm/Dry
Anticipated Volatilization (%)	Incorp within 48 hrs.		15
Available Organic N	Dried Basis	kg Tonne ⁻¹	5.59
Ammonium nitrogen available	Dried Basis	kg Tonne ⁻²	0.29
Total available nitrogen (Year 1) (@25%)	Dried Basis	kg Tonne ⁻¹	5.88
Mineralization N Year 2 (@12%)	Dried Basis	kg Tonne ⁻¹	2.68
Mineralization N Year 3 (@6%)	Dried Basis	kg Tonne ⁻¹	1.34
Phosphorus	Dried Basis	kg Tonne ⁻¹	1.48
P ₂ O ₅ equivalent	Dried Basis	kg Tonne ⁻¹	3.40
Total Available P2O5	Dried Basis	kg Tonne ⁻¹	1.70
Phosphorous (Olsen)			
Phosphorous	Dried Basis	mg kg ⁻¹	53.50
Phosphorus	Dried Basis	kg Tonne ⁻¹	0.05
P ₂ O ₅ equivalent	Dried Basis	kg Tonne ⁻¹	0.12
Total Available P ₂ O ₅	Dried Basis	kg Tonne ⁻¹	0.06

Application Rate based on Nitrogen Target			56	Land Area Required (Ha)
Nitrogen based application rate	Dried Basis	tonnes ha ⁻¹	10	178
Amount of Available P ₂ O ₅ applied	Dried Basis	kg ha ⁻¹	16	
P2O5 Application check		%	41	
Application Rate based on Phosphorous (1xCR)			37	Land Area Required (Ha)
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha ⁻¹	22	78
Amount of Nitrogen applied	Dried Basis	kg ha ⁻¹	128	
Additional Nitrogen required		kg ha ⁻¹	72	
Application Rate based on Phosphorous (2xCR)			74	Land Area Required (Ha)
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha ⁻¹	43	39
Amount of Nitrogen applied	Dried Basis	kg ha ⁻¹	255	
Additional Nitrogen required		kg ha ⁻¹	199	

Selected Application rate based on:		1xCR	P2O5
Selected Application Rate:	Dried Basis	tonnes ha ⁻¹	22
		tons ac ⁻¹	10
	Wet	tonnes ha ⁻¹	99
		tons ac ⁻¹	45

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

Table 5.7a. Field Prescription Application Rates for Blended Biosolids

Field ID:	NW09-8-6E	
2016 Crop:	Soybeans	
2016 Target Yield (Bu):	40	
	lb/ac	kg/ha
Target Nitrogen recommended:	50	56
Fertilizer Phosphate (P ₂ O ₅) Recommended:	35	39.2
1 x P ₂ O ₅ Crop Removal @ target Yield:	33	37
2 x P ₂ O ₅ Crop Removal @ target Yield:	66	74

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	03.0	3.5	27
Available Phosphate-P	17.0		34
Available Potassium	401		802
Available Sulfate-S			-

Biosolids Characteristics and Analysis

Parameter Name	Parameter Description	Unit	Biosolid Analysis (Cell 1)	Biosolids Analysis (Cell 2)	Weighted Average Value (Cells 1 and 2)
Reported Volume (plus 10% safety volume)	In-field	m ³	1,335	6,842	8,177
Specific Gravity	As Received	kg L ⁻¹	1.18	1.13	1.14
Dry tonnes biosolids available	As Received	tonnes	566	1,693	2,373
Moisture	As Received	%	65.50	78.30	75.10
Total Solids	As Received	%	35.90	21.90	25.41
Total Volatile Solids	Dry Basis	%	12	31	26
Organic Matter	Dry Basis	%	21.70	6.10	10.0
Total Organic Carbon	Dry Basis	%	7.40	18.30	15.57
C:N Ratio	Dry Basis	x:1	10.88	8.06	8.32
C:P Ratio	Dry Basis	x:1	44.05	123.65	101.77
N:P Ratio	Dry Basis	x:1	4.05	15.34	12.51
pH	Saturated Paste		7.68	8.47	8.27
Total Kjeldahl N	% Dried Basis	%	0.68	2.27	1.87
Total Kjeldahl N	Dried Basis	mg kg ⁻¹	6,800	22,700	18719
Total Kjeldahl N	Dried Basis	kg Tonne ⁻¹	6.80	22.70	18.72
Ammonium - N	Dried Basis	mg kg ⁻¹	111.00	337.00	280.41
Ammonium - N	Dried Basis	kg Tonne ⁻¹	0.11	0.34	0.28
Available Nitrate	Dried Basis	mg kg ⁻¹	-	-	-
Available Nitrate-N	Dried Basis	mg kg ⁻¹	-	-	-
Total Phosphorous	Dried Basis	mg kg ⁻¹	1,680	1,480	1530

Amount of Sludge Nitrogen Available to Crop

Organic N	Dried Basis	mg kg ⁻¹	6,689.00	22,363.00	18439
Organic N	Dried Basis	kg Tonne ⁻¹	6.69	22.36	18
Method of Application:			Surface/Incorp	Surface/Incorp	Surface/Incorp
Anticipated Weather			Warm/Dry	Warm/Dry	Warm/Dry
Anticipated Volatilization (%)	Incorp. within 48 hrs		15	15	15
Available Organic N	Dried Basis	kg Tonne ⁻¹	1.67	5.59	4.61
Ammonium nitrogen available	Dried Basis	kg Tonne ⁻¹	0.09	0.29	0.24
Total available nitrogen (Year 1) (@25%)	Dried Basis	kg Tonne ⁻¹	1.77	5.88	4.85
Mineralization N Year 2 (@12%)	Dried Basis	kg Tonne ⁻¹	0.80	2.68	2.21
Mineralization N Year 3 (@6%)	Dried Basis	kg Tonne ⁻¹	0.40	1.34	1.11
Phosphorus	Dried Basis	kg Tonne ⁻¹	1.68	1.48	1.53
P ₂ O ₅ equivalent	Dried Basis	kg Tonne ⁻¹	3.86	3.40	3.52
Total Available P2O5	Dried Basis	kg Tonne ⁻¹	1.93	1.70	1.76
Phosphorous (Olsen)					
Phosphorous	Dried Basis	mg kg ⁻¹	49.20	53.50	52.42
Phosphorous	Dried Basis	kg Tonne ⁻¹	0.05	0.05	0.05
P ₂ O ₅ equivalent	Dried Basis	kg Tonne ⁻¹	0.11	0.12	0.12
Total Available P ₂ O ₅	Dried Basis	kg Tonne ⁻¹	0.06	0.06	0.06

Blended Application Rate based on Nitrogen Target			56	Land Area Required (Ha)	Land Area Required (Ac)
Nitrogen based application rate	Dried Basis	tonnes ha ⁻¹	12	49	121
Amount of Available P ₂ O ₅ applied	Dried Basis	kg ha ⁻¹	22		
P ₂ O ₅ Application check		%	57		
Blended Application Rate based on Phosphorous (1xCR)			37	Land Area Required (Ha)	Land Area Required (Ac)
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha ⁻¹	21	27	67
Amount of Nitrogen applied	Dried Basis	kg ha ⁻¹	102		
Additional Nitrogen required		kg ha ⁻¹	46		
Application Rate based on Phosphorous (2xCR)			74	Land Area Required (Ha)	Land Area Required (Ac)
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha ⁻¹	42	13	33
Amount of Nitrogen applied	Dried Basis	kg ha ⁻¹	204		
Additional Nitrogen required		kg ha ⁻¹	148		
Selected Application rate based on:					Nitrogen
	Dried Basis	tonnes ha ⁻¹	12		
		tons ac ⁻¹	5		
	Wet	tonnes ha ⁻¹	32.18		
		tons ac ⁻¹	14.48		

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

Weighted Average Value differs from an average in that a weighted average returns a number that depends on the variables of both value and weight. In this case the weighted value is based on the dry tonnes biosolids available (corrected for density). For example the following calculation for TKN (kg tonne⁻¹) = ((6.80 kg/tonne x 566 tonnes) + (22.70 kg/tonne x 1693 tonnes))/(566 tonnes + 1693 tonnes), thus = 18.72 TKN kg/tonne.