



London MRF Upgrade – Oversized Plastics
CIF Project Number #855

Final Report
October 2016

Prepared for:
Waste Diversion Ontario
Continuous Improvement Fund Office
Barrie, Ontario

Acknowledgement

This Project has been delivered with the assistance of Waste Diversion Ontario's Continuous Improvement Fund, a fund financed by Ontario municipalities and stewards of Blue Box waste in Ontario. Notwithstanding this support, the views expressed are the views of the author(s), and Waste Diversion Ontario and Stewardship Ontario accept no responsibility for these views.

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Executive Summary

The City of London (the City) owns and contracts out the operation of a two-stream Regional Materials Recovery Facility (MRF) used to process Blue Box recyclables. The City completed minor modifications to the residual sorting station and pre-sort room at the MRF to change the way they handle film and oversized plastics. The modifications allowed the City to divert and market oversized plastic containers as a separate product. The Continuous Improvement Fund (CIF) provided financial assistance in completing the project.

The MRF provides processing services to 9 municipalities in the area, including the City, and processes approximately 35,000 tonnes annually. Under the former system, oversized and film plastics were removed in the pre-sort room and marketed together as a mixed film product which had generated little revenue, but allowed the City to divert plastic film 'program bags' and some of the oversized plastics collected at the curb.

The City's MRF operator installed a new chute in the pre-sort room and storage bunker off the residue line to accommodate the separation of oversized plastics as a separate marketable product. This allowed the City to market all of the oversized plastics collected at the curb, some of which had been added to the residue under the previous system. The capital costs of these modifications were \$70,000 for the new chute and \$15,000 for the storage bunker.

In the first 12 month period after the change, the combined total of oversized and film plastics recycled increased by 86% from 140 tonnes to 260 tonnes. This amount increased further to 330 tonnes in 2015, which included 150 tonnes of film and 180 tonnes of oversized plastics.

The total combined revenue increased by 685% from \$2,160 to \$16,995 in the 12 months following the modifications. In 2015, the combined revenue from the sale of film and oversized plastics rose to \$26,475 in response to increased tonnage and favourable market prices. Through negotiations with the MRF operator, there have been no cost impact to operations. The City estimates the simple payback period for this project work at 36 months.

A key learning from this project is to anticipate that the mix of materials processed will change over time, and modifications will be required to accommodate. With this in mind, the initial MRF design must accommodate future modifications in general, without designing for the specific changes.

This project was completed on time and on budget. The City's approved CIF grant for this project is \$29,210.

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1 Introduction

In 2014, the City of London made modifications to the MRF to allow the separation of oversized plastic containers from film plastics. Under the modified system the oversized plastics are removed (i.e., positive sort) in the pre-sort room, sent down the residue line, removed (positive sort) from the residue line at the residue clean-up station and placed in a bunker for oversized plastics.

Before the modifications, film plastics and oversized plastics were removed in the pre-sort room, baled and shipped together to end markets. The percentage of oversized plastic in the film bales was limited by the end-marketed specifications, and thus limited the quantity of oversized plastic that could be recycled. If the oversized plastics were not shipped with the film plastic, they would be treated as residue which would increase the residue disposal cost and reduce the City's diversion rate.

The marketed tonnes of film and oversized plastics increased by 85% in the 12 months following the modification and the revenue increased by approximately 685% in the same period. The annual revenue generated is currently exceeding the initial estimates. Based on current revenue, the projected return on investment is 3 years (by May 2017). The cost of the modifications was \$85,000



Figure 1: MRF Sort Room

2 Background

2.1 Program Overview

The City of London currently provides Blue Box recycling to 176,500 households, including 54,500 households (31%) in multi-residential buildings (2015 WDO Datacall). Collection services are provided under a contract service with 19 trucks for curbside and two trucks for multi-residential. The City owned two-stream Regional Materials Recovery Facility (MRF) was opened in August 2011 and its operation is contracted to Miller Waste Systems.

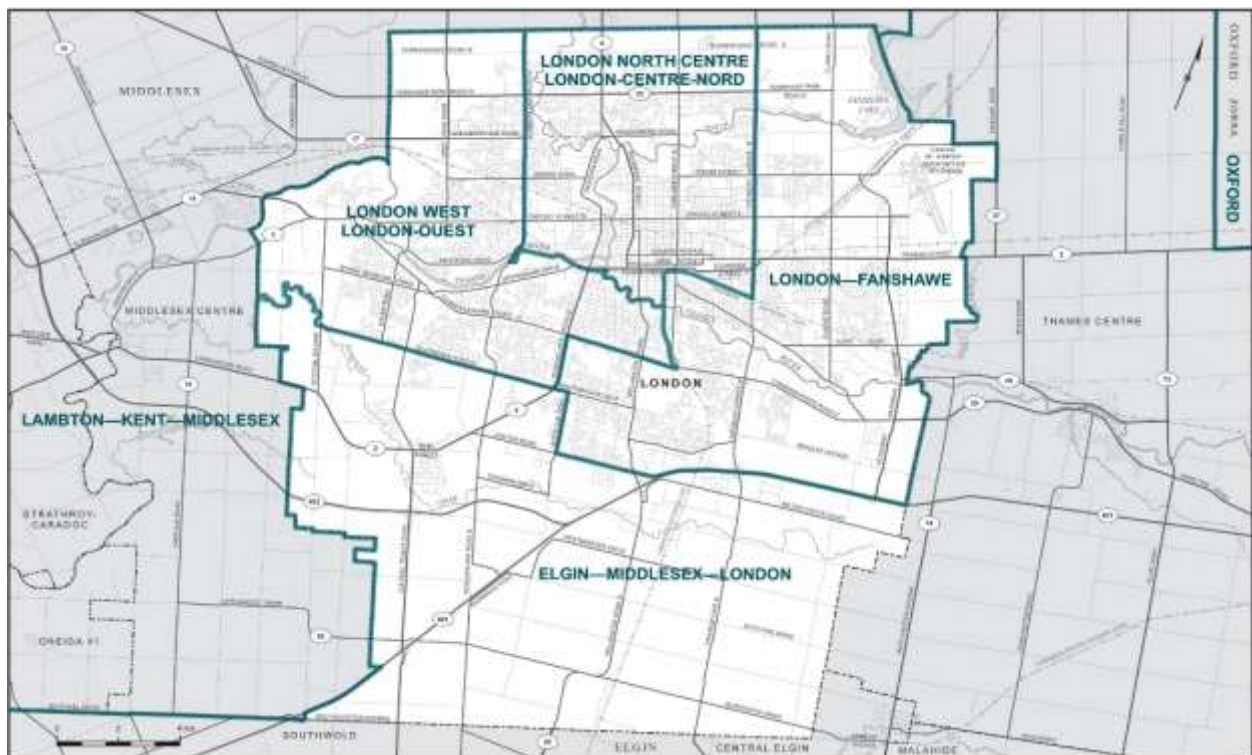


Figure 2: Map of London.
Image retrieved from www.redecoupage-federal-redistribution.ca/ April 13, 2016.

2.2 Waste Management Services

The City provides residents with the following waste management collection services:

- Single-family recycling: Curbside collection every six business days of Blue Box materials using a two stream box program
- Multi-family recycling: Weekly collection of Blue Box materials using two stream cart & front end loading bin collections
- Single-family yard material collection: Curbside collection six times per year of yard materials and fall leaves
- Single-family garbage: Curbside collection every six business days of up to 3 containers of garbage
- Multi-family garbage: Weekly or twice-per-week collection of garbage generally in 4 and 6 yard bins.
- Drop-off Depots: Four drop-off depots for household garbage, yard materials and recyclable materials including Blue Box recyclables, construction & renovation materials, electronics, scrap metal, appliances, used clothing, etc.

In addition to the collection of residential waste and resource materials, the City of London owns and operates the W12A Landfill, owns and contracts-out the operation of a regional MRF, and contracts organics processing services.

2.3 Current Blue Box Program Tonnes Recycled

The City currently recycles approximately 23,400 tonnes of material collected from residents through the residential Blue Box program (2015 WDO Datacall). The amount of material recycled from each household within the City is approximately 133 kg/household (2015 WDO Datacall).



Figure 3: Curbside waste collection

2.4 Program Challenges and Solutions addressed by this Project

This Project found a creative solution to managing two problem materials received at the MRF: film plastic and oversized plastic containers. Film plastic is not an accepted material in London's program and efforts are made to reduce the quantity of this material that is managed at the MRF.

Film plastic is a problem material because of the impact it has on both collection and processing operations. For the collection operation, large transparent plastic bags are permitted (though discouraged) for use as a recycling container. These are referred to as 'program bags' and are considered as a recycling container. They offer convenience for residents, but increase incoming contamination because collection staff are not able to sort at the curb as they do with open Blue Boxes.

For the processing operation, program bags require more staff resources to manage as they need to be ripped open to access the recyclables, and when the bag contains contaminants these materials need to be quickly removed from the process.

Furthermore, when the bags and other film plastic are not removed in the pre-sort operation they create wear on the machinery and generally cause inefficiencies at each sorting station (mechanical and manual).

Film plastic has historically also been a challenging material to market and has a lower revenue value. For these reasons London has not added plastic film as a Blue Box accepted material and instead encourages residents to recycle film plastic through retail plastic bag recycling programs. However, a significant quantity of film plastic is received at the MRF either as program bags, or plastic film contaminates, and in an effort to avoid sending this to landfill London has found end-markets to accept the plastic film.

Oversized plastic containers are included in London's recycling program. As predominately HDPE they have stable end-markets and higher revenue per tonne. However, they are a problem materials because of their size. They must be removed at the pre-sort or they will jam other parts of the operation. Once removed at pre-sort they then need to be manually moved to the HDPE bunker, and again because of their size and the limited space in pre-sort this creates challenge of the need to move them often. An option to alleviate this was to manage the oversized plastics with film plastic at the pre-sort by pulling it off the line and dropping into the film bunker which feeds directly to the film baler.

As noted, prior to the modifications made to the sorting line, film plastics and oversized plastics were removed from the line at the pre-sort room, baled, and shipped to end markets together. The quantity of oversized plastics that can be mixed into the film bales is limited by the end-market specifications. Furthermore, the oversized plastics that were mixed in with film were sold for the lower revenue value of film, representing lost revenue potential. If the oversized plastics were not shipped with the film, they would have had to be managed as residue, which would increase the residue disposal cost and reduce the City's diversion rate.



Figure 4: Oversized plastics at the MRF

3 Approach

Modifications were made to the MRF to allow the separation of oversized from film plastics. The modifications were made because the end market dictated so, as these companies could no longer handle the oversized plastics mixed with the film and asked that the MRF only send them film plastics. Upon consultation with Miller Waste, the City of London decided to put in a second container return conveyor and bunker to separate out and store the oversized plastics. After the modifications were made, the oversized plastics are removed in the pre-sort room, sent down to the residue line, removed from the residue line at the residue clean-up station and placed in the separate bunker.

Yarmouth Metals Fabricated Limited was contracted to install the bunker. The return conveyor was manufactured and installed by Machinex Industries Inc. Both installations were completed in June of 2014. The two pieces of equipment have worked very well since they were installed and there have been zero issues recorded so far.

3.1 Modifications Completed

The modifications were completed by the MRF operator at the residual clean-up station and included:

- Adding a second container return conveyor, and thus freeing up the bunker space under the station where containers had previously been placed. In order to integrate the container return conveyor, the reception panel was removed and then new sorting hoppers and extension panels were also installed.
- Adding a bunker to capture and store oversized plastics.



Figure 5: Container Return Conveyor

The bunker was installed by Yarmouth Metal fabricators from St. Thomas, ON to temporarily store oversized plastic containers before they are sent to the bailer. The installation and delivery lasted 3-4 weeks and was completed in June 2014. The bunker came in 3 separate parts and was installed without the need to stop operations.

The C-34 return container conveyor (18" wide, 10'-7" long) was manufactured and installed by Machinex and added to the residue clean up station to transport the oversized plastics into the bunker. The installation took two days. The container return conveyor was installed on a weekend while operations had been shut down to eliminate any potentially lost productivity.



Figure 6: Bunker to capture oversized plastics

3.2 Monitoring the Project Results

Monthly summaries of film plastic and oversized plastics shipped to market and revenue received was reviewed. This report includes summary data (Tables 1 and 2, Figure 7 and Appendix A) for film plastic and oversized plastics. The data includes tonnes shipped to end-markets and revenue received for the period January 2012 to September 2016.

4 Project Results and Analysis

4.1 Project Results

Table 1 includes twenty four months of pre and post modification data. The table summarises the tonnage and revenue generated for the film and oversized plastics over these periods. More comprehensive data from July 2013 to September 2016 is presented in the Appendix.

Table 1: Provided summary data for 6, 12, and 24 months pre and post modification.

Period	Tonnes (rounded)			Revenue (rounded)		
	Pre	Post	% Change	Pre	Post	% Change
6 months	70	125	80%	\$1,140	\$5,040	340%
12 months	140	260	85%	\$2,160	\$16,995	685%
24 months	360	590	65%	\$5,130	\$44,410	765%

Separating the film and the oversized plastics has helped increase the value of the film and the oversized plastics. Currently, the MRF sells the oversized plastics for \$176/tonne while the film plastics are sold for \$30/tonne. More oversized plastics are collected and recycled now that there is market for it. Before the modifications, very little oversized plastics were collected at the curb.

Table 2 includes six months of pre vs post data and is a breakdown of the tonnes and revenue received for both film and oversized plastics over the six month pre vs post periods. The total tonnes marketed almost doubled, and the total revenue in the six

month period following the modifications was \$5,042, representing a more than a 300% increase compared to the six month period before the modification. A portion of this increase is due to the increase in the per tonne market value of film from \$17 to \$35 per tonne, a factor that was independent of the modification.

Table 2: Tonnes & Revenue, 6 months Pre and Post Modifications

	Film Plastic			Oversized Plastic			Total Revenue
	Tonnes	Revenue \$/tonne	Revenue	Tonnes	Revenue \$/tonne	Revenue	
Pre-Modifications (oversized is baled with film)							
Dec-13	7	\$15	\$111				\$111
Jan-14	21	\$12	\$253				\$253
Feb-14	6	\$12	\$74				\$74
Mar-14	17	\$12	\$209				\$209
Apr-14		\$21	\$0				\$0
May-14	18	\$28	\$496				\$496
Total/ Average	70	\$17	\$1,143				\$1,143
Post-Modifications (film and oversized are baled separately)							
Jun-14	18	\$32	\$582	8	\$49	\$368	\$950
Jul-14		\$30	\$0	9	\$46	\$431	\$431
Aug-14	15	\$30	\$455	18	\$47	\$830	\$1,284
Sep-14	18	\$30	\$530	9	\$49	\$420	\$950
Oct-14		\$50	\$0	9	\$47	\$401	\$401
Nov-14	16	\$38	\$593	8	\$53	\$431	\$1,025
Total/ Average	67	\$35	\$2,160	60	\$49	\$2,882	\$5,042

4.2 Analysis of Results

Tables A-1 and A-2 in the appendix and Figure 7 on following page present revenues from film and oversized plastics pre and post project. Month 1 in Figure 7 is June 2014, as the modifications were completed during this period. Since implementation, revenues of \$40,000 (approximately) over the 24 month period after the modification have been received. Revenue appears to be increasing as we divert more of this material to markets and pricing remains favourable. In 2015, the City received approximately \$27,400 for the sale of 326 combined tonnes of these plastics, up from \$17,000 in 2014.

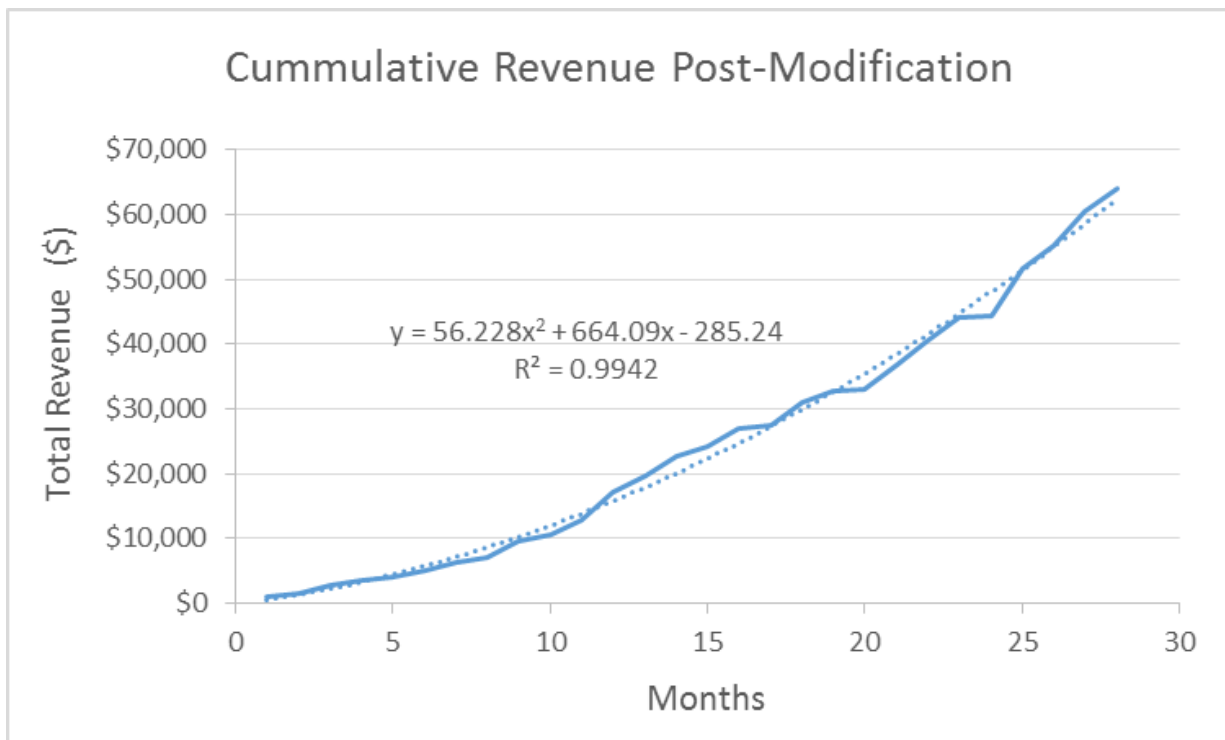


Figure 7: Cumulative Monthly Revenue following Modifications

Figure 7 presents the revenue generated in the 27 months since the modifications were made. Using a simple regression model, an equation (as presented in Figure 8) was created to estimate revenue by month. Using the Figure 7 equation, the MRF is expected to generate \$86,000 in revenue from the sale of film and oversized plastics alone in 36 months. That exceeds by a \$1,000, the initial \$85,000 that was invested in the project.

Revenue increased due to a number of factors:

- More plastics were recycled as a result of the modifications
- The oversized plastics could be sold for a higher revenue once separated from the lower revenue film plastic
- Commodity market prices were more favourable following the modifications

Using the pre-modification data for projection, the MRF would have generated about \$7,000 from the sale of 473 tonnes of mixed film and oversized as at September 2016. This is way below the 726 tonnes and \$63,000 revenue that the MRF generated for the same period post modification.

4.3 Operating Costs

There has been no change in the contracted operating costs to the City. The MRF operator identified that no additional staff have been employed as a result of targeting the oversized plastics. The operator also agreed to maintain the second container return at no additional cost.

4.4 Lessons Learned

The London MRF began operations in August 2011 and was a newly constructed facility at that time. As a new facility it had many features that contributed to its effective and efficient operation. Since opening, the facility continues to maintain a higher than average capture rate, low operating costs, and high revenue return on materials marketed.

In designing a MRF, it is not always possible to anticipate every potential new material that may be managed at the MRF in the future, nor would this be advisable as it would generally add to the capital costs of constructions. However, it is important that the design of the MRF anticipate that the mix of materials processed will change over time, and modifications will be required to accommodate. With this in mind, the initial MRF design must accommodate future modifications in general, without designing for the specific changes. This will ensure capacity to adjust to the changing waste stream with minimum cost alterations. This project, is an example of how successful initial design accommodated changes in year 3 at minimal cost and with a high return on investment.

Since the modifications, there haven't been any operational issues. The bunker could be a little bigger to accommodate more oversized plastics but even at the current size, it serves its purpose very well. In the future, the process could be automated to allow the bunker to open when it's full. On a different note, the amount of black oversized plastics included in the outgoing bales negatively affects the market price.

Also, with proper sorting and less contaminants in a particular material, the waste can be marketed for a much higher value. Mixed film and oversized plastics were initially sold for \$15 on average. As at the time of writing this report, film sells for \$30 and oversized plastics for \$175.

5 Project Budget

5.1 Capital costs

The procurement, purchase and installation of the new equipment was completed by the City's MRF operator at a set cost of \$85,000 plus HST, including:

Second container return chute	\$70,000
Oversized plastics storage bunker	<u>\$15,000</u>
Total	\$85,000

Note: the second container return chute was required to free up space for the oversized plastics bunker. This also has the added benefit of increasing the capture of the missed containers from the residue.

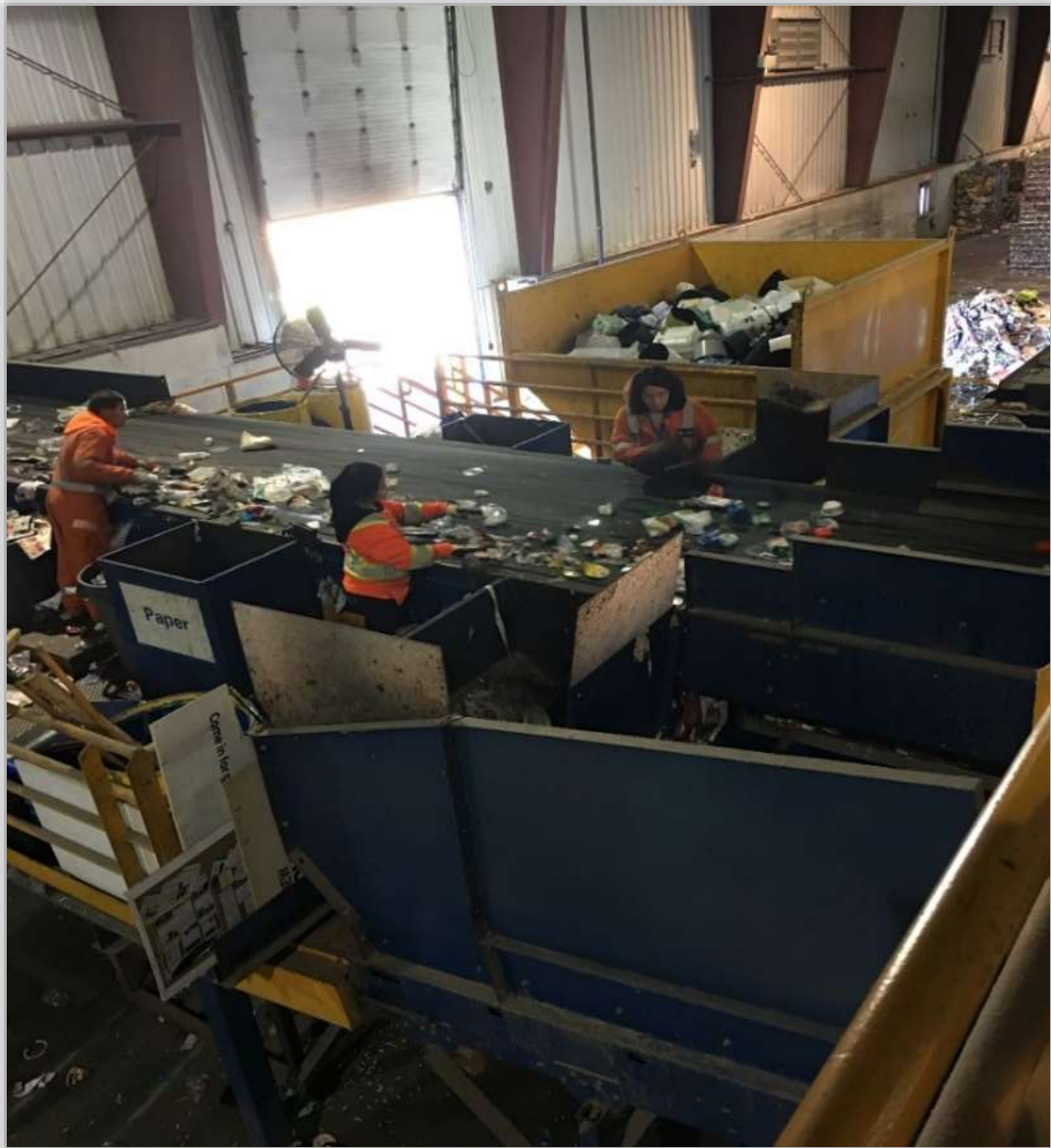


Figure 8: Sorting station showing the new conveyor and the bunker

6 Conclusions

The MRF oversized plastics upgrade has been a success by increasing capture and revenue and with a forecasted 36 month return-on-investment. Since June 2014, the MRF has generated over \$50,000 in revenue from the sales of the film and the oversized plastics. Over \$40,000 was generated in the first 24 months (June 2014- May 2016), post-modification, as opposed to the \$5,000 that was generated pre-modification (June 2012- May 2014).

By separating the films and the plastics, the oversized plastics have been marketed for about \$120 to \$220, while the film now sells for \$34 on average as opposed to the \$15 it was been sold for previously. Without the modifications, the MRF would have been producing in total, 900 tonnes (since it started) and slightly over \$14,000 in revenue. Present values (September 2016) stand at \$70,000 revenue and 1,178 tonnes. The equipment is expected to be in service for at least 25 years. Over this period, the City expects to manage 7,800 tonnes of film and oversized plastics and generate over \$5,000,000 in revenue.

Appendix A

Table A-1: Film Plastic & Oversized Plastic, Tonnes & Revenue, Pre-Modifications
January 2012 to May 2014

Month	Film Plastic			Oversized Plastic			Total Revenue/ \$
	Tonnes	\$/Tonne	Revenue	Tonnes	\$/Tonne	Revenue	
Pre-Modifications							
12-Jan	0	\$10	\$0				\$0
12-Feb	18	\$10	\$182				\$182
12-Mar	28	\$17	\$471				\$471
12-Apr	22	\$30	\$657				\$657
12-May	21	\$30	\$621				\$621
12-Jun	10	\$30	\$313				\$313
12-Jul	21	\$14	\$292				\$292
12-Aug	12	\$10	\$122				\$122
12-Sep	11	\$15	\$158				\$158
12-Oct	23	\$15	\$344				\$344
12-Nov	9	\$15	\$139				\$139
12-Dec	18	\$15	\$264				\$264
13-Jan	18	\$15	\$270				\$270
13-Feb	11	\$15	\$158				\$158
13-Mar	16	\$15	\$247				\$247
13-Apr	22	\$15	\$331				\$331
13-May	22	\$15	\$327				\$327
13-Jun	20	\$15	\$302				\$302
13-Jul	10	\$15	\$144				\$144
13-Aug	26	\$10	\$256				\$256
13-Sep	12	\$8	\$96				\$96
13-Oct	23	\$7	\$158				\$158
13-Nov	10	\$6	\$62				\$62
13-Dec	7	\$15	\$111				\$111
14-Jan	21	\$12	\$253				\$253
14-Feb	6	\$12	\$74				\$74
14-Mar	17	\$12	\$209				\$209
14-Apr	0	\$21	\$0				\$0
14-May	18	\$28	\$496				\$496
TOTAL	452	\$15	\$7,059				\$7,059

Table A-2: Film Plastic & Oversized Plastic, Tonnes & Revenue, Post-Modifications
June 2014 to September 2016

Month	Film Plastic			Oversized Plastic			Total Revenue/ \$
	Tonnes	\$/Tonne	Tonnes	Tonnes	Tonnes	Revenue	
Post-Modifications							
14-Jun	18	\$32	\$582	8	\$49	\$368	\$950
14-Jul	0	\$30	\$0	9	\$46	\$431	\$431
14-Aug	15	\$30	\$455	18	\$47	\$830	\$1,284
14-Sep	18	\$30	\$530	9	\$49	\$420	\$950
14-Oct	0	\$50	\$0	9	\$47	\$401	\$401
14-Nov	16	\$38	\$593	8	\$53	\$431	\$1,025
14-Dec	15	\$53	\$780	9	\$52	\$493	\$1,273
15-Jan	10	\$55	\$551	1	\$160	\$139	\$690
15-Feb	10	\$33	\$338	13	\$160	\$2,126	\$2,465
15-Mar	17	\$43	\$721	2	\$160	\$285	\$1,006
15-Apr	20	\$30	\$596	12	\$160	\$1,864	\$2,460
15-May	0		\$0	25	\$160	\$4,059	\$4,059
15-Jun	13	\$30	\$388	12	\$182	\$2,256	\$2,644
15-Jul	22	\$30	\$649	15	\$150	\$2,291	\$2,939
15-Aug	0	\$0	\$0	14	\$120	\$1,696	\$1,696
15-Sep	14	\$30	\$413	37	\$59	\$2,166	\$2,579
15-Oct	17	\$30	\$499	17	\$0	\$0	\$499
15-Nov	13	\$30	\$378	17	\$198	\$3,363	\$3,741
15-Dec	11	\$43	\$483	17	\$70	\$1,214	\$1,697
16-Jan	11	\$30	\$328	0		\$0	\$328
16-Feb	11	\$30	\$321	15	\$220	\$3,305	\$3,626
16-Mar	13	\$30	\$376	15	\$220	\$3,406	\$3,782
16-Apr	14	\$30	\$428	14	\$220	\$3,034	\$3,462
16-May	14	\$30	\$425	0		\$0	\$425
16-Jun	16	\$30	\$466	30	\$220	\$6,671	\$7,137
16-Jul	9	\$30	\$258	15	\$220	\$3,353	\$3,611
16-Aug	15	\$30	\$460	27	\$180	\$4,925	\$5,385
16-Sep	11	\$30	\$334	17	\$175	\$3,007	\$3,341
TOTAL	340	\$33	\$11,353	386	\$130	\$52,533	\$63,886