



Volume 10: Province-Wide Summary & Study Conclusions

A Study of the Optimization of the Blue Box Material Processing System in Ontario *Final Report*

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Prepared for Waste Diversion Ontario by:



Resource Recycling Systems
Sustainable Systems for a Waste-Free Future

STEWARDEDGE

Volume 10: Province-Wide Summary & Study Conclusions

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1. Introduction

The purpose of this study is to provide Waste Diversion Ontario (WDO), including the Continuous Improvement Fund (CIF), individual municipal owners, the Association of Municipalities of Ontario (AMO) and Stewardship Ontario (SO) with comprehensive independent information on a theoretical optimized MRF and transfer facility network for the province of Ontario.

The Project Team has developed a geographic information system (GIS) model that will:

- Theoretically reflect a cost-effective, efficient and successful recovery system for packaging & printed paper in Ontario, and
- Inform decision-making toward an optimized provincial system for the transfer, hauling and sorting of Blue Box recyclables for market

Volume 10 presents an overview of the options and variations included in the analysis for each region and provides a province-wide summary which outlines four scenarios developed to highlight the differences among options. Study conclusions drawn from the analysis and next steps are also presented.

2. Existing System Cost

2.1. Approach to Estimating 2010 Existing System Cost

An estimate of the cost of the Existing System is required to compare to the estimated cost of the optimized system options.

The cost data for 2010 reported by municipalities, verified by WDO and stored in the WDO Database, has been used as the basis of our cost estimates for the Existing System. These data represent the most current and complete data on the actual cost of Ontario's Blue Box system. For more detail on the approach to estimating the existing system cost for 2010, see Volume 3.

Table 1 summarizes the gross cost of the Blue Box transfer and processing system in Ontario for 2010.

Table 1: Estimated Existing System Cost in 2010

	Tonnes	Annual Capital and Operating Cost (\$)
Cost data from 27 of the largest 30 programs + 5 smaller programs for which processing and revenue are reported separately	767,914	\$93,633,000
Theoretical costs for the remaining 3 of the 30 largest programs	38,689	\$4,596,000
11 smaller programs with cost data for which processing and revenue are reported separately	7,915	\$1,508,000
Estimate of costs for the 177 small programs based on the 11 representative smaller programs	72,725	\$13,860,000
Total Processing	887,242	\$113,596,000
Theoretical transfer cost for known transfer operations	284,363	\$9,505,000
Transfer cost for programs with unknown material flows based on costs from known transfer operations	3,487	\$117,000
Total Transfer	287,849	\$9,622,000
TOTALS¹	887,242	\$123,218,000

2.2. Approach to Projecting 2025 Natural Growth Existing System Cost

The greenfield baseline and optimized system options are estimated for 2025. Therefore, in order to compare to the Existing System, an estimate of the cost of the Existing System in 2025 is required.

Two key changes will affect the processing and transfer cost:

1. Change in the tonnes recovered: Under the Natural Growth Scenario (see Volume 2), material recovery rates remain approximately the same or are slightly higher given recent trends. Also, the population will have increased. Therefore, overall an increase in tonnages is projected.
2. Change in composition: The change in composition toward lighter weight, more complex and in some cases lower value material will tend to result in a higher management cost.

It is possible that any underutilized capacity in the system that could allow the increase in tonnes to be managed at a lower unit cost would be entirely offset by the higher cost to manage the remaining and incremental tonnes.

Therefore, the projected cost of the Existing System in 2025 was calculated as a range +/- 5% as summarized in Table 2. For more detail on how the 2025 Existing System cost was projected, see Volume 3.

¹ Tonnes transferred are included in the tonnes processed.

Table 2: Projected Existing System Cost in 2025

	Tonnes	Annual Capital and Operating Cost (\$)
Cost data from 27 of the largest 30 programs + 5 smaller programs for which processing and revenue are reported separately	901,067	\$104,328,000 - \$115,310,000
Theoretical costs for the remaining 3 of the 30 largest programs	45,955	\$5,122,000 - \$5,122,000
11 smaller programs with cost data for which processing and revenue are reported separately	11,366	\$2,131,000 - \$2,355,000
Estimate of costs for the 177 small programs based on the 11 representative smaller programs	88,066	\$15,944,000 - \$17,623,000
Total Processing	1,046,453	\$127,524,000 - \$140,409,000
Theoretical transfer cost for known transfer operations	351,235	\$10,662,000 - \$11,410,000
Transfer cost for programs with unknown material flows based on costs from known transfer operations	4,207	\$125,000 - \$132,000
Total Transfer	355,441	\$10,787,000 - \$11,542,000
TOTALS²	1,046,453	\$138,311,000 - \$151,951,000

In summary, the Existing System processing and transfer cost is estimated to be \$123,218,000 in 2010 and between \$138,311,000 and \$151,951,000 in 2025. For 2010, approximately 77% of the cost is the actual reported cost while the remaining 23% is modelled either based on the actual cost in representative programs or a theoretical unit cost.

3. Summary of Options

3.1. Eastern Region Summary

In the Eastern Region, the following options and variations were included in the analysis.

- Baseline: 1 MRF in Ottawa (Natural growth recovery) – the minimum number of MRFs for the Region
- Option 1: 1 MRF in Ottawa and 1 in Kingston (Natural growth recovery)
- Variation A on the Baseline: Existing MRFs in Ottawa Valley, Cornwall and Kingston are utilized as Transfer Stations
- Variation B on the Baseline: Existing MRFs in North Dundas and North Glengarry are utilized as Transfer Stations in addition to those used in Variation A

² Tonnes transferred are included in the tonnes processed.

- Variation C on the Baseline: All Existing MRFs and Transfer Stations (except for Metro Waste Recycling in Ottawa) are utilized as Transfer Stations.
- High Recovery Baseline: Same as Baseline above but using the High Recovery tonnes
- High Recovery Option 1: Same as Option 1 above but using the High Recovery tonnes
- Variation C on the High Recovery Baseline: Same as Variation C on the Baseline above but using the High Recovery tonnes

A discussion of the total annual cost and the capital costs and the results of the analysis for the Eastern Region is presented in Volume 4.

3.2. Central Region & GTA Summary

In the Central Region, the following options and variations were included in the analysis.

- Baseline: 3 MRFs; 1 near Peel, 1 in Toronto East, and 1 in Toronto West; All City of Toronto Transfer Stations are utilized. (Natural Growth Recovery)
- Option 1: 4 MRFs; 1 near Durham, 1 near Peel and 2 in Toronto (1 in the West and 1 in the East); All City of Toronto Transfer Stations are utilized. (Natural Growth Recovery)
- Option 1-Ba: 4 MRFs; 1 in Barrie, 1 near Peel and 2 in Toronto (1 in the West and 1 in the East), i.e. Option 1 using a MRF in Barrie instead of Durham; All City of Toronto Transfer Stations are utilized. (Natural Growth Recovery)
- Option 2: 5 MRFs; 1 near Durham, 1 near Barrie, 1 near Peel and 2 in Toronto (1 in the West and 1 in the East); All City of Toronto Transfer Stations are utilized. (Natural Growth Recovery)
- Variation A on the Baseline: Existing MRFs in Southampton, Durham, Peterborough, Trenton, and East Gwillimbury are utilized as transfer stations; All City of Toronto Transfer Stations are utilized; Existing MRF in Peel utilized as a MRF.
- Variation B on the Baseline: Existing MRFs in Counties of Northumberland Simcoe are used as transfer stations and all City of Toronto Transfer Stations are utilized; These in addition to those used in Variation A on the Baseline.
- Variation C on the Baseline: All remaining MRFs and transfer stations (except those determined to not fit our criteria) are utilized as transfer stations.
- Variation A on the Option 1: Existing MRFs in Kingston, Southampton, Durham, Peterborough, Trenton, and East Gwillimbury are utilized as transfer stations; All City of Toronto Transfer Stations are utilized; Existing MRFs in Peel and Durham are utilized as a MRFs.
- Variation B on the Option 1: Existing MRFs in Counties of Northumberland and Simcoe used as transfer stations and all City of Toronto Transfer Stations are utilized. These in addition to those used in Variation A on the Baseline.
- Variation C on the Option 1: All remaining MRFs and transfer stations (except those determined to not fit our criteria) are utilized as transfer stations.
- High Recovery Baseline: Same as Baseline above but using the High Recovery tonnes
- High Recovery Option 1, 1-Ba, 2: Same as Options 1, 1-Ba, 2 above but using the High Recovery tonnes.
- Variation C on the High Recovery Baseline: Same as Variation C on the Baseline above but using the High Recovery tonnes.

A discussion of the total annual cost and the capital costs and the results of the analysis for the Central Region & GTA is presented in Volume 5.

3.3. Southwestern Region Summary

In the Southwestern Region, the following options and variations were included in the analysis.

- Baseline: 1 MRF in Hamilton, and 1 in London (Natural Growth Recovery)
- Option 1: 1 MRF in Hamilton, 1 in London, and 1 in Windsor (Natural Growth Recovery)
- Option 1-So: 1 MRF in Hamilton, 1 in London and 1 in Southfield, MI (Natural Growth Recovery)
- Option 1-Wa: 1 MRF in Hamilton, 1 in Waterloo, and 1 in Windsor (Natural Growth Recovery)
- Option 2: 1 MRF in Hamilton, 1 in London, 1 in Waterloo, and 1 in Windsor (Natural Growth Recovery)
- Option 3: 1 MRF in Hamilton, 1 in London, 1 in Waterloo, 1 in Windsor, and 1 in Niagara Falls (Natural Growth Recovery)
- Variation A on the Baseline: Existing MRFs in Huron Park, Windsor, Norfolk, Niagara Falls, and Waterloo utilized as transfer stations. Existing MRFs in Hamilton and London (City MRF) utilized as a MRF.
- Variation B on the Baseline: Existing MRF in Guelph used as a transfer station and continued utilization of transfer stations in Cambridge (Waterloo) and Woodstock as transfer stations. These in addition to those used in Variation A.
- Variation C on the Baseline: All remaining MRFs and transfer stations (except BFI Canada & Emterra in London, Waste Management in Petrolia, and the Norjohn Transfer System Ltd in Burlington) are utilized as transfer stations.
- High Recovery Baseline: Same as Baseline above but using the High Recovery tonnes
- High Recovery Option 1, 1-Wa, 2, 3: Same as Option 1, 1-Wa, 2, 3 above but using the High Recovery tonnes.
- Variation C on the High Recovery Option 1: Same as Variation C on the Baseline above but using the High Recovery tonnes

A discussion of the total annual cost and the capital costs and the results of the analysis for the Southwestern Region is presented in Volume 6.

3.4. Northern Region Summary

In the Northern Region, the following options and variations were included in the analysis.

- Baseline: 3 MRFs; 1 in Greater Sudbury, 1 in Thunder Bay, and 1 in Winnipeg (Natural growth recovery)
- Option 1: 4 MRFs; 1 in Greater Sudbury, 1 in Thunder Bay, 1 in Sault Ste. Marie and 1 in Winnipeg (Natural growth recovery)
- Variation A on the Baseline: Existing MRFs in Kapuskasing and New Liskard utilized as transfer stations, existing transfer stations in Timmins and Kenora District are utilized.
- Variation B on the Baseline: Existing transfer station in Kenora is utilized in addition to those used in Variation A
- Variation C on the Baseline: The existing Thunder Bay MRF is utilized as a MRF. All Existing MRFs and transfer stations (except for Greg's Recycling in Devlin, R & D Recycling in North Bay, Teck Northern

Roads in Kirkland Lake, Asselin Transportation in Fort Frances, and the Fort Frances TS) are utilized as transfer stations.

- High Recovery Baseline: Same as Baseline above but using the High Recovery tonnes
- High Recovery Option 1: Same as Option 1 above but using the High Recovery tonnes
- Variation C on the High Recovery Baseline: Same as Variation C on the Baseline above but using the High Recovery tonnes

A discussion of the total annual cost and the capital costs and the results of the analysis for the Northern Region is presented in Volume 7.

4. Province-Wide Summary

No single system has been recommended for a given region since there were no discussions with municipal officials and to acknowledge the need to consider local factors and criteria and analyse collection impacts.

For a province-wide summary, the project team chose combinations of the regional options to develop four scenarios which highlight some of the differences in the options. For each province-wide option the total tonnes, total capital and operating costs were summed and the cost per tonne was determined. Any change in the movement of tonnes from one region to another between the options was corrected to ensure that there was no double counting of tonnes and associated cost. The four scenarios developed are:

- Lowest Capital and Operating Cost: This combines the greenfield scenario (i.e. all new facilities), which is the Baseline scenario for each of the four regions and generally having fewer MRFs.
- Increased Redundancy in the Central Region – An option with an additional MRF in the Central Region: This combines the Eastern Baseline, Southwestern Baseline, Central Option 1-Ba (an additional MRF in Barrie), and the Northern Baseline.
- Increased Redundancy in Southwestern, Central and Northern Regions – An option with additional MRFs in the other regions: This combines the Eastern Baseline (with material from the Kingston area moving to the Central Region), Southwestern Option 3, Central Option 2 and Northern Option 1.
- Lowest Capital and Operating Cost with No Collection Impact: This used variation C of each of the regional options in the first scenario (Lowest Capital and Operating Cost), in which there is no change to where material is hauled by using all existing facilities, i.e. it uses existing municipal MRFs and private MRF locations as the hub MRFs defined in the greenfield options and all other existing facilities are used as transfer stations.

The results for these four scenarios are shown in Table 3. The four scenarios were also run with the quantities under the High Recovery scenario to understand the range of potential costs and tonnages. The tonnage managed at each facility and therefore total capital and operating cost does increase significantly under the High Growth scenario, but the cost per tonne changes nominally.

Table 3: Province-Wide Summary of Optimized Systems

	Total Annual Cost	Tonnes	Cost/Tonne	% Increase in Cost
Natural Growth				
Lowest Cost Scenario	\$106,481,000	1,056,000	\$ 101	
Increased redundancy in Central	\$107,787,000	1,056,000	\$ 102	1.2%
Increased redundancy in SW, C, N	\$113,510,000	1,056,000	\$ 107	6.6%
Lowest Cost No Collection Impact	\$112,438,000	1,056,000	\$ 106	5.6%
High Recovery				
Lowest Cost Scenario	\$115,008,000	1,150,000	\$ 100	8.0%
Increased redundancy in Central	\$116,375,000	1,150,000	\$ 101	9.3%
Increased redundancy in SW, C, N	\$121,493,000	1,150,000	\$ 106	14.1%
Lowest Cost No Collection Impact	\$121,767,000	1,150,000	\$ 106	14.4%

Table 4 summarizes the savings of an optimized province-wide transfer and processing system over the existing transfer and processing system under the four different criteria described above.

Table 4: Comparison of Optimized Systems to Existing System

Natural Growth	Total Annual Cost	Total Annual Cost with Excess Capacity*	Percent Saving from Low Estimate of Projected Existing System Cost	Percent Saving from High Estimate of Projected Existing System Cost
Lowest Cost Scenario	\$106,481,000	\$111,805,050	19%	26%
Increased redundancy in Central Region	\$107,787,000	\$113,176,350	18%	26%
Increased redundancy in SW,C,N Regions	\$113,510,000	\$119,185,500	14%	22%
Lowest Cost No Collection Impact	\$112,438,000	\$118,059,900	15%	22%

* Costs include capital, labour and operating costs

**To be conservative, the costs of province-wide optimized options are increased by 5% to reflect the inclusion of additional excess capacity to that already built into the design and modelling

The capital cost for each of the scenarios is shown in Table 5. The effect of using existing facilities on initial capital investment is shown.

Table 5: Province-Wide Capital Cost Summary for Optimized Systems

	Total capital for new MRFs	Total capital for upgrades to Existing MRFs	Total capital for new TS	Total capital for conversions from MRF to TS & upgrades to existing TS	Total
Lowest Cost Scenario	\$201,940,600	\$0	\$42,270,000	\$0	\$244,210,600
Increased redundancy in Central Region	\$201,295,000	\$0	\$40,180,000	\$0	\$241,475,000
Increased redundancy in SW, C, N Regions	\$246,423,700	\$0	\$33,910,000	\$0	\$280,333,700
Lowest Cost No Collection Impact	\$113,395,800	\$37,065,000	\$5,730,000	\$25,700,000	\$181,890,800
Lowest Cost Scenario Utilize Existing Facilities	\$113,395,800	\$37,065,000	\$15,095,000	\$10,595,000	\$176,150,800

5. Study Conclusions

Computer modelling of the Blue Box materials transfer & processing network for Ontario has been completed. The results, together with the guidance documents presented in this report and summarized below, provide guidance on how stakeholder decisions can move towards an optimized system over time. The transfer-processing model tool and the data that drive it is now available to help define what an optimized, cost effective and efficient recovery system can be for the province.

Based on results from use of the computer model the following five conclusions can be drawn:

- Reducing the number of MRFs reduces overall processing and transfer system costs:*
 - Cost savings province-wide range from 14% to 26% as presented in the Province-Wide Summary table
 - Savings vary depending on number of MRFs and transfer stations in the system
 - The province could be served with as few as 9 MRFs (8 in Ontario and 1 in Winnipeg)
 - Increasing from the minimum number of MRFs to 16 MRFs province-wide increases the overall capital and operating costs by about 11% over the lowest cost scenario and could achieve additional redundancy and ensure greater competition among service providers.
- The lowest cost modelled system is the one with the fewest MRFs, however regional dynamics will dictate how much savings can actually be achieved by getting to the minimum number of MRFs*
 - Regional dynamics arising from the characteristics of material generation density and geography, the location, capability and condition of the existing infrastructure and current contracts affect the potential savings
 - In the Eastern Region with Ottawa as the only major population center, adding a second MRF in Kingston significantly increases the overall capital and operating costs per tonne by 10% (\$100.32/tonne to \$110.64/tonne) over the lowest cost scenario

- In the Southwestern Region in which the population is more widely distributed in cities adding MRFs to those proposed for Hamilton and London in the lowest cost, fewest MRFs scenario has a less significant increase of 2% (\$97.46/tonne to \$99.85/tonne) in the overall capital and operating costs per tonne
 - In the Central and Northern regions adding MRFs to the lowest cost, fewest MRFs scenarios increases the capital and operating cost per tonne by 4% (\$96.13/tonne to \$99.79/tonne) and 6% (\$164.69/tonne to \$175.34/tonne) respectively
3. *The key to the hub and spoke system is highly efficient medium and large MRFs running 2-shifts per day*
- In the lowest cost, fewest MRFs scenario, processing costs still constitute 77% of the total transfer and processing system cost
 - These highly efficient MRFs operate with a capacity ranging from 100k - 200k tonnes per year and have target operating costs of \$71 - \$78 per tonne when operating at full capacity
 - The supply of material from the less dense areas (accessed through hub and spoke supply strategies) enables these efficiencies to be realized; for example, according to the model, a MRF in London (the “hub”) with just its own tonnes would have an operating cost of \$114 per tonne, however, with the additional tonnes from regional transfers (the “spokes”) this operating cost can be reduced to \$86 per tonne
 - Transfer loading costs, including capital and operating costs, add between \$14 and \$34 per tonne depending on the size of the operation and these additional costs must be offset by lower MRF processing costs to justify the hub and spoke system
 - The target operating costs for the MRFs can be reached through a combination of new equipment, new process design, and better management and operating practices and systems
4. *Material can be transferred economically long distances*
- Utilizing transfer stations allows smaller communities to accept a wider variety of materials (the standard suite of materials), while constructing a MRF locally that could separate such a wide variety of materials would be cost prohibitive
 - The distance that a transfer station can economically haul depends on how many tonnes are aggregated there and what size of MRF is available to receive the materials
 - The fewer tonnes at the aggregation point and the larger, more efficient the receiving MRF, the farther the material may be transferred economically; for example, a transfer station with 5,000 tpy could economically haul 790 km to a medium sized 2-shift MRF or 830 km to a large sized 2-shift MRF
 - The hub and spoke system will not be significantly affected by high increases in fuel costs
 - All but the largest long distance transfers (i.e. Waterloo to Hamilton) are significantly shorter than the maximum economical haul distance and will not be affected significantly, even by a doubling of the fuel cost
5. *Collection costs need to be studied to fully understand savings potential*
- The lowest cost scenarios achieve their efficiencies through consolidation of transfer stations and this can have a significant effect on collection routes, depending on the final location of these transfer stations – and quantifying that impact was not part of this study
 - Collection impacts vary due to differing equipment utilized, the distances from the end of collection routes or depot locations to these aggregation points and local private infrastructure

- Modelled scenarios using all current infrastructure as transfer stations and thus having no impact on existing collection haul distances still showed 15% - 22% cost savings on the processing and transfer cost over the Existing System, as presented in the Province-Wide Summary
- The specific location of transfer stations can be adjusted with little effect on the overall regional or province costs
 - There is less than a 1.5% impact from moving the location of some of the transfer stations from the greenfield model to existing sites

5.1. Possible Next Steps

In order to achieve the benefits of optimization, the following would be required under the existing legislative and regulatory framework and the shared responsibility between industry and municipalities:

- Information needs to be provided to key municipal staff and decision-makers at regional and local level, regarding:
 - the level of potential system savings
 - guidance for transition planning depending on the situation
 - analysis of the capital investment requirements
 - additional analysis about impacts on local collection system
- Support is required for municipal staff and decision-makers to assess and evaluate the options, and
- A commitment and process is required to share the benefits and allocate costs equitably among all stakeholders

Therefore, potential next steps are:

- Present the results of this report to the municipalities focusing on the specific region and its implications
- Convene stakeholder groups, both the host community for a proposed hub or spoke location, as well as the affected communities that would haul to those MRFs, so that their specific concerns can be addressed in the development of a transition process
- Identify and establish mechanisms for sharing of benefits of the optimized system among all stakeholders
- Where applicable, study the impacts of differing options on local collection systems
- As the dialogue develops about any hub and spoke sub-system in a region then actual costs or next stage engineering estimates can replace those used in the model's database, allowing the model to more accurately inform decisions on hub and spoke development
- Potential merchant capacity should be taken into consideration – using best practice procurement approaches and public private partnership strategies to bring the best business deal and pricing to the public agencies as they seek to find their role in a more optimized system; this includes the question of how to utilize private sector capacity that is being built even as this study is being assembled