

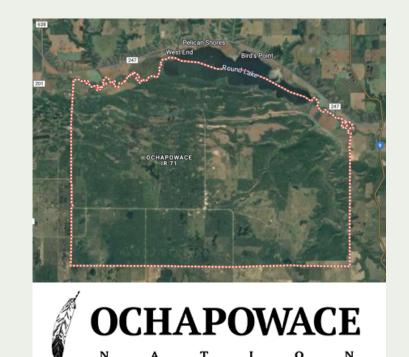
Alternative Design to Traditional Septic Systems for Ochapowace Nation



Lanzer EJ Cruz, Trisha Mae S. Junco, Ruth Samara Mamani, Marianne Cadenas Manaois Faculty Supervisor: Dr. Stephanie Young External Supervisor: Mr. Deon Hassler

Background

- Located 175 km east of Regina.
- Aim to design three alternatives/retrofits that will meet the objectives communicated by the community.



Problem Statement

- Current septic systems faces downfall in maintenance and efficiency.
- Risks of leakage
- Lack of funding

Objectives

(Google Earth, 2024)

- Low cost
- Low maintenance
- Clean effluent
- Operator-friendly
- Support autonomy

Recommended Design

Alternative 1: Vermicomposting Toilet and Greywater System
*Note: Keeps the current Lagoon

- Produces clean effluent
- Low Maintenance and maintenance cost
- Operator friendly
- Produces useful by-product
- Supports autonomy

Weighted Matrix

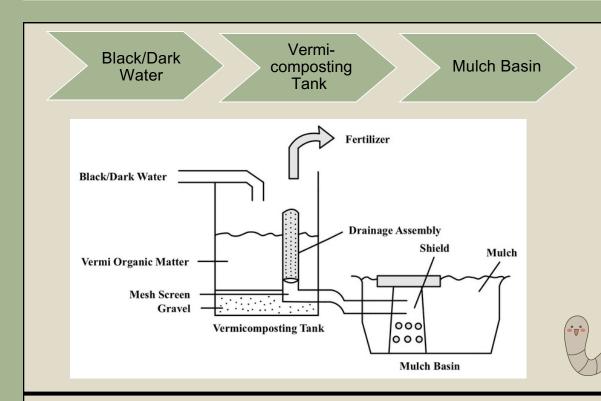
Criteria	Weight	Alternative 1	Alternative 2	Alternative 3
Cost	8	8*8=64	3*8=24	6*8=48
Maintenance	10	9*10=90	6*10=60	7*10=70
Operator Friendly	8	8*8=64	8*8=64	6*48=48
Removal Efficiency	9	10*9=90	10*9=90	10*9=90
Time (or HRT)	6	7*6=42	5*6=30	9*6=54
Environmental Impact	7	9.5*7=66.5	5*7=35	7*7=49
Foot Print & Sizing	4	9*4=36	5*4=20	6*4=24
Support for Autonomy	7	6*7=42	4*7=28	3*7=21
Total		<u>494.5</u>	351	404

Design Alternatives

Alternative 1: Vermicomposting Toilet and Greywater System

Alternative 2: Vermicomposting Toilets and Sewage Collection System

Alternative 3: Aerobic Treatment Unit Retrofit



Vermicomposting Toilet

Biodegradation:

- Biochemical Oxygen Demand (BOD): 90%
- Five-day Biochemical Oxygen Demand (BOD5): 98-100%
- Chemical Oxygen Demand (COD): 80-90%,
- Total Dissolved Solids (TDS): 90-92%
- Total Suspended Solids (TSS): 90-95%

Maintenance:

- 3-4 months adding organic materials
- Periodic removal of fertilizer

Greywater System

Biodegradation

- Five-day Biochemical Oxygen Demand (BOD5): 98%
- Chemical Oxygen Demand (COD): 74%
- Total Organic Carbon (TOC): 74%
- Total Phosphorus: 97%
- Total Nitrogen: 19%
- Thermotolerant Fecal Coliforms (TTFF): 99%
- Methylene Blue Active Substances (MBAS): 99%
- Suspended Solid (SS): 55-99.9%

Maintenance:

- 3-5 years dig and replenished mulch
- Periodic removal of obstructions in mulch shield

Lagoon Sewage Collection System Expansion

A piping system: 5.82 km piping to service 19 additional buildings

Mulch Basin

CSA-Certified IPEX HDPE Material

Retrofitted Holding Tank

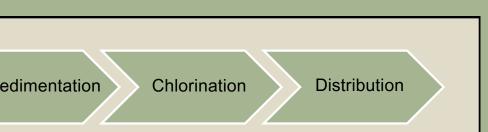
Retrofitted Holding Tank

Greywater

- 6" piping size based on Hazen-Williams Friction Loss and IPEX
 "Pipe-with-the-stripe" Size Determination Calculation.
- Reduce trucking to individual homes, utilize the lagoon capacity, and slowly integrate centralized systems into the community.

Equalization & Pre-Treatment



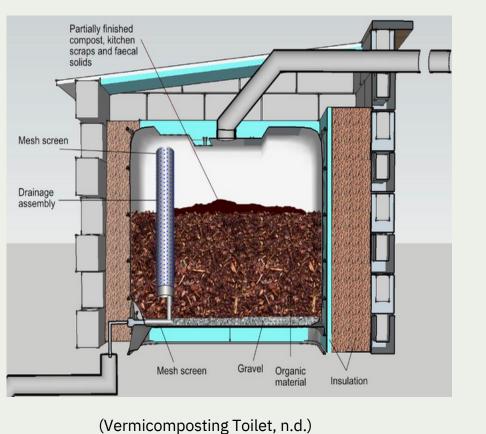


Aerobic Treatment Unit (ATU) Retrofit Benefits: Higher effluent quality than a septic tank

- Higher effluent quality than a septic tank
 Optimizes the existing septic system by retrofitting
- (holding or septic tank)
 Removes the need for a drain field
 Reduces ammonia, CBOD, BOD5, TSS, nutrients, effluent
- Irrigation reuse for lawns and landscape plants

Final Design

Alternative 1: Vermicomposting Toilet and Greywater System





(Greywater Landscape Design, n.d.)

Cost Estimation: ± 20%

ALT. 1	Capital Cost	CAD 5,991.9 per household	
	Annual Maintenance and Operation	CAD 340 per year	
ALT. 2	Capital Cost	CAD 1,775,100 + CAD 5,991.9	
		per household	
	Annual Maintenance	CAD 23,216.40 + CAD 340	
	and Operation	per year	
ALT. 3	Capital Cost	CAD 11,749 per household	
	Annual Maintenance and Operation	CAD 957 per year	

Conclusion

- Promising results based on Vermicomposting Toilet Literature Review
- Reduction of Wastewater contaminants is guaranteed
- Stated objectives are met

Acknowledgements

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