



**MRF Upgrade – Container Line Retrofit  
CIF Project # 515.11**

**August 2016**

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## **Executive Summary**

This report outlines the monitoring results of the most recent CIF funded equipment purchase and installation of Northumberland County's container line processing equipment.

The purpose of this project was to increase cost effectiveness, diversion, MRF optimization and rationalization.

Based on these objectives the primary focus was to update the processing equipment to allow for optical sorting of PET plastics, improve safety conditions for employees and reduce operating costs.

This project has been very successful for Northumberland County. The Material Recovery Facility (MRF) has increased the diversion of PET recyclables by 66% and realized an annual savings of \$360,000 per year.

Results were achieved by increasing tonnes marketed, decreasing labour costs, decreasing residual disposal fees and eliminating WSIB injury claims.

The overall payback period for the capital investment of this project is 2.5 years.

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## 1.0 Introduction

This monitoring report provides pre and post installation data of the original container line processing equipment versus the new container line processing equipment, performance levels, related labour and operational costs. Upon commissioning the newly installed equipment, comparative data was collected to determine the overall effectiveness of the processing line. The monitoring timeframe for this project spans from March 1, 2014 – February 28, 2015 (pre-installation) and March 1, 2015 – February 28, 2016 (post installation).

## 2.0 Program Background

Northumberland County offers a wide range of programs and services to over 85,000 residents.

People, Partnerships, Possibilities – Strategic Plan 2015-2019 uses the County's Vision, Mission and Core Values to set priorities for the future to ensure that we can continue to meet changing needs of our citizens and the world we live in.

**Our Vision:** To bring together people, partnerships and possibilities for a strong and vibrant Northumberland County.

**Our Mission:** To be a best practices leader of the County government and a collaborative partner with our member municipalities, and community partners.

**Our Core Values** are defined as: Care & Supportive, Collaboration & Communication, Honesty & Integrity, Innovation & Excellence, Mutual Trust & Respect and Accountability.

The MRF Container Line Retrofit detailed within this report supports the County Core Value of Innovation & Excellence.

In 2014, Northumberland County adopted a new Long-Term Waste Management Master Plan (LTWMMP). The new LTWMMP provides direction on how to increase the County's current Waste Diversion Rate of 40% to beyond 70% by the year 2020. The plan contained a recommendation to upgrade the Material Recovery Facility's Container Processing Line within 2015.

The County of Northumberland has committed to operate the Material Recovery Facility. As a result, capital equipment replacement reserves are included within the annual budget.

The publically owned and operated Northumberland MRF is a 55,000 sq. ft. single stream facility that is currently processing approximately 15,000 tonnes per year (60 tonnes per operating day) on a single shift. The facility manages a broad spectrum of plastics inclusive of film plastic and all rigid container grades. The MRF (ECA A311713) is licensed to receive material from all of Ontario with a maximum inbound limit of 350 tonnes per operating day.

**Blue Box processing services provided by the County include:**

- Single Stream processing of residential and IC&I sector blue box material throughout the County
- Two stream processing of City of Kawartha Lakes blue box material
- Direct bale processing of dedicated loads of fibre from private contractors

To improve overall processing performance and reduce operating costs, the Northumberland MRF has conducted the following capital improvements over the past few years:

- Installation of a new triple deck fibre screen system (2009-E&E funded)
- Installation of a new fibre sort line equipped with optical sort technology (2009-not funded)
- MRF Energy Audit (2010-CIF funded)
- Installation of a new container baler and supporting metal infeed conveyor (2011-CIF funded)
- Installation of a new fibre baler (2012-not funded)

In 2008 the MRF underwent a fibre line equipment retrofit. This project focused on replacing aging fibre processing equipment with new processing technologies. At that time, container processing equipment was being developed rapidly in the marketplace; therefore, it was not recommended to proceed with replacing the container line equipment until new and emerging technologies could be fully evaluated.

The MRF's container system was designed in 1996. Since then, processing equipment and the types of materials in the Blue Box have changed significantly. Today we see high volumes of PET beverage bottles and thermoform packaging items (fruit, vegetable and merchandise packaging).

Challenges with the 1996 container line processing equipment included:

- equipment required manual sorting of all PET
- inability to capture all PET materials (15% is not captured and went to the landfill)
- glass sorting equipment in the container line was redundant
- high risk of employee repetitive motion injuries

In 2013, the County entered into a processing contract with the City of Kawartha Lakes (CKL) whereby, Northumberland committed to processing recyclable materials from CKL until the year 2018 with a possible extension until the year 2020. This regionalized approach provides Northumberland with economies of scale which added to the financial rationale for proceeding with this project.

**Photo 1 – County of Northumberland Material Recycling Facility- Grafton, ON**



**3.0 Project Description and Objectives**

The County released Tender # 47-14 requesting the supply and installation of PET Optical processing equipment and all associated work. The County received two bid submissions and awarded the project to Machinex Recycling Services Inc.

The installation of this equipment will reduce employee risk of injuries.

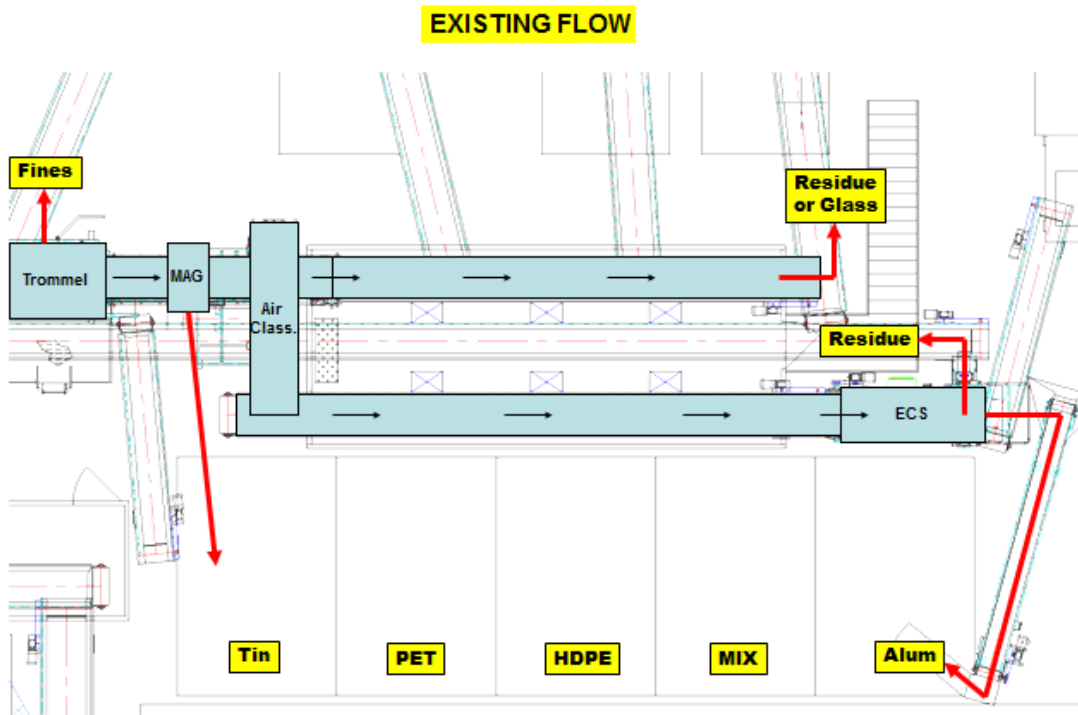
Repetitive motion injuries are a major concern for MRF sorters. PET plastic water bottles were being hand sorted by employees, leading in some instances to the onset of these injuries. By installing an optical sorting unit designed to mechanically sort PET, it was believed that the number of repetitive stress injuries sustained by employees would be reduced. The optic sorting equipment

would perform the majority of the PET sorting functions and reduce staffing levels with the remaining affected employees undertaking a quality control role.

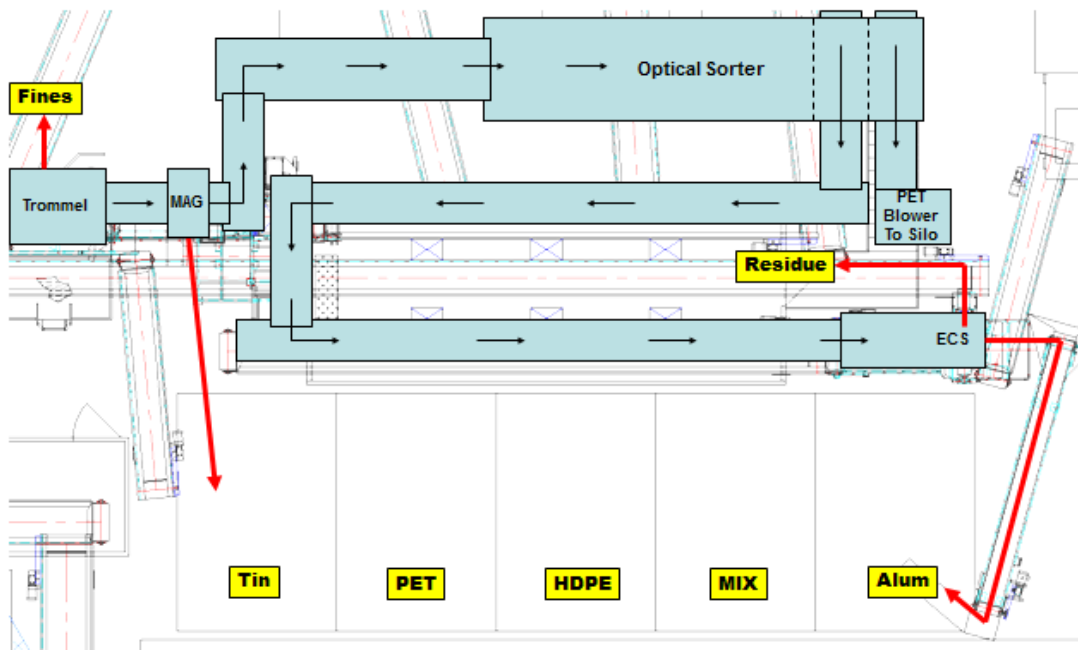
**Tender details were as follows:**

This Request for Proposal was for the provision to supply and install PET Optical processing equipment.

Two illustrations were included in the tender showing the current processing configuration and a conceptual design of the container line with a PET Optical sorter. The conceptual illustration was for the purpose of visual clarification for the bidders to see areas requiring equipment upgrades/retrofits and did not predispose any final system components.



### Conceptual Diagram with Optical Sorter



#### Specifications within the tender:

- Install Optical Sorting Equipment and install/remove all necessary structure components, conveyors, controls at the Northumberland County Material Recovery Facility
- Shall have a minimum PET sorting efficiency of 95%
- Shall have a minimum sorting capacity of 4 tonnes per hour (pre-optical sorter)
- PET quality control shall have an enclosure booth designed for a minimum size for one employee which will remove non PET materials. Non PET materials shall be placed on a conveyor that will feed onto the residual line.
- Shall use Canadian Industrial as Electrical contractor. Electrical shall be connected to existing processing equipment to ensure proper start up and shut down sequence interlinked as necessary with all other processing equipment.
- Optical Sorter Platform structure shall be a minimum of 136 inches in height. There will be glass stored under this platform.
- Structure platform and components shall be completed while the MRF is in full operations.



- The shutdown period for linking the system together and removing all unnecessary equipment shall be mutually agreed upon by the Contractor and the County. All of the Contractor's equipment must be on site prior to the beginning of the shutdown period. Specify the number of days for entire plant downtime requirements – electrical, conveyor removal and transfer conveyers.
- Contractor shall remove and relocate all unnecessary structures, equipment, electrical and equipment components necessary not limited to air sort equipment, transfer conveyor(s), electrical components, stairways, ladders, platforms. These components are to be placed outside of the MRF and remain the ownership of Northumberland County.
- The Contractor shall be solely responsible for the payment of all duties and other costs associated with the movement of the equipment.
- Proponent shall be responsible to take out wiring permit required by the Electrical Safety Authority (ESA)
- Proponent shall be responsible for successful ESA inspection prior to start-up and all costs associated with the inspection and corrective actions required.
- Proponent shall be responsible to provide Pre-Start Health and Safety Review prior to start-up and all cost associated with the review and corrective actions required.
- Shall provide all manufacturer recommended spare parts inventory with delivery of Optical Sorter.
- The Contractor shall ensure the proper training and education of County staff in the operation and maintenance of the equipment installed.
- The Contractor shall provide the County with a schedule for the proper maintenance and upkeep of the equipment installed.

**Performance Testing and Commissioning Requirements were as follows:**

Start-up shall be performed in the presence of the Plant Manager and or designate. During the start-up period the Contractor shall make all changes and adjustments to the equipment and shall demonstrate to the County that the equipment is capable of proper and uninterrupted operation and is ready to process recyclable materials. Start-up shall include check-out of conveyor and rotating equipment speeds, motor current and voltage, excessive vibration or noise, conveyor tracking, gear box and bearing temperatures, etc., and demonstrate to the County all control functions.

Prior to notifying the County that the facility is ready to start processing recyclable materials the Contractor shall turn over to the Plant Manager copies of all permits, equipment test reports, governing authorities' inspection reports, all else required to demonstrate to the County that the equipment has been properly installed, that the

equipment conforms to the rules and regulations of the governing authorities and that the equipment is ready to process recyclable materials.

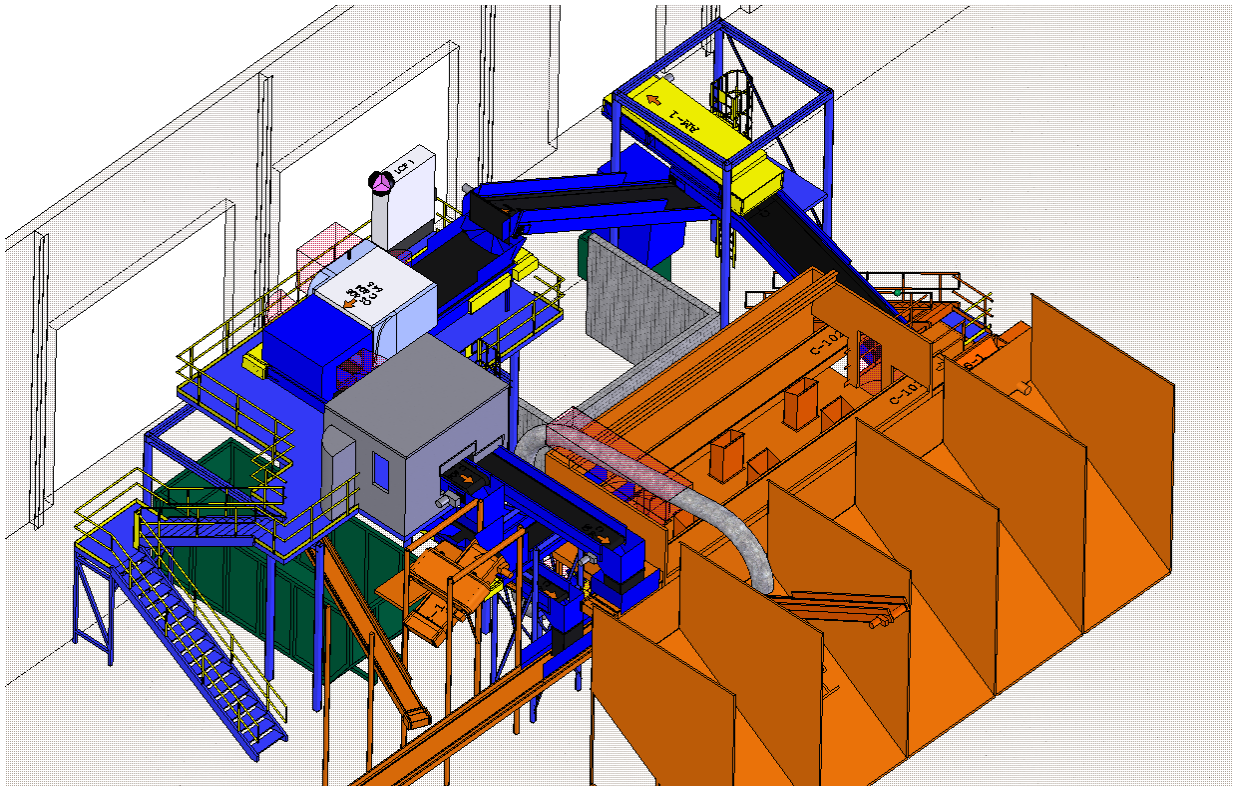
The Contractor shall be solely responsible for ensuring that all equipment conforms with all applicable regulations and has been inspected by all authorities having jurisdiction prior to processing recyclable materials.

During the commissioning phase, the Contractor shall demonstrate to the County that the equipment supplied and installed is capable of processing a minimum rate of 4 tonnes per hour of container recyclable materials through the PET Optical Sorter, without overloads, plug-ups, trip outs, and excessive spillage. In addition, the equipment shall have a minimum PET sorting efficiency of 95%. The County will accept the equipment once the above processing and efficiency rates are demonstrated for 3 days of normal operations.

The Contractor will make all modifications to equipment necessary to correct any problems that become evident during the commissioning phase, prior to County approval and acceptance of the equipment.

#### 4.0 Tender Details:

Machinex submitted the schematic below that included all the specifications and processing requirements.



The full tendered price (purchase and installation) of the project was \$ 860,260. This price included additional equipment recommend within the tender submission.

Equipment included within the tender submission was Mach HYSPEC Optical Sorter, Mesh Air Screen, PET QC Station, PET Blower system, structural components, Landings, various conveyors and electrical components.

The project delivery timeframe was 16 weeks from point of order and installation timeframe was approximately 2 weeks.

**Photo 2 - Depicts the main optical processing unit that was installed**



## 5.0 Monitoring

### Commissioning

Commissioning of the new system was completed during the first week of operations. Within the tender the contractor was required to achieve a minimum of 4 tonnes of material per hour through the Optical Sorter and a PET sorting efficiency rate of at least 95%. As illustrated in Table 1 the equipment had an average Efficiency Rate of 97% and Table 2 shows an achieved volume of over 4 tonnes per hour of materials processed at the optical equipment.

**Table 1 - Optical Efficiency Testing**

Optics Efficiency Testing	Test A	Test B	Test C	Average
Efficiency	95.85 %	98.11 %	95.89 %	96.62 %

**Table 2 - Tonnage Acceptance Test**

Measurement	Tonnes
Total System Throughput	7.68
Processed Amount	11.52
Volume Throughput at Optical Sorter	4.11

### Operational Monitoring – Pre & Post Optical Processing Equipment

Processing tonnage and recovery rates were recorded in 2014 from the original container line processing equipment to establish a baseline of information to compare with the 2015 post optical equipment results.

Table 3 depicts the pre and post installation recovery rate comparisons for the original Count equipment and the newly installed Machinex MACH HYSPEC Optical Sorter and associated equipment.

## 6.0 Results

**Table 3- Pre Installation vs. Post Installation Optical Processing Equipment**

Summary	Pre Optical Sorting Equipment Tonnes Marketed 2014 (Mar 1, 2014 – Feb 28, 2015) Pre 12 Months	Post Optical Sorting Equipment Tonnes Marketed 2015 (Mar 1, 2015 – Feb 28, 2016) Post 12 Months	Improvement in Throughput	Revenue (CIF Price Sheet 2015 Avg \$/Tonne)	Revenue per year
PET	371	616	245 tonnes or 66%	\$295	\$72,275
HDPE	159	171	12 tonnes or 8%	\$617	\$7,404
Mixed Plastic	185	241	56 tonnes or 30%	\$58	\$3,248
Aluminum	180	197	17 tonnes or 9%	\$1548	\$26,316
Polycoat	40	78	38 tonnes or 95%	\$114	\$4,332
<b>Total</b>	<b>935</b>	<b>1303</b>	<b>369 tonnes or 39%</b>		<b>\$113,575</b>
<b>Additional Material Revenue Per Year</b>					<b>\$ 113,575</b>
<b>Savings on Labour (Actual Savings in 2015)</b>					<b>\$189,812</b>
<b>WSIB Avoidance</b>					<b>\$15,000</b>
<b>*Landfill Tipping Fee Cost Avoidance</b>					<b>\$42,320</b>
<b>Total Savings Per Year</b>					<b>\$360,707</b>
<b>Payback Period (years)</b>					<b>2.5</b>
<b>CIF Funding</b>					<b>\$318,509</b>

### Notes:

Total tonnes processed in Pre and Post timelines slightly increased from 2014 to 2015 (i.e., 14,845 tonnes vs 14,855 tonnes respectively). Despite this slight increase, overall captured tonnes increased by 39% as illustrated in Table 3.

\*Landfill Tipping Fee Cost Avoidance was calculated by Landfill Tipping fee x increased tonnage captured (\$115 x 368 tonnes).

This project has been very successful for Northumberland County. The Material Recovery Facility (MRF) has increased the diversion of PET recyclables by 66% and realized an annual savings of \$360,000 per year.

In addition to diverting more PET, Northumberland has seen an increase in diversion of HDPE 8%, Mixed Plastics 30%, Aluminum Cans 9% and Polycoat containers 95%. The new equipment allows for less PET items on the sorting belts which increases the ability of Sorters to pick other items and by eliminating PET passing through the eddy current separator, it improves the ejection rate of aluminum cans thus capturing additional aluminum. Overall, this project has increased the diversion of all containers by 39%.

There were no reported WSIB costs associated with the new processing equipment during the post installation timeline. Past history illustrated an average of \$15,000 annually for WSIB injuries associated with repetitive motion injuries with the previous equipment.

Sorting staff levels have decreased by 4 sorting positions on the container line (from 8 sorters before the upgrade to 4 sorters afterwards). Currently, the MRF utilizes 1 sorter within the PET quality control station and up to 3 sorters within the container sorting station sorting HDPE, Mixed Plastics, Polycoat/Gable, Glass and Aluminum Cans.

In addition to the savings Northumberland County increased the throughput rates within the container line from 2 tonnes per hour to 8 tonnes per hour.

Table 4 depicts the Actual cost vs the Budgeted cost. As highlighted the actual cost was \$906,444 and the budgeted was \$950,000. The project was \$43,556 under budget.

**Table 4 Actual Costs vs Budget**

<b>Allocation</b>	<b>Budget</b>	<b>Actual</b>
Tender 47-14 Supply & Install Equipment	\$950,000	\$765,185
Contingency and Monitoring Study		\$12,435
Enhancements to hydro and electrical		\$23,268
Cost to ship/process materials during installation		\$5,000
New equipment replacement parts inventory		\$11,066
Additional Recommended Equipment		\$89,491
<b>Total</b>	<b>\$950,000</b>	<b>\$906,444</b>

## **7.0 Conclusion**

This project has been very successful for Northumberland County. The Material Recovery Facility (MRF) has seen increase of 66% diversion of PET recyclables and realized an annual savings of \$360,000 per year.

In addition to diverting more PET, Northumberland has seen an increase in diversion of HDPE 8%, Mixed Plastics 30%, Aluminum Cans 9% and Polycoat containers 95%. Overall, this project has increased the diversion of all containers by 39%.

Results were achieved by increasing tonnes marketed, decreasing labour costs, decreasing residual disposal fees and eliminating WSIB injury claims.

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