

APPENDIX A10: TM 10 – Service Delivery Opportunities

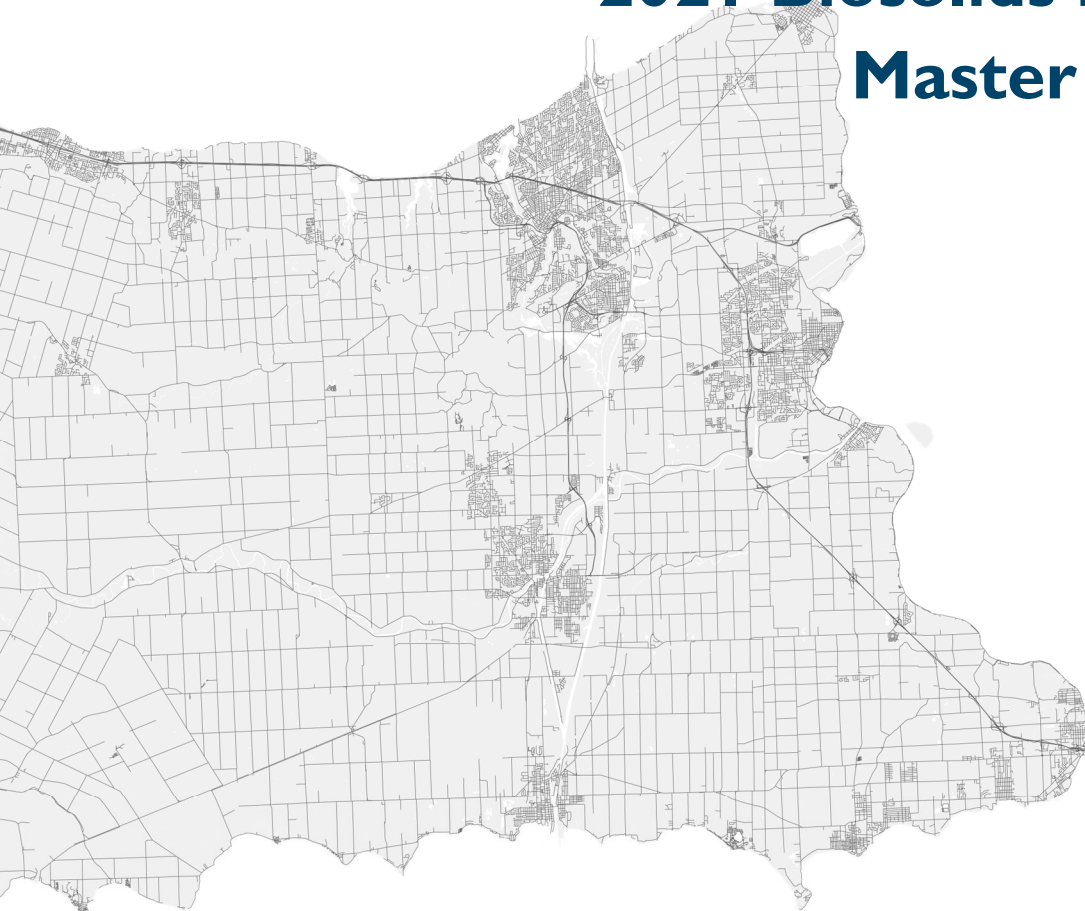


Niagara Region

Technical Memorandum 10
Service Delivery Opportunities

2021 Biosolids Management Master Plan Update

November 2023



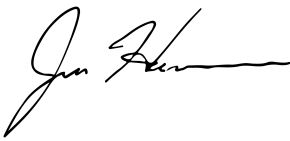
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**621143 – Niagara Biosolids Management Master Plan Update
Technical Memorandum 10 – Service Delivery Opportunities**

QA/QC - SIGN OFF SHEET

This report has been reviewed and approved by the undersigned.



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I.0 Introduction

I.1 Background and Purpose

Niagara Region has extensive water and wastewater infrastructure, with ten (10) wastewater treatment plants (WWTP) and six (6) water treatment plants (WTP). The majority of the solids generated at the WWTPs are anaerobically digested, and the resulting liquid biosolids are currently transported to the centralized Garner Road Biosolids Storage and Dewatering Facility (Garner Road Biosolids Facility) for storage prior to land application or dewatering and further processing. The solid residuals from the six water treatment plants are either transported to the Garner Road Biosolids Facility or discharged into sanitary sewers to be treated at the receiving WWTP and managed as part of the resulting wastewater solids.

The Region currently has contracts with two third-party contractors as part of their biosolids management program: Walker Environmental and Thomas Nutrient Solutions (TNS).

Walker Environmental currently hauls dewatered cake from the Garner Road Facility and Niagara Falls WWTP to its N-Viro Alkaline Stabilization facility in Thorold. Walker provides enhanced treatment of the Region’s biosolids, and markets and sells the final soil amendment product through licensed distributors.

Thomas Nutrient Solutions is responsible for managing Niagara’s liquid biosolids land application program and identifying and partnering with farmers for biosolids application to their agricultural land. They are also responsible for haulage, and lagoon operation and maintenance at the Garner Road facility. Thomas Nutrient maintains a Non-Agricultural Source Materials (NASM) plan for each agricultural end user and is responsible for acting in accordance with the Nutrient Management Act.

As summarized in TM 7, seven biosolids management strategies were developed and evaluated, and the top three strategies identified were:

1. **Strategy 4:** Anaerobic Digestion + Dewatering + Advanced Alkaline Treatment to produce a fertilizer product for land application
2. **Strategy 2:** Anaerobic digestion + Dewatering + Cake Land Application
3. **Strategy 1:** Anaerobic Digestion + Liquid Biosolids Land Application

TM 5 and TM 8 then developed these strategies further and provided specific capital projects and operational recommendations, which are summarized below:

1. Continue dewatering at Niagara Falls WWTP and continue contracting Walker Environmental to haul and process cake until, at a minimum, existing centrifuges reach the end of their useful life.

2. Continue sending liquid biosolids from all WWTPs (except Niagara Falls), and thickened WTP residuals from Grimsby WTP, Decew WTP and Niagara Falls WTP to the Garner Road Facility. Continue discharging WTP residuals from Welland WTP, Rosehill WTP and Port Colborne WTP to the local sewer.
3. Pilot direct biosolids cake land application in collaboration with Thomas Nutrient Solution and area farmers to assess feasibility and end-user buy-in. Pending success of this pilot, complete additional upgrades at the Garner Road Facility:
 - a. Option 1 (pilot is successful): Increase dewatering capacity and add cake storage
 - b. Option 2 (pilot is not successful): Increase dewatering and liquid storage capacity

As the next step in the Biosolids Management Master Plan Update, the Region is reviewing their current service delivery model and identifying opportunities for improvement. Technical Memorandum (TM) 10 will review current work performed by third party contractors and identify opportunities to improve the service delivery model in alignment with the biosolids management program recommendations previously described in TM 5, TM 7, and TM 8.

1.2 Technical Memorandum Outline

This technical memorandum (TM) is organized into the following sections:

1. **Introduction:** This section provides the background and propose of the TM and its outline.
2. **Management of Liquid Biosolids:** This section reviews current third-party management of liquid biosolids and identifies potential improvements to meet existing and future conditions.
3. **Management of Dewatered Biosolids:** This section reviews current third-party management of dewatered biosolids and identifies potential improvements to meet existing and future conditions.
4. **Recommendations:** This section summarizes recommendations related to management of third-party contracts.
5. **Summary and Next Steps**

2.0 Management of Liquid Biosolids

2.1 Overview of Existing Contract with Thomas Nutrient Solutions

On October 1, 2020, Niagara Region contracted Thomas Nutrient Solutions to provide the followings services to manage liquid biosolids within the Region:

- Haul liquid biosolids from Region WWTPs and residuals from Decew, Grimsby and Niagara Falls WTPs to the Garner Road Biosolids Facility
- Transport biosolids and residuals between Regional facilities as required
- Manage, operate and maintain Garner Road Biosolids Facility including decanting lagoons to achieve 4 – 6% total solids, transfer of liquid biosolids between lagoons and storage tanks, mixing of lagoons and general grounds keeping. Region of Niagara staff operate and maintain the dewatering centrifuges at Garner Road Biosolids Facility.
- Implement and maintain a land application program for up to 50% of annually generated biosolids in the Region, in compliance with the Nutrient Management Act. This includes working with agricultural landowners to apply Non-Agricultural Source Material (NASM) on farmland and maintaining an appropriately sized land bank.
- Emergency response and after-hours transportation of liquid biosolids as required.

The initial term of the contract expires on December 31, 2024, with a possibility for extension for up to two additional years, concluding December 31, 2026.

The Region pays a specific unit rate per volume of biosolids hauled, that varies based on the locations it is being transferred between, and also based on an estimated quality of biosolids set at the time of contract tender. The rates are adjusted annually to account for inflation.

2.2 Current Practices

Currently, Thomas Nutrient Solutions is in Year 3 of their contract with the Region. This section reviews key elements of current operations to help identify potential opportunities for optimization.

2.2.1 Lagoon Decanting at the Garner Road Biosolids Facility

The existing contract requires Thomas Nutrient Solution to decant the lagoons at the Garner Road Facility to achieve a solids content of 4 – 6% in the land applied biosolids. In practice, the solids content of the land applied biosolids has been decreasing over a three-year period (4.48% to 3.59%), with a five-year average solids content of 4.2%. It is understood that the capacity of the receiving forcemain has declined over time, which limits the volume of supernatant that can be pumped offsite. The Region is currently working to restore design capacity to this forcemain so supernatant volume pumped can increase. Furthermore, typical liquid haul trucks have pumps suitable for pumping biosolids with total solids concentration less than 5%, so the full range of solids stated in the contract (4 – 6%) is not easily achievable in practice. It is beneficial to maintain a higher solids concentration in the lagoons to reduce the volume of liquid biosolids that must be hauled away for land application.

2.2.2 Direct Land Application from WWTPs

The contract allows for TNS to directly land apply liquid biosolids from Anger Avenue, Niagara Falls, Port Weller, Port Dalhousie, and Welland WWTPs rather than hauling these biosolids to the Garner Road facility. The intention is to provide an alternative disposal site for liquid biosolids if Garner Road is at capacity, and this option is not currently used during normal operation. It is understood that there is a limited area of agricultural land near Fort Erie (Anger Avenue WWTP) suitable for biosolids application, limiting the practice of directly land applying liquid biosolids from Anger Avenue, although this may change in future. There may be more potential for direct land application of liquid biosolids from Port Weller, Port Dalhousie and Welland WWTPs; however, these facilities are closer to the Garner Road facility, so it is more economical to haul liquid biosolids to Garner Road for storage than include storage at these WWTP during normal operation.

2.2.3 Management of Complaints

Per the contract TNS is responsible for managing any resident complaints related to hauling of biosolids and associated odours. Overall, this system is working well. Complaints are not common and are generally related to haul trucks passing through their communities.

2.3 Future Liquid Biosolids Management Requirements

Although the total biosolids produced in the Region will increase within the planning horizon to 2051, based on the recommended updates to the biosolids program, proposed increases in the portion of total biosolids undergoing dewatering will reduce the volume of liquid requiring hauling overall.

Specifically, if dewatering is added at Baker Road WWTP as recommended for consideration in the long term, liquid hauling from Baker Road to Garner Road will no longer be required, except as a contingency measure. Furthermore, liquid from the other WWTPs will continue to be hauled to Garner Road, including potentially adding liquid hauling from Niagara Falls WWTP to Garner Road in the future. If the proposed cake land application pilot is successful, a smaller portion of biosolids will be land applied as a liquid, and the majority of biosolids would be dewatered and either land applied as cake or sent to the N-Viro facility for further processing.

Overall, it is expected that the total hauled volume of liquid biosolids will decrease. The requirements for hauling cake will increase, to be discussed further in Section 3.

2.4 Alternative Approaches to Managing Liquid Biosolids

Currently a third-party contractor, Thomas Nutrient Solutions, manages transfer and hauling of all the liquid biosolids in the Region, including land application of approximately 50% of the biosolids produced in the Region. Alternative approaches for managing liquid biosolids are listed in Table 2-1, with advantages and disadvantages identified.

Table 2-1 Alternative Approaches to Managing Liquid Biosolids

ALTERNATIVE	ADVANTAGES	DISADVANTAGES	RECOMMENDATION
1. Continue using third party to haul and transfer liquid biosolids (Existing Condition)	<ul style="list-style-type: none"> • Currently working well • Allows specialist contractor to manage liquid biosolids and NASM plans with agricultural end-users, outside of Region staff expertise • Transfers risk of operations to a third party 	<ul style="list-style-type: none"> • On-going cost, potentially higher than a Region-operated program • Less control over biosolids management, and solids concentration in lagoons • Some risk to rely solely on private company whose financial situation or ownership may change 	<p>Recommended. Specialized work should be outsourced. Updates to existing contract terms should be implemented at time of renewal or when contract is retendered.</p>
2. Issue separate contracts to manage: a) All liquid biosolids (Hauling from WWTP, lagoon management, hauling to land application) b) Land application of cake	<ul style="list-style-type: none"> • Allows for greater competition and potentially lower cost, as contractors will not need to have equipment for both cake and liquid hauling; • Opportunity for cake land application contractor to find alternative uses (ie. drying, composting at facilities outside of Region) 	<ul style="list-style-type: none"> • Onus is on Region to coordinate work of different contractors. • Less flexibility in how to split production of cake and liquid biosolids in order to meet contractual obligations to different land appliers 	<p>Do not pursue. Challenging to coordinate and less flexibility on end uses of biosolids to meet contractual requirements</p>

ALTERNATIVE	ADVANTAGES	DISADVANTAGES	RECOMMENDATION
<p>3. Issue separate contracts to manage:</p> <p>a) Hauling of liquid from WWTPs, lagoon management</p> <p>b) Land application of liquid and cake</p>	<ul style="list-style-type: none"> Potentially more lucrative to land application haulers, as there are more potential end uses leading to larger potential land bank Separates management of lagoons from liquid land application, and removes potential conflict and reduced thickening in lagoons Land application contractor can optimize split between cake and liquid land application to minimize costs. 	<ul style="list-style-type: none"> Onus is on Region to coordinate work of different contractors, and ensure contractor managing lagoons meets needs of land application contractor May be harder to find a contractor with equipment to haul both liquid and cake 	<p>Recommended. Consider implementing at end of existing contract to reduce conflict of interest and increase competition</p>
<p>4. Region takes over management of hauled liquid biosolids</p>	<ul style="list-style-type: none"> Reduced reliance on third-party contractor Greater control of operations 	<ul style="list-style-type: none"> Significant capital investment for hauling fleet Staff labour cost and training Responsible for NASM agreements and contracts with farmers 	<p>Do not pursue. Cost and additional risk to manage NASM contracts outweighs potential benefits.</p>
<p>5. Region takes over management of lagoon decanting only</p>	<ul style="list-style-type: none"> Greater control over solids concentration in liquid biosolids prior to land application Removes the needs for a sampling/verification program to ensure sufficient decanting is being completed by 3rd party contractor 	<ul style="list-style-type: none"> Increased labour/operations costs Greater coordination required between Region and 3rd party contractor responsible for hauling 	<p>Alternate Recommendation. Consider if Alternative 3 is not pursued to better control solids concentration in liquid biosolids being land applied. Will require additional review of feasibility.</p>

Overall, it is recommended to continue contracting management of liquid biosolids to a third-party contractor. This reduces the labour and capital investment requirements of the Region.

Currently, the Region uses one contractor for the management of liquid biosolids which includes trucking of sludge from the wastewater and water treatment plants to the Garner Road facility, management of lagoon operation at the Garner Road facility, and liquid land application. At the end of the current contract, the Region should consider breaking out this work into two contracts (Alternative 3 in Table 2-2):

Contract 1 – Transport liquid biosolids from WWTPs and WTPs to Garner Road, and manage decanting in lagoons

Contract 2 – Transport and land application of cake and liquid biosolids from Garner Road, including management of NASM contracts with end users.

This arrangement would allow for a wider pool of contractors to bid on the work and increase potential for competitive bidding. It would also remove the potential conflict of interest that exists when the contractor responsible for managing gravity thickening in the lagoons is also responsible for hauling the liquid biosolids to land application and are paid on a volume basis.

Alternatively, if the existing liquid biosolids management contract scope is maintained (Alternative 1 in Table 2-2), a different strategy would be needed to better control solids concentration in liquid biosolids being land applied. This could be accomplished by:

- a) Region implementing a sampling program to verify solids concentrations in lagoons prior to land application; or
- b) Region taking over decanting of the lagoons to control thickening (Alternative 5 in Table 2-2).

Although both of these approaches would allow for better control of thickening levels in the lagoons, it would also require additional Region staffing and coordination with contractors in both cases. If Alternative 3 is not pursued, a further feasibility analysis is recommended to determine the best approach to control solids concentrations in liquid biosolids land application, to ultimately reduce hauling volumes.

2.5 Recommendations for Managing Liquid Biosolids

The following are recommendations for managing liquid biosolids in the Region, considering the proposed biosolids management strategies described in TM 5 and TM 7.

- Continue using third-party contractor to manage liquid biosolids; consider developing separate contract for land application of biosolids (both liquid and cake if cake pilot program is successful).
- Continue allowing for liquid biosolids to be hauled directly to land application from Anger Avenue, Niagara Falls, Port Weller, Port Dalhousie, and Welland WWTPs to maintain flexibility, and provide a contingency measure if Garner Road storage is temporarily unavailable. Consider requesting pricing for direct land application of liquid biosolids from other WWTPs (Baker Road, Niagara-on-the-Lake, Seaway, Crystal Beach) to increase flexibility in future contract. If land application will be done by a separate contract, includes these provisions in this contract.
- Improve control over solids concentration in lagoons through decanting with a target minimum concentration of 4% total solids in the land applied biosolids. This will reduce the volume of liquid biosolids hauled to land application and the associated costs, which are on a volume basis. This can be achieved by:
 - a. The Region implementing a sampling program to periodically verify solids concentrations in the lagoon being removed for land application. As an incentive, the Region should consider introducing a discounted unit price (\$/m³) to haul liquid biosolids from Garner Road to land application if total solids are less than 4%. This alternative is preferred as long as the current contract scope is maintained.
 - b. Separating contracts for management of lagoons from land application of biosolids to avoid conflict of interest. This alternative should be considered before renewing current contract.
 - c. The Region taking over managing of the lagoons and associated decanting. This alternative should be considered before renewing current contract.

A separate feasibility study is recommended to review alternatives related to lagoon management and control of thickened biosolids concentrations in more detail.

- Update expected biosolids quantities in contract to reflect current values and expected changes in hauling.

- Require that contractor demonstrates that they have a sufficiently sized land bank for estimated quantity of biosolids plus 30% to allow for increases over course of the contract.
- If dewatering is still being used at Niagara Fall WWTP upon contract renewal, update contract terms to allow for provisional hauling of dewatered cake from Niagara Falls WWTPs to Garner Road or direct land application in the scenario where Walker Environmental cannot receive the cake; also including hauling price for cake from Garner Road to direct land application.

Further recommendations related to biosolids cake management will be discussed further in Section 3.

3.0 Management of Dewatered Biosolids

3.1 Overview of Existing Contract with Walker Environmental

The Region’s current contract with Walker Environmental, which was last renewed in March 2017, currently requires the Region to supply a minimum of 4700 dry tonnes and up to a maximum of 6000 dry tonnes of dewatered biosolids to Walker Environmental. The current contract has a term of 10 years, which expires in March 2027. After this point, there is an option to extend the contract an additional 5 years.

Walker Environmental hauls the dewatered cake from both the Garner Road facility and Niagara Falls WWTP and processes it to create a fertilizer product using advanced alkaline stabilization.

Walker Environmental requires biosolids from the Region to have a total solids content between 22 and 40%, and pricing is on a dry tonne unit basis with a unit rate that increases for lower total solids concentrations.

The contract also requires Walker Environmental to allocate enough of their plant capacity to handle at least 85% of the biosolids produced by the Region per year. Walker Environment is responsible for marketing and selling the final ‘N-Rich’ fertilizer product and maintaining compliance with their facility’s Environmental Compliance Approval.

3.2 Current Practices

3.2.1 Biosolids Dewatering

The Region currently operates and maintains centrifuges at the Garner Road facility and Niagara Falls WWTP in order to provide sufficient volumes of dewatered cake to meet their contractual obligations with Walker Environmental. Although Thomas Nutrient Solutions manages the liquid biosolids at the Garner Road Facility, Niagara Region staff maintain and operate the centrifuges, providing both labour and polymer supply to run this equipment. The centrifuges are located on

the second floor of the dewatering building, and cake is discharged to the truck bay below where it is loaded into haul trucks from Walker Environmental. The centrifuges at Niagara Falls WWTP are also run by Region operations staff, with Walker Environmental picking up the cake from the WWTP and hauling it to their nearby N-Viro processing facility.

As previously mentioned, the Region must operate the centrifuges to provide a solids content between 22 and 40%. Actual cake solids concentrations do not generally exceed 32%. The Region targets a solids concentration that is high enough to reduce tipping fees to Walker Environmental, which decrease with higher solids concentrations, without overspending on polymer that is required to achieve higher solids concentrations.

3.2.2 Dewatered Cake to N-Viro Facility

Currently, the Region targets sending 50% of the biosolids generated in the Region to the N-Viro Facility owned and operated by Walker Environmental. Per the contract, the Region must send a minimum of 4700 dry tonnes per year, and up to 6000 dry tonnes per year. Actual quantities sent to N-Viro between 2019 and 2022 are summarized in the table below.

Table 3-1 – Quantities of Cake Sent to N-Viro Facility from Garner Road and Niagara Falls WWTP between 2019 – 2022

YEAR	QUANTITY (WET TONNES/YEAR)	QUANTITY (EQUIVALENT DRY TONNE/YEAR AT 30%)
2019	15,515	4655
2020	18,013	5404
2021	14,287	4286
2022	15,223	4567
AVERAGE	15,759	4728

As shown in the table, the Region only sent the minimum annual quantity of 4700 dt/year to N-Viro in one of the last four years. Per the Region’s Contract with Walker Environmental, they are required to pay for 4700 dt/year, even if this full volume is not used. As the annual dry tonne quantities in the table above are calculated based on a total solids concentration of 30%, the actual dry tonnage may vary as the solids concentration fluctuates. In recent years, centrifuge maintenance issues have made it more difficult to produce sufficient quantities of cake.

3.3 Future Dewatered Biosolids Management Requirements

TM 5 recommends adding dewatering at Garner Road Facility and potentially at Baker Road WWTP in the long term as part of the updated biosolids management program in the Region. In this case, a larger volume of dewatered cake will be produced in the Region each year. Some of this dewatered cake will continue to be sent to the N-Viro facility, and some will be land applied directly as cake if sufficient buy-in is obtained from local farmers. The program should allow for flexibility in quantities that will be land applied and sent to the N-Viro facility.

By incorporating direct land application of cake, the Region would increase diversity in their program and become less reliant on Walker Environmental to process their dewatered biosolids in the future. This will also provide a third outlet for biosolids in the Region and increase resilience if there are any conditions that arise which prevent Walker Environmental from receiving biosolids.

3.4 Alternative Approaches to Managing Dewatered Biosolids

Currently all dewatering is performed by Niagara Region, with Walker Environmental hauling and processing the cake at their N-Viro facility. Alternative approaches for managing biosolids cake, to incorporate the recommended direct cake land application program, are listed in the table below, with advantages and disadvantages identified.

Table 3-2 Alternative Approaches to Managing Dewatered Biosolids

ALTERNATIVE	ADVANTAGES	DISADVANTAGES	RECOMMENDATION
1. Continue using N-Viro to process between 4700 and 6000 dt/year of biosolids and directly land apply remainder as cake	<ul style="list-style-type: none"> No changes required to volumes in current contract Region is able to consistently produce 4700 dt/year 	<ul style="list-style-type: none"> Max allowable quantity is less than 50% of future biosolids amount, although if cake land application pilot is successful, this may not be a concern as other end uses of cake will be available 	<p>Alternative Approach. Maintaining existing quantities is acceptable if cake land application pilot is successful, and some cake can be diverted away from N-Viro. Recommend pursuing if alternative 2 below cannot be agreed to in Walker Environment contract</p>
2. Increase maximum volume of dewatered biosolids sent to N-Viro to 8000 dt/year and maintain minimum of 4700 dt/year; directly land apply remainder as cake	<ul style="list-style-type: none"> Greater program flexibility, which allows for increased quantities to N-Viro if cake land application is not always available 	<ul style="list-style-type: none"> Requires contract update, although changes will improve consistency of contract terms This additional capacity may not be available, or may be committed to other municipalities 	<p>Preferred Approach. Request increase in reserved quantity for Niagara Region upon contract renewal to match 85% of biosolids already in contract. Do not change minimum required quantity.</p>
3. Maintain maximum volume of dewatered biosolids sent to N-Viro as 6000 dt/year and decrease minimum volume to <4700 dt/year, and directly land apply remainder as cake	<ul style="list-style-type: none"> Greater program flexibility; allows Region to directly land apply a greater quantity of cake if demand is there, reducing program costs 	<ul style="list-style-type: none"> Requires contract update Less likely to be acceptable to Walker without giving up reserved Region capacity at N-Viro facility (ie. reducing max. allowable quantity) 	<p>Not recommended. Region should not have issue meeting this target, particularly as biosolids quantities increase, and additional dewatering capacity is added.</p>

ALTERNATIVE	ADVANTAGES	DISADVANTAGES	RECOMMENDATION
<p>4. Stop sending dewatered cake to N-Viro, and directly land apply all biosolids as cake</p>	<ul style="list-style-type: none"> • Lower cost due to less material processing 	<ul style="list-style-type: none"> • Lower quality end product • Demand for cake may not be high enough (to be confirmed with Pilot) • N-Viro facility is already functioning and part of local economy; removing business would be detrimental 	<p>Not recommended. Too much reliance on cake land application, and less program flexibility and resiliency. Reduces support of existing local industry.</p>
<p>5. Hire third-party contractor to operate centralized dewatering facility at Garner Road and manage contract with Walker Environmental</p>	<ul style="list-style-type: none"> • Reduced number of Region staff required • Transfers risk to third party for solids content 	<ul style="list-style-type: none"> • Reliant on third party to manage Walker Environmental contract; difficult to control how much is sent to N-Viro vs. liquid land application vs. direct cake land application • Region would not have direct control of solids content and would be in the middle of two contractors and would have to manage disputes • Higher claims risk from Walkers 	<p>Not recommended. Challenging to control costs and how biosolids are processed (dewatered vs liquid land application)</p>

Overall, it is recommended to revise the terms of the Region’s contract with Walker Environmental to allow for an increase in the reserved quantity of biosolids. This will allow for greater program flexibility, particularly as total biosolids quantities in the Region increase over time. The quantities of dewatered biosolids that are land applied verses sent to the N-Viro facility should be flexible in the contract language, while still meeting minimum commitments to third party contractors.

3.5 Recommendations for Managing Dewatered Biosolids

The following are recommendations for managing dewatered biosolids in the Region, considering the current contractual obligations, future needs and the proposed biosolids management strategies described in TM 5 and TM 7.

- Continue contract with Walker Environmental, with proposed contract revisions, including increasing maximum quantity of biosolids reserved for Niagara from 6000 dt/year to 8000 dt/year. Maintain minimum required biosolids quantity of 4700 dt/year to N-Viro to ensure incentive to Walker Environmental.
- Engage a third-party contractor to haul cake from Garner Road to direct land application. This may or may not be the same contractor that manages liquid land application.

4.0 Summary and Next Steps

This TM provides recommendations for managing third party contracts going forward, incorporating proposed changes to the Region’s biosolids management program. Risks associated with the existing contracts will also be documents in TM 11 – Contingency Plan. Recommendations from both TM 10 and TM 11 will be incorporated in the final Biosolids Master Plan Report.