CITY OF
WINNIPEG

BIOSOLIDS LAND APPLICATION PROGRAM

National Water
and Wastewater
Conference
Monday, November 4, 2024

Background

City of Winnipeg Wastewater Treatment Systems

- The City of Winnipeg operates three wastewater treatment plants:
  - North End Water Pollution Control Centre (NEWPCC)
    - Population served: 455,000
    - Average daily flow treated: 195 million L/day
  - South End Water Pollution Control Centre (SEWPCC)
    - Population served: 200,000
    - Average daily flow treated: 58 million L/day
  - West End Water Pollution Control Centre (WEWPCC)
    - Population served: 90,000
    - Average daily flow treated: 20 million L/day
- Currently, all City municipal sludge is produced at, or hauled to, the North End Plant where it is anaerobically digested to produce Class B biosolids.

BACKGROUND

The goal of the Program is to provide a means of reusing a portion of the annual biosolids produced by the City in an environmentally sustainable manner through land application that maximizes beneficial use of biosolids, minimizes the associated environmental and health risks, and complies with all applicable regulations.

WSP's role is to provide project management, planning, coordination, communication and technical expertise on behalf of the program. WSP works with cooperating farm producers to ensure they understand the agronomic opportunities from biosolids land application. WSP then works with the RM Council to ensure a good fit for the community and coordinates odour monitoring, soil sampling and application rates for the land base.

INTRODUCTION

Program Life Cycle

- Fall: Engagement with cooperating farm producers to organize the application lands for the next growing season.
- Fall – Winter: Engage with the Municipal Council to obtain local jurisdictional approvals.
- Spring: Establish in-field storage sites on application fields.
- June – October: Transport the biosolids from NEWPCC to the temporary storage sites.
- Late August – September: Post harvest soil sampling, application rate and land application.
- October: Post harvest soil monitoring of application fields from last three years.
- October – December: Reporting to farm producers and Regulator.

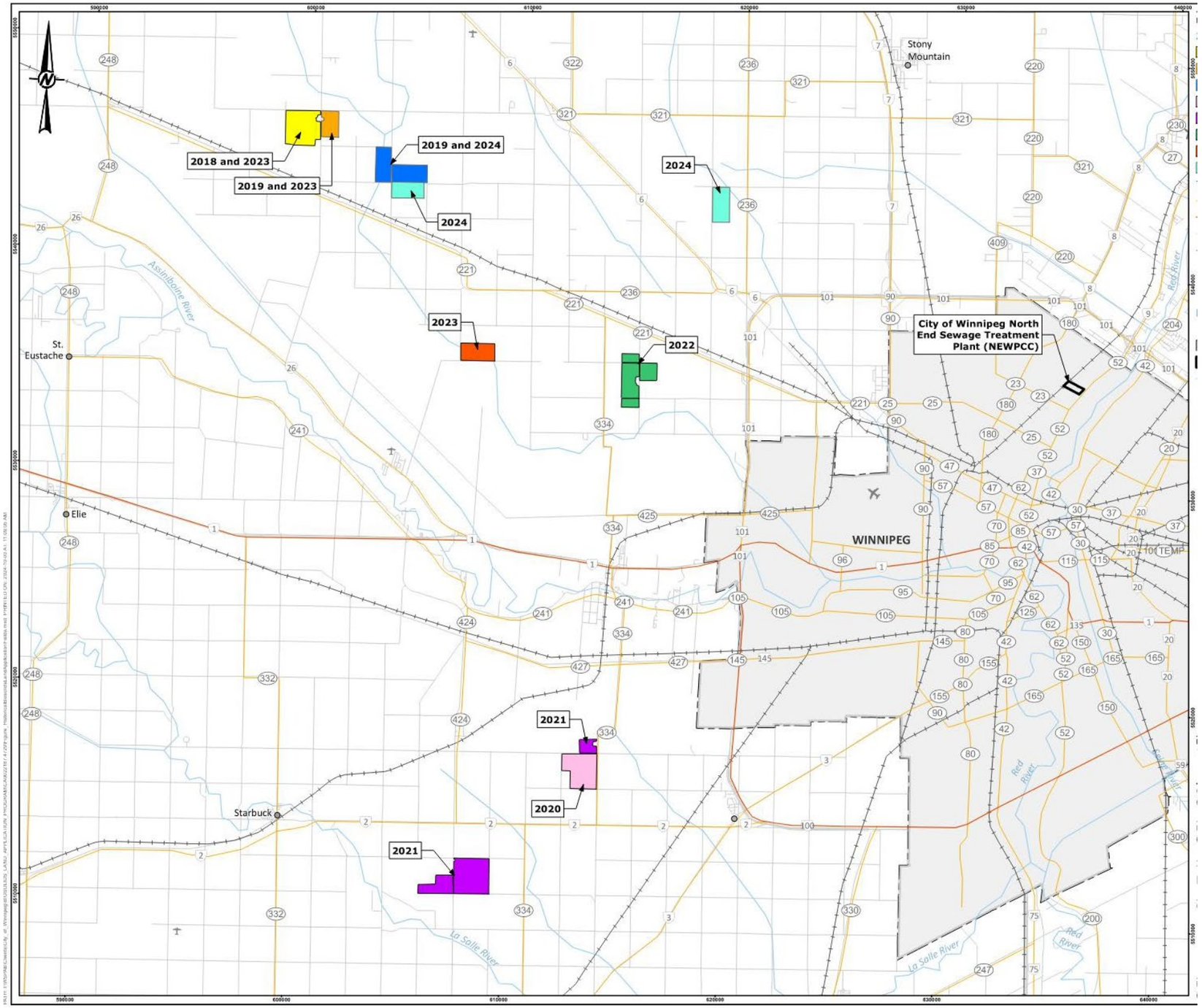
REGULATORY FRAMEWORK

The Biosolids Land Application Program complies with the following regulations:

Area Map

Travel Limitation

- Trucking limitation of 55 km from NEWPCC
- RTAC Highways preferred
- Highway Permits required if Class B Highways & Provincial Roads
- Municipal Gravel Road
  - Maintenance required
  - New road development



POTENTIAL CONCERNS AND MITIGATION

Concerns	Mitigation
Odour	Setback distances, tillage, daily straw storage cover and regular monitoring
Pathogens	Partially treated to Class B material, climate exposure, tillage, buffer zones, cropping system, crop rotation
Emerging Substances of Concern	Climate exposure, microbial degradation, photo-degradation, delayed periods of time between application and harvest, setback distances, land rotation and academic literature review
Metals	City of Winnipeg sewer by-law limits the disposal of impacted substances through the sewer system, biosolids monitoring, soil monitoring, land rotation, mass balance, and regulatory guidelines
Nutrient Loading	Regulations, agronomic application rates, setback distances, cropping management, land rotation, and soil monitoring
Groundwater	Agronomic application rates, setback distances from wells, 1.5 metre clay for application sites and storage sites and regulations
Surface Water	Controlled application rates, setback distances, no winter spreading and regulations

TEMPORARY FIELD STORAGE

The approach to field storage is consistent with the following:

- Environment Act; Livestock, Manure and Mortalities Management Regulation
- Environment Act Licence #3377
- Canadian Council of Ministers of the Environment - Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage
- US Environment Protection Agency Guidance Document for field storage of biosolids

Considerations for field storage of biosolids:

- Site selection (1/2-mile distance from residences)
- Timing of storage
- Wind direction
- Daily straw cover for odour management
- Site security and Storm Water management

WATER PROTECTION

Regulation

- Defined zones that determine where biosolids can be applied
- Setback distances from wells, water bodies, wetlands, surface and groundwater features
- Minimum 1.5 m depth of clay between surface and water table
- Limits on metals applied to soil
- Soil monitoring for 3 years following application

Beneficial Management Practices

- Land and Crop rotation
- Technology
  - GPS guidance and auto steer
  - Variable rate calibrated spreaders
  - Odour monitoring
- Incorporation within 24 - 48 hours of application

Social Monitoring

- Reporting hot lines
- Advisory Committee

ODOUR MONITORING

In-Field Odour Assessment Scale for Bi-weekly Monitoring Events

Numerical Level	Intensity Leve Description
0	No odour or non-offending odour observed
1	Little annoying or Faint - The odour is barely detectable: you need to stand still and inhale while facing into the wind to notice it
2	Annoying or Moderate - The odour is easily detected while walking and breathing normally but it is not overpowering
3	Very Annoying or Strong - The odour is penetrating; you can't get away from it and it can easily be always detected
4	Extremely Annoying or Pungent

In-field Odour Assessment Results Average Over Six Years

Assessment Distance	2018	2019	2020	2021	2022	2023	Average
50m	0.8	0.7	0.9	0.6	0.4	0.8	**0.7**
25m	1.8	1.2	1.5	0.8	1.2	1.3	**1.3**
10m	2.1	1.4	2.1	1.3	1.3	1.6	**1.6**
5m	2.6	1.7	2..8	1.8	1.3	1.3	**2.0**
Check	0.0	0.1	0.1	0.1	0.1	0.3	**0.1**

Since 2018 the assessment panels have been members of:

- WSP
- City of Winnipeg
- MECC (Environment Officers)
- MB Agriculture
- Rosser Council

TRAFFIC MANAGEMENT PLAN

- An average of ten semi-trucks per day make the round trip to the temporary storage sites
- Least intrusive travel route
- Enclosed in an ejector trailer which features a sealed gasket and hydraulically operated tailgate to eliminate liquid, solids, and odour releases
- Typically hauling occurs Monday to Friday between 6am and 3pm
- Occasional hauling may occur on weekends and statutory holidays
- Trucks are governed to 30 km/hr when passing of yard sites on gravel roads
- Road conditions are documented at start of year and monitored by project and RM staff through the trucking period
- City completes road maintenance and dust mitigation as required on RM roads

Nutrient Returns

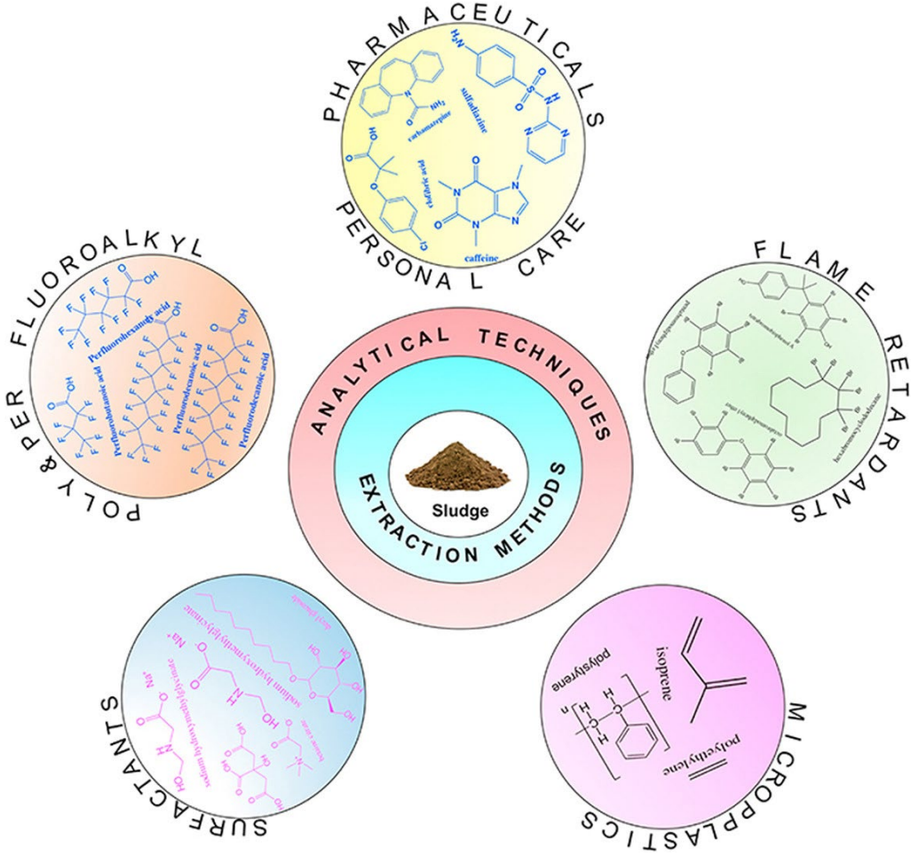
Year	Municipality	Area (ha)	Volume Biosolids Applied	Estimated Total Nitrogen Returned	Estimated Total Phosphorus Returned	Estimated Total Carbon Returned
			Dry Tonnes			
2017	Macdonald	55	731	26.65	13.19	213.06
2018	Rosser	260	3,050	111.13	54.99	888.46
2019	Rosser	326	3,956	144.12	71.31	1,152.17
2020	Macdonald	239	3,118	113.59	56.20	908.11
2021	Macdonald	331	4,724	172.11	85.19	1,375.97
2022	Rosser	251	4,399	160.09	79.21	1,279.88
2023	Rosser	450	5,785	222.14	109.92	1,775.10
2024	Rosser	565	6,417	246.41	121.92	1,970.02
Total to Date:		**2,477**	**32,180**	**1,196.24**	**591.93**	**9,562.77**

Economic Returns

	Area (ha)	PAN (13.2 kg/T)	P_2O_5 (10.9 kg/T)	Potash (0.8 kg/T)	Sulfate-S (2.26 kg/T	Total Carbon (304 kg/T)
2024	565	95,713	79,036 kg	5,801kg	16,387 kg	2,226,057 kg
Totals (2017-2024):	2,477	411Tonnes	340 Tonnes	25 Tonnes	70 Tonnes	9,565 Tonnes
Commodity Pricing		Urea: $1.61/kg	MAP: $1.89/kg	K: $0.90/kg	S: $0.91/kg	Federal Govt Carbon Pollution Pricing
Economic Return 2024		$136,263 or $241.20/ha	$132,196 or $233.98/ha	$4,620 or $8.18/ha	$13,189 or $23.35/ha	$157,600
Estimated Total (2017 – 2024)		**$661,612**	**$641,865**	**$22,433**	**$64,042**	**$442,437**

Future Considerations

- **Contaminants of Emerging concern**
  - PFAS / PFOS
  - Microplastics
  - Pharmaceuticals / personal care products
  - Surfactants
- **Human & Ecological Risk Assessments**
  - Uptake, translocation and toxic effect criterion
- **Analytical Techniques & Extractions**
  - Extraction Methods
  - Detection Limits
- **Regulation**
  - Licencing/Permits
  - Criteria & Guidelines
- **Management**
  - Class B → Class A Product, how does it get to a sustainable end use state with distribution and economic return.



Source: Kumar et al. 2022

Future Considerations

- Social Stigma of Biosolids Management
  - Icky & odorous
  - Bacteria and vectors
  - Soil / groundwater contamination
  - Double up on the mitigations
    - (i.e., if 50 m is good, then 100 m is better)
  - That is a “City” problem
  - Property resale value (as a neighbour)
  - Lack of trust in the science / practitioners
  - Lack of understanding of a circular economy
  - Lack of understanding of where waste goes and how it needs to be managed
  - Social media / media reporting

Conclusion

THANK YOU

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