



Water and Waste Department • Service des eaux et des déchets

**MAY 16 2018**

Manitoba Sustainable Development  
Climate Change and Environmental Protection Division  
Environmental Approvals Branch  
1007 Century Street  
Winnipeg, MB R3H 0W4

Client File No.: 5951.00  
Our File Nos.: S-1021, EMS  
020-17-08-11-00  
020-17-08-11-0N

Attention: Robert Boswick, P.Eng., Environmental Engineer

**RE: CITY OF WINNIPEG BIOSOLIDS LAND APPLICATION – RESPONSE TO TAC  
COMMENTS**

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Please find attached the response letter to the Technical Advisory Committee comments on the City of Winnipeg Biosolids Land Application Environment Act Proposal.

Should you have any questions on this letter, please contact Duane Griffin at 204-986-4483 or by email at [dgriffin@winnipeg.ca](mailto:dgriffin@winnipeg.ca).

Yours truly,

Chris Carroll, P. Eng., MBA  
Manager of Wastewater Services Division

Attachment

AEW/jl

- c: M.L. Geer, CPA, CA, Water and Waste Department (email)  
G.K. Patton, P.Eng., Water and Waste Department (email)  
D.E. Griffin, P.Eng., Water and Waste Department (email)  
D. Keam, WSP Global Company (email)





May 11, 2018

Public

Mr. Robert Boswick, P.Eng.  
Manitoba Sustainable Development  
1007 Century Street, Winnipeg, MB  
R3H 0W4



**Attention: Mr. Robert Boswick, P.Eng.**

Dear Sir:

**Subject: City of Winnipeg Biosolids Land Application Program - File 5951.00**  
**Client ref.: 619-2016 - Response to TAC Comments**

WSP Canada Group Limited (WSP) has been retained by City of Winnipeg, Water and Waste Department (City) to complete the City of Winnipeg Biosolids Land Application Environment Act Proposal (EAP). The EAP was submitted on January 30, 2018. On April 25, 2018, the Technical Advisory Committee's (TAC) comments were received by the City regarding the EAP submission. Outlined below are our responses to the TAC questions, concerns and comments.

**TAC Comments From: Manitoba Sustainable Development, Water Stewardship and Biodiversity Division, Water Science and Watershed Management Branch, Water Quality Management, Brian Wiebe, Ph.D., P.Ag.**

**General Comments**

**Comment:** Application of biosolids at 2x crop P removal assuming 25% of total biosolids P is plant available would be a good place to start (note below that in Table C.2 the selected application rate is listed as 2X but the 18 tonne/ha rate is a 3x rate). Under Monitoring (section 9.1.3) I would add that we need crop yield data and an analysis of Total Phosphorus from a sample of any crop removed (grain and also straw if removed from the field) to be able to estimate crop removal of P (important for fine tuning application rates).

Addition of a small amount of starter P with the seed will be important for many crops especially in cool/wet springs (for canola 10 lbs P<sub>2</sub>O<sub>5</sub>/acre would be the AgVise labs recommendation) but is generally a good idea when the main phosphorus application is broadcast and incorporated so that emerging seeds have ready access to P during early growth. As per other biosolids programs, biosolids should only be applied to fields with an Olsen-P soil test value (0-15cm) of less than 60 mg/kg.

**Response:** As outlined in Section 6.2.2.2 of the EAP; the agri-environmental prudent approach to nutrient management planning for the City's land application of biosolids program is to base land application rate recommendations on phosphorus requirements with a soil monitoring program and preparedness to adapt if soil monitoring for nitrate-nitrogen and phosphorus (Olsen-P) demonstrate limitations or excessive development of nutrient reserves. Regardless, the proposed approach to provide biosolids application prescriptions that ensure land application process will be compliant with; *The Environment Act (C.C.S.M c. E125) Livestock Manure and Mortalities Management Regulations and the Water Protection Act (C.C.S.M. c.W65) Nutrient Management Regulation*, emphasising the need for respecting buffer zones, limitations, soil constraints and agronomic practices.

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The City will engage in continued agronomic monitoring (yield data and tissues, grain and straw sampling) of biosolid applied fields to better understand the phosphorus balance between biosolids, soil and crop.

Cooperating farm producers are being advised to supplement the biosolids land application with a starter phosphorus to ensure crop availability at early stages of emergence, growth and development.

**Appendix C – Table C.2 (annotated copy of table attached)**

**Comment:** The soil test data section should not be titled “Plant Available Nutrients Soil Test Data” but rather “soil test data” because the soil test phosphorus value is not a measure of plant available P. Olsen-P and all other soil test P methods are extractions which when correlated with field data for the area give guidance as to the probability of a crop response to fertilizer P. Calling it Available P is misleading and causes confusion in those reading the table. “Available Phosphate-P” should be labelled “Phosphorus (Olsen-P)”. The soil test results were not attached so I do not know what tests were used on the other elements but all should be labelled by the method and not the word “available”.

**Response:** Agreed, the soil test data section of Table C.2 will be changed to “Soil Test Data”. The proponent acknowledges that chemical extraction methods selectively, based on extraction method, remove P compounds from soil matrix to estimate the phosphorus that is available for plants’ uptake during the growing season. The proponent additionally understands that the soil test phosphorus is calibrated or correlated against actual crop uptake or the probability of a fertilizer response. Specifically, the Olsen-P soil test was developed for calcareous soils and has been used to quantify plant available P in a calcareous soil (Havlin et al, 1999). Regardless, proponent ensures that the soil test methodology is consistent with; *The Environment Act (C.C.S.M c. E125) Livestock Manure and Mortalities Management Regulations and the Water Protection Act (C.C.S.M. c.W65) Nutrient Management Regulation*.

The soil test results were submitted to MSD with previous submissions and are available upon request.

**Comment:** The calculations looks fine and use an estimate of 25% of total P being plant available which is acceptable for now. However at the bottom of the table they have a section “Selected Application Rate” which indicates that they have selected to apply at a 2X crop P removal rate but the application rate they list (18 tonnes/ha) is based on a 3x crop P removal. I would not be in favour of a 3x rate especially since we are only assuming 25% available which could well turn out to be too low.

**Response:** The insert for this table is an error (typo), the actual application rate calculation was 12 tonnes/ha as reported in the City of Winnipeg Biosolids Land Application Pilot Program Summary Report (WSP, December 22, 2017).

**Literature review phosphorus: Section 6.2.2.2**

**Comment:** The modified Kelowna extraction is not a recognized nor useful measure of plant available phosphorus in biosolids. I have been following the scientific literature and to date no one has found an extraction which can accurately predict plant available P from biosolids (plant availability is a function of the biosolid properties, the soil properties and how they interact – each biosolid-soil mixture is unique).

**Response:** It is acknowledged that the Kelowna extraction is not the most effective measure of plant available phosphorus in biosolids and it is for this purpose that the recommendations for application rates is not based on this methodology, but rather a tool to evaluate quality of the material without any better tool available.

**Comment:** The reference to Pastene (1981) relies on a few lines referenced in O’Connor et al (2002) [which is not in their reference list but they may mean O’Connor et al (2004)]. This reference does not contain any information as to the type of biosolid, the Fe and Al concentration or how the P-supplying power was assessed so Pastene’s finding may or may not be relevant but cannot be given any weight without more information from the actual thesis. Basing their conclusions that the Winnipeg biosolids will provide a low percentage of plant available P on the Al-Fe/P molar ratio as per Pastene (1981) is unwarranted, especially since they have other actual references with detailed method descriptions indicating the 25-75% plant available P is likely appropriate for Winnipeg biosolids.

**Response:** Reference O’Connor et al (2002) should be O’Connor et al (2004).

WSP directly contacted the University of Wisconsin to acquire a copy of the Pastene (1981) thesis in electronic form. The University of Wisconsin was unable to provide an electronic scan. The only means to acquire a copy of the thesis would be to be in person to scan/photocopy, and this was not feasible.

As future data is collected through the City's biosolids land application program, knowledge on this point will improve and will provide a better understanding of P bioavailability of the City's biosolids.

**Comment:** O'Connor et al (2004) found that biosolids containing >50g/kg total Fe+Al AND a solids content >60% had bio-availability

**Response:** Agree, as future data is collected through the City's biosolids land application program, knowledge on this point will improve and will provide a better understanding of P bioavailability of the City's biosolids.

**Comment:** McCoy et al (1986) used TSP (triple super phosphate) not MCP (monocalcium phosphate) and compared it to composted sewage sludge (high solids and potentially lower plant available P due to drying) which had been treated with Fe or Fe+Al and found it was 10% as plant available as fertilizer P (FE+AL of 45 and 54g/kg for the 2 composts). The proposal mistakenly attributes some results from de Haan (1980) to McCoy et al. de Haan (1980) who used MCP found 4% P bio-availability for non-biosolid sludges (called "chemical" sludge in the paper – either effluent or surface water treated with Fe/Al to remove P/impurities) which were a very different material from biosolids. For actual sewage sludges, De Haan found 17-54% P bioavailability for Fe treated sewage sludge and the only Fe treated sludge to have lower P availability than other sewage sludges was one that had 15% Fe content (150 g/kg which is much higher than Winnipeg biosolids).

**Response:** Agree, WSP did miss-attribute the statement from de Haan (1980) to McCoy et al (1986). While the sludge is different from the City of Winnipeg Biosolids the chemical treatment with  $FeCl_3$  is similar and apparently reduces the plant uptake of phosphorus relative to MAP.

As future data is collected through the City's biosolids land application program, knowledge on this point will improve and will provide a better understanding of P bioavailability of the City's biosolids.

**Comment:** Vaneeckhaute et al (2015) did not study biosolids but rather Fe treated liquid hog manure. They found that corn grown with the  $FePO_4$ -sludge yielded as well as with P fertilizer despite lower P uptake – they do not clarify whether the fertilizer treatment had luxury uptake or if the sludge treatment was considered P deficient. The low water solubility indeed indicates poor suitability as a starter fertilizer and would suggest a small amount of starter P fertilizer may be warranted but otherwise the sludge appeared to meet crop P requirements.

**Response:** Agree, the treatment with Fe is the concern with potentially limiting Phosphorus uptake regardless of the amendment source. The phytoavailability of phosphorus from the City of Winnipeg biosolids is not well understood due to the chemical treatment in the system. The risk of under supplying a vital nutrient to the cooperating farm producer's agronomic system causing an economic impact is an agri-sustainable concern. Additionally, by under applying the quantity a greater land area is required, which may decrease the economic feasibility of the program. The published literature on the relative availability varies in source material, sampling and analysis procedures, soils characteristics and while some authors imply that chemical treatment of municipal biosolids limits the availability of phosphorus to crops as many authors imply moderate or good relative availability when compared to a commercial fertilizer.

**Responses for comments provided within the EAP report body as annotated by Brian Wiebe, Ph.D., P.Ag.**

### Section 5.1.2

**Concern:**  $FeCl_3$  biosolids Phosphate-P was approximately 4% of total phosphorus.

**Comment:** The other 96% would presumably be fairly plant available.

**Response:** Modified Kelowna phosphorus was measured on the City of Winnipeg biosolids and ranged from 226 to 1380 mg/kg with a mean concentrations of 637 mg/kg. The modified Kelowna P represent approximately 4% of the total phosphorus. Similarly, Smith et al (2002) completes a bicarbonate extractable P measure on fresh samples of the biosolids and found that it varied from <1.0% to >10% of the total-P concentration. Regardless, the final calculation of relative plant available phosphorus is not based on this analysis or extraction.

**Concern:** Table C.2. Example of Field Prescription Application Rate

**Comment:**  $62/2.915 = 27 \text{ kg P/ha}$

**Response:**  $1 \times P_{2O5} \text{ Crop Removal @ target yield: } 55 \text{ lb/ac} \times 1.12 \text{ conversion factor} = 61.6 \text{ kg/ha}$  (Tri-Provincial Manure Application and Use Guidelines).

**Comment:** Available Phosphate – P should be labeled as Olsen – P



**Response:** The parameter listed in the table is consistent with the ALS Certificate of Analysis. Table parameter labels are to maintain consistency between certificate of analysis and reporting tables. The methodology is Olsen –P.

**Comment:** Remove the analysis of Phosphate P (modified Kelowna solution, total phosphate ratio and percent phosphate of total.

**Response:** Agreed, this will be removed from the table. These parameters are only provided as background information and do not contribute to the determination of the proposed application rates.

**TAC Comments From: Manitoba Sustainable Development, Environmental Compliance and Enforcement, Nada Suresh, Julie Froese, Sonja Bridges**

**Comment:** EAP proposes a 75 meters setback distance (pages 13 & 39) from any occupied residence for land application of biosolids. However, it was noted that Clause 13 (a) in EAL 1089 ERR prescribed 300 meter setback distance.

**Response:**

The 75 meters setback distance is a recommended practice provided in the Farm Practice for Pig Producers in Manitoba (April 2007) for material that is surface applied and incorporated within 48 hours. The purpose to request this reduced land setback distance is to ensure that as much of the agricultural surface area receives the benefit of biosolids application enhancing the agronomic and economic benefits for the cooperating farm producer. With continued urban sprawl occurring, having the extended setback distance from residences may reduce the useable area on a parcel of land so significantly that it may eliminate the parcel due to insufficient land available. The City would request that the 75 meter setback distance be applied in the licence and allow good neighbour practices to establish additional setback if and when required to accommodate individual concerns. Additionally, the 75 m setback from residences has been accepted by Manitoba Sustainable Development in previous EAP submissions for municipal biosolids land application programs, e.g. City of Steinbach, RM of Springfield, Granny's Poultry Cooperative Ltd. and Town of Gladstone.

**Comment:** It is noted that Environment Act Licence No. 1089 ERR issued to the City of Winnipeg is also dealing with temporary storage, transportation of biosolids and the disposal of biosolids on agricultural lands. It is also noted that several clauses under the above-mentioned Licence directly infringe upon activities proposed in the Environmental Act proposal. Clause 6 of the EAL 1089 ERR effectively prohibits temporary storage of biosolids other than designated temporary storage pad in RM of West St. Paul. EAP for the biosolids land application program propose field storage of biosolids for a period of five months, which is also considered as a temporary storage of biosolids. Thus it is recommended that suspension of relevant clauses in the EAL 1089 ERR, which having a bearing on the field storage component of the present EAL, be considered as part of the review process. Further, it is recommended that as part of the review process of this EAP, which proposed to obtain a new Environment Act Licence, to consider cancellation of existing EAL#1089 ERR which deals with management of City's biosolids.

**Response:** The City is working on the closure of EAL 1089 ERR. The City will develop a decommissioning plan for the land associated with EAL 1089ERR.

#### **Additional Items – Request for Suspension of Clauses**

At this time, the City would like to request the suspension of Clause 13 (a) in EAL 1089 ERR in which the 300 meter setback distance is prescribed. Also at this time, the City would like to request the suspension of Clause 6, 7, 8,9 and Appendix A in EAL 1089 ERR which are associated with the temporary storage facility, application timing, leachate associated with temporary storage and notification to the RM of West St. Paul. This suspension is requested to prevent conflict between EAL 1089 ERR and a newly granted EAL.



WSP and the City of Winnipeg greatly appreciate all comments received by the TAC and appreciate the effort put into the review of the EAP. Should there be any further questions or comments regarding our responses to the TAC comments, please contact the undersigned directly at your convenience.

Kind regards,

A handwritten signature in black ink, appearing to read 'D. Keam'.

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

DK/ds

Encl.

cc: Ms. Amanda Wolfe, P.Eng. Water and Wastewater Department, City of Winnipeg

WSP ref.: 17M-00008-00