# *Final Report*

## CIF 643.13 Town of Markham

## Public Space Recycling:

## Big BLUE Belly Solar Recycling Containers

**Prepared For: Continuous Improvement Fund**

**Prepared By: Baleen Group**

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**Submitted By: Town of Markham**


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MARKHAM

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CIF CONTINUOUS IMPROVEMENT FUND

Thinking beyond the box
Stewardship Ontario

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## 1.0 Executive Summary

The following document summarizes the performance, impact and learning's from the Town of Markham Big 'Blue' Belly Project. The Big Blue Belly units have proven to be a very effective tool in support of Markham's drive towards Zero Waste, litter reduction and efficient delivery of services. Key metrics observed thus far include:

PERFORMANCE METRICS:

- All 24 containers are installed and currently functioning after being in service for more than 8 months
- Compaction rates resulted in volumes as great as 86% higher than traditional recycling /waste containers
- Big Blue Belly Control Panel provides a powerful and user-friendly tool to manage the business of owning and servicing these outdoor recycling containers on a 'just in time' basis

IMPACT METRICS:

- Unionville BIA diversion rate increased from 29.58% to 69.17%; Markham BIA from 0% to 90.76%;
- Container "fullness" reduced as much as by 50% or more for both areas compared to previous non-compacting containers
- Labour and vehicle costs to service these units estimated to be reduced by 50-86%
- Payback period for this Program will be between 2.64 and 4.54 years (not including intangible cost benefits)
- Surveys of Town staff and residents found very high awareness, likelihood to use and belief that usage leads to reduced litter and increased recycling;
- 100% of surveyed staff said they believe using the Big Belly software makes their job more efficient and reduces unnecessary service /monitoring trips.

LEARNINGS:

Based on the objectives set forth at the beginning of this project, Markham staff observed improved recycling participation in the BIA's. In addition, there is a strong business case supporting a reduction in the number of collections required to maintain the containers, therefore reducing green house gas emissions, staff time and operational cost to service the containers. Moreover, there has been a measurable decrease in the amount of litter and increase in the amount of recycling collected.

Public space containers with the combination of compaction technology and wireless communications are a powerful tool for modernizing traditional municipal service delivery.

## 2.0 Background

In 2010, Markham initiated a 6-month pilot project to test the use of four solar powered compacting public space containers manufactured by 'Big Belly Solar'. Historically, Big Belly's have been used for the collection of street trash. Markham made the decision to be the first to test the containers for the collection of single stream recyclables generated in public spaces. *Big Belly Solar*, located in the United States, is the only manufacturer of solar public space containers. *Waste Management Inc.* is the Canadian distributor of the Big Belly product.

A key benefit of the Big Belly Solar unit is the wireless software that can provide real time data on the level of container fullness. Operations staff are able to monitor container levels via online computer program or portable tablet. Markham will be the first municipality in Canada to incorporate this technology in its operations.

The online management console program pinpoints each individual container on a map, and measures container fullness, as well as tracks the container usage. This data will allow Markham to reduce the amount of unnecessary collections, decrease costs, and reduce greenhouse gases.

The pilot project purchase of 4 Big Blue Belly's was funded in part from MESF (Markham Environmental Sustainability Fund) and tested the use of three Big Blue Belly containers for single stream recyclables and one Big Blue Belly for the collection of Public space trash at select municipal facilities.

The pilot project results indicated the Big Blue Belly container achieved the anticipated objectives of the pilot, which included:

- improved public participation in public space recycling;
- reduction in the number of collections required to maintain the containers, therefore reducing green house gas emissions, staff time and cost to empty the containers;
- decrease in the amount of litter;
- increased diversion

The success of the pilot project sparked interest within Markham's Business Improvement Areas (BIA), which attract thousands of visitors each year. Markham began discussions with the BIA's to provide Big Blue Belly containers on each Main Street.

At the Development Services Committee of June 21, 2011, a memo entitled "Public Space Recycling – Heritage Big Blue Belly Pilot Project Update" was received and subsequently approved by Council on June 28, 2011 approving the purchase of twelve containers to complete the project on both Main Streets. Each Main Street is now equipped with 12 Big Blue Belly's (see Appendix 9.6).

In preparation for the launch of the Big Blue Belly units, Markham staff conducted a baseline audit of the selected streets from June 7 – June 30, 2011. During this time all units in the selected areas were monitored. Each bin was tracked:

- Bin name, location
- Total of weight of all materials collected
- Total weight of garbage and recyclables (if applicable)
- Collection Frequency
- Container Fullness (by volume)
- % of recyclables within garbage

This data was tracked for all locations prior to the launch of the Big Blue Belly Units for comparison.

## 3.0 Evaluation of Project in Reference to Best Practices for Open Space Recycling

Markham made concerted effort to adhere to the WDO Best Practices for Open Space Recycling as per the October 2009 WDO Report "Best Practices Review". The following is an evaluation of how Markham has applied these Best Practices.

### 3.1 Best Practice #1: Clear and Consistent Signage

The Big Blue Belly containers clearly indicate the types of recyclables that are to be deposited inside. The container is wrapped in graphics that depict images of acceptable recyclable materials. Rather than listing the acceptable recyclables in a list of words such as "paper" or "cans", Markham used images of these materials to ensure a clear visual understanding of what can go in. We have learned that images encourage understanding among many residents such as children, elderly, and people learning English as a second language. The images and graphics meet Best Practices as the text and images are written in reverse colour versus the signage background - light coloured text on dark coloured background.

Best practices Markham's Big Blue Belly Project met include:

- Use of realistic, simple, high quality graphics of acceptable materials
- Positive reinforcement of acceptable material. (Did not list unacceptable materials).
- Used a minimal amount of text
- Varied the font size
- Used symbols rather than text to communicate in multilingual communities
- Used a light coloured font on a dark background
- Identified items that may be a source of confusion such as coffee cups and lids
- Used a slogan that can be incorporated into additional signage "Recycle on the Go!"
- Placed signage on container so as not to be obscured by inside plastic linter
- Avoided putting too many images and words together on the signage

### 3.2 Best Practice #2: Placement of the Recycling Containers

Prior to the Big Blue Belly containers being placed out on Main Street Unionville and Main Street Markham, there were only garbage receptacles along the street. Based on waste audits of high generation locations, we were able to determine the hotspots where a Big Blue Belly would be beneficial. All containers are placed along the street as close together as possible. Due to accessibility issues and on street parking we were not able to meet the best practice of a maximum of 14 metres on all containers, however, since the Big Blue Belly is equipped with compaction we are able to collect increased volumes of recyclables within a larger space of traffic. The Big Blue Belly's are strategically placed in front of storefront businesses with high traffic and waste consumption such as coffee shops and other food retail outlets. All Big Blue Belly units are paired (side to side) with heritage garbage receptacles to avoid contamination.

Best practices Markham's Big Blue Belly Project met include:

- Thorough waste audits of the areas, Markham identified areas of high traffic flow and waste generation and located containers in those areas.
- Recycling containers are placed where people will expect them (near entrances and exits to stores selling food products, and outside public washrooms).
- All Big Belly's are paired side by side with a garbage receptacle to avoid contamination

### 3.3 Best Practice #3: Design of the Recycling Containers

The Big Blue Belly open space recycling program is single stream in order to follow the best practice that open space recycling should mirror that of curbside collection.

Best practices Markham's Big Blue Belly Project met include:

- The Big Blue Belly container is composed of durable material heavy enough to stabilize the bin during inclement weather and deter vandalism but it is not too heavy that it cannot be moved by operations staff.
- The Big Blue Belly container has a front (not top) opening which limits rain and snow from entering the container
- The Big Blue Belly container has curved edge openings to minimize the risk of injury
- The size of the containers and the ability of the container to compact the materials inside accommodate fluctuating quantities.
- The wireless software allows operations staff to be alerted when a container needs to be emptied, resulting in avoidance of container overflow and street litter.

### 3.4 Best Practice #4: Communication with Park Staff, Vendors and Collection Crew

At the outset of the Big Blue Belly project planning process, a list of stakeholders was developed for consultation. This included operations staff, BIA members, storeowners, waste management staff and management, recycling processors and vendors. Meetings took place with the BIA to discuss food-packaging options in stores that can lead to more sustainable choices. Polystyrene was banned from being available in stores and alternate recyclable options were substituted. Information was shared on suppliers of green products. Ongoing communication between the stakeholders was paramount to the project's success. A media launch was held on both Main Streets with all vendors and stakeholders, and the public in attendance to promote the program as a cooperative effort.

Best practices Markham's Big Blue Belly Project met include:

- The development of a stakeholder list completed with ongoing regular meetings with all involved in the project
- Stakeholders were involved early in the planning process of the project and had valuable input
- Stakeholders were consulted throughout the implementation of the project.

## 4.0 Results of Baseline Monitoring

As mentioned in Section 2 above, in preparation for the launch of the Big Blue Belly units, town of Markham staff conducted a Baseline audit of the affected areas from June 7 – June 30, 2011. During this time all units in the involved areas were monitored. Following the installation of the Big Blue Belly Units Markham staff continued this audit process for the same coverage area for a Test Period from September 1, 2011 to January 23, 2012.

The pre-installation baseline results were as follows:

**Baseline Study**

Conducted June 7 - June 30, 2011

| | Unionville | Markham |
|---|---|---|
| Number of Garbage Containers | 16 | 17 |
| Number of Recycling Containers | 12 | 0 |

| | Unionville | Markham |
|---|---|---|
| Weight of Garbage Collected | 3,582 | 1,965 |
| Weight of Recycling Collected | 1,505 | 0 |
| Diversion Rate | 29.58% | 0.00% |

| | Unionville | Markham |
|---|---|---|
| Average Garbage Container "Fullness" | 43.04% | 26.85% |
| Average Recycling Container "Fullness" | 30.79% | N/A |

The post-installation Test Period results were as follows:

**Big Blue Belly Test Period Study**

Conducted Sep 1, 2011 - Jan 23, 2012

| | Unionville | Markham |
|---|---|---|
| Number of Garbage Containers | 16 | 17 |
| Number of Recycling Containers | 12 | 12 |

| | Unionville | Markham |
|---|---|---|
| Weight of Garbage Collected | 197 | 60 |
| Weight of Recycling Collected | 442 | 590 |
| Diversion Rate | 69.17% | 90.76% |

| | Unionville | Markham |
|---|---|---|
| Average Garbage Container "Fullness" | N/A | N/A |
| Average Recycling Container "Fullness" | 16.53% | 15.36% |

| | Unionville | Markham |
|---|---|---|
| Diversion Rate increase | 39.59% | 90.76% |

The primary consideration in analyzing these results is the fact that it compares a summer time period with a Fall/Winter time period. This is not an ideal test as the usage of these areas and traffic varies greatly and as such the absolute amounts of garbage and recycling collected cannot be accurately compared in an apples-to-apples basis. What can be measured and compared are diversion rates where we observed Diversion Rate increases from 29.58% to 69.17% in Unionville as well as from 0% to 90.76% in Markham.

Assuming both areas are able to maintain these diversion rates, this will result in significant amounts of garbage being diverted from landfill.

It is also important to notice that Container “Fullness” also reduced greatly – as much as by 50% or more for both areas compared to previous containers. Again it is difficult to make accurate forecasts on this observation based on the affect of seasonality but it is important to note that the routine monitoring of the fullness of containers that required Town staff to physically travel to the bin and observe can now be done automatically and remotely with Big Blue Belly wireless technology. The savings in time, resources, vehicle usage and corresponding GHG emissions from this capability will be significant as we will see in Section 6.0. As well, Town staff servicing the Big Blue Belly units reported that there was a significant reduction in the amount of waste and recycling that is blown from uncovered receptacles due to high winds. While this result is also difficult to quantify it is none-the-less a very important factor for the acceptance of the units by local residents, local members of the BIA as well as Town staff responsible to manually pick up the wind-swept waste in the past. Moreover this reduction in visible litter is hoped to reduce the likelihood of an individual on the street thoughtlessly littering. With well

appointed and clearly marked recycling bins at key locations within the BIA, the goal is to create an environment that local residents can take pride in, that visitors will enjoy and return and ideally improve overall public participation in public space recycling.

Increased waste diversion, reduced human and vehicle resources as well as cost to service the bins, reduced garbage spoiling the local landscape as well as the added ability to accurately monitor and forecast work flows in this area are all positive outcomes from the adoption of Big Blue Belly technology by the Town of Markham.

## 5.0 Compaction Test Results

As mentioned in Section 2.0 above, one of the challenges with the Test Period of the Big Blue Belly Project was not having the necessary motherboards available until January 2012. So while Test Results were not as accurate and scientifically rigorous as we might have liked we have also gone out of our way to push the Big Blue Belly technology to its limits to be able to extrapolate those findings onto the larger study.

One such case was a rudimentary Compaction Test where a single Big Blue Belly unit was filled with recyclables and the results observed and reported. The results from this Test and observations were as follows:

- Units were filled with material until the yellow warning light came on
- At this point, material was removed and weighed.
- Weight of material inside the bin was approx. 40 lbs. (contained materials such as paper, bottle and coffee cups).
- The compaction was deemed to be "OK" but observed that compaction could vary greatly based on the type of materials being compacted
- Continued to add material and let the unit compact
- Indicator light turned red at approx. 50 lbs. whereupon the unit stopped compacting
- NOTE: If indicator light becomes red the unit will stop compacting but does have room for more material however when bin is to be emptied material will be over flowing the bin when removed.

A valid comparison to note is that during the "Baseline Test" period from June 7 – June 20, 2011 there were 12 recycling containers in Unionville that were emptied a total of 18 times (daily Monday to Friday). During this period the average weight of recyclables collected ranged from just over 5 pounds up to 8.5 pounds with an average of 6.97 lbs. Assuming weights of recyclables collected do not change, using Big Blue Belly technology would enable Town of Markham to reduce the number of times where recycling containers need to be emptied by as much as 86%. The corresponding labour costs, truck usage and GHG emissions and impact on traffic would be similarly reduced.

It is important to recognize that the Big Blue Belly Compaction technology working in conjunction with wireless communication technology will allow Markham staff to

service the same number of containers with considerably less resources allowing those resources to be tasked to other important duties within the Town.

## 6.0 Financial Considerations/Business Case

The Waste & Environmental Management Department purchased 24 Big Blue Belly containers using Capital funding for the Main Streets of Markham and Unionville. Now that the containers have been deployed, Operations Department has agreed to maintain, provide collection and monitor the containers usage via wireless software. The Waste & Environmental Management Department has a 2011 Capital Budget reserved for the purchase of an upgrade to 8 existing Big Blue Belly's and for a 5-year service contract for 12 containers. The 12 newest containers purchased included the cost of a 5-year wireless service contract. In 2016, at the end of the 5-year wireless service contract, the Operations Department has the option to renew for another 5-year service term for the existing 24 containers or as many as they own in total at the time.

The Cost Details for the Big Blue Belly Project are as follows:

| Date | Markham PO # | Description | Supplier | Cost* | |
|---|---|---|---|---|---|
| 40349 | PP10235 | Purchase 4 Big Belly Solar Compactors | Waste Management Canada | $ 20,427.08 | 1 |
| 40632 | PP10633 | Purchase of 3 Big Belly Solar Compactors | Waste Management Canada | $ 15,508.74 | 2 |
| 40663 | WS-Leigh | Graphic Design for Wraps 2 versions | Foxx Advertising | $ 678.00 | |
| 40702 | PP11285 | Purchase of 5 Big Belly Solar Compactors | Waste Management Canada | $ 23,052.73 | 3 |
| 40724 | WS-Leigh | Purchased 5 custom artwork wraps | Beyond Digital Imaging | $ 1,344.70 | |
| 40814 | PD11251 | Purchase of 12 Big Belly Solar Compactors** | Waste Management Canada | $ 57,569.02 | 4 |
| 40841 | Invoice 1151287 | Purchase of 12 custom artwork wraps | Beyond Digital Imaging | $ 3,654.00 | |
| 40908 | Invoice 116-470503 | Purchase Clean Wireless Monitoring for five years | Waste Management | $ 12,705.59 | |
| | WS- Kimberley | Big Belly Promotion and Education DVD Video Production | Minds Combined Media Inc. | $ 1,695.00 | |
| **Total:** | | | | **$136,634.86** | * |

1 Includes custom wrap artwork, clean wireless, shipping and taxes

2 Includes custom wrap artwork, shipping and taxes (no clean wireless)

3 Includes shipping and taxes only (no clean wireless or wraps)

4 Includes clean wireless, shipping and taxes (no wraps). Please note Markham purchased a total of 24 Big Belly containers. The CIF grant agreement covers the cost of 18.

The Cost Summary for the Big Blue Belly Project is as follows:

| Description | Quantity | Price Per Unit* | Total Cost* | |
|---|---|---|---|---|
| Big Belly Containers | 24 | $4,856.56 | $116,557.57 | |
| Wraps | 17 | $310.41 | $4,998.70 | |
| Clean Wireless 5 Year Service | 12 | $1,058.79 | $12,705.59 | |
| Promotion & Education | 1 | N/A | $2,373.00 | |
| **Total:** | | | **$136,634.86** | * |
| * | Includes Taxes and Shipping | | | |

For the calculation of an accurate Business Case, ROI and Payback Period the following considerations were factored in:

| | | |
|---|---|---|
| It is important to note that the Big Blue Belly Bins were specially selected for use in BIAs. Aside from all other benefits they were also selected for their aesthetic appearance. The cost of comparable units should be factored into the Analysis. | | |
| Per unit cost of new gabage bins selected for recent BIA deployment | $ | 1,096.10 |
| **Total Incremental Cost of Big Blue Belly Deployment =** | **$** | **110,328.46** |

With a key objective of this Project being to reduce the amount, cost and impact of collections, operations and maintenance the cost breakdown of this function for high and low seasons is as follows:

| | | | Pre | | | |
|---|---|---|---|---|---|---|
| | | | | Week | Month | Period |
| May -Nov | | Man hours/wk = | 30 | | | |
| Total weeks = | 26 | Truck hours/wk = | 15 | | | |
| | | Hourly Labour Rate = | $ 23.54 | | | |
| | | Hour Truck Rate = | $ 46.45 | | | |
| | | Labour Costs = | | $ 706.20 | $ 3,060.20 | $18,361.20 |
| | | Truck Costs = | | $ 696.75 | $ 3,019.25 | $18,115.50 |
| | | Total Costs = | | $ 1,402.95 | $ 6,079.45 | $36,476.70 |
| Nov - May | | Man hours/wk = | 10 | | | |
| Total weeks = | 26 | Truck hours/wk = | 5 | | | |
| | | Hourly Labour Rate = | $ 23.54 | | | |
| | | Hour Truck Rate = | $ 46.45 | | | |
| | | Labour Costs = | | $ 235.40 | $ 1,020.07 | $ 6,120.40 |
| | | Truck Costs = | | $ 232.25 | $ 1,006.42 | $ 6,038.50 |
| | | Total Costs = | | $ 467.65 | $ 2,026.48 | $12,158.90 |
| Annual Costs | | | | | | |
| | | Labour Costs = | | | | $24,481.60 |
| | | Truck Costs = | | | | $24,154.00 |
| | | Total Costs = | | | | $48,635.60 |

Given the upfront costs of the Project and the expected cost savings, Town of Markham is working to monitor actual cost savings and impact of the Project. While there are many "intangibles" that are difficult to accurately quantify such as:

- improved public participation in public space recycling
- improved waste diversion
- reduced contamination of materials streams
- decrease in the amount of litter
- decrease in local business owner and resident complaints of litter
- increase in the amount of recycling collected
- increased pride and enjoyment of local residents from a cleaner Town
- increased visitor traffic from a cleaner Town
- enhanced Operational knowledge from wireless communication
- enhanced profile of Town of Markham's leadership position on Zero Waste
- etc.

NOTE: a number of these more intangible benefits are addressed in Surveys conducted with both residents and Town staff that can be found in Appendix 9.2.

Of the more concrete expense line items the following calculations can be made:

| | |
|---|---|
| Recent analysis and observation of the deployment of the Big Blue Belly units suggests that total reduction in labour and truck resources could be approximately | 50% |
| As such, the total annual savings in reduced labour and truck resources = | $ 24,317.80 |
| Based solely on labour/truck resource reduction, estimated pay-back period = | 4.54 years |
| Compaction tests have shown that Town of Markham to reduce the number of times where recycling bins need to be emptied by as much as | 86% |
| As such, the total annual savings in reduced labour and truck resources = | $ 41,826.62 |
| Based solely on labour/truck resource reduction, estimated pay-back period = | 2.64 years |

Under the current model Town of Markham has a payback period of 2.64 to 4.54 years. This does not include many of the intangible factors listed above. Moreover should labour costs or vehicle operation costs increase the payback period will be even shorter.

It is important to note that Town of Markham has been approached by groups that propose to lease similar such units on a low or no cost basis in return for the advertising revenues generated. While this model has been widely adopted the added functionality of compaction and wireless communications promise to make this an even more cost-effective service offering due to the significant decreases in operational cost that municipalities can realize.

## 7.0 Knowledge Component

It cannot be overstated the importance of the functionality of these state of the art containers with compaction capabilities and wireless technology. This technology will be tested for the first time in Canada, which will dramatically change how public space waste and recycling will be handled. No longer will maintenance staff be reliant on a regular schedule to clean out bins that may be nearly empty or overflowing. This same staff will now have the ability to monitor the status of all bins in real time and respond only to those needing their attention. Ongoing tracking and reporting will enable them to forecast their time and travel allocation with wireless technology allowing them to immediately respond to any urgent situations should they arise.

The system comes with an intuitive interface that can be customized for the municipality's specific needs and capabilities. While the Town of Markham is still in the learning Phase and has yet to fully realize the benefits of all the functionality it is important to understand all of the capabilities of the Big Blue Belly system. Screenshots of the system in use can be viewed at Appendix 9.3.

### 7.1 Survey Results:

In addition to data from the Big Blue Belly system, Town of Markham is also able to measure the Program's effectiveness by survey questions to both the public and Town staff. The full results of these surveys can be found at Appendix 9.2. Some key results are as follows:

| **Public** | |
|---|---|
| Did you know the Big Belly's are for recyclables? | 77.4% said Yes |
| Do you think the Big Blue Belly helps to reduce street litter? | 94.3% said Yes |
| Are you more likely to use a Big Blue Belly over a conventional recycling container? | 79.2% said Yes |
| Would you like to see Big Belly's in other places in Markham? | 90.6% said Yes |
| **Staff** | |
| Do you find the Big Blue Belly solar software program easy to use? | 90.9% said Yes |
| Do you find using the Big Blue Belly software program makes your job more efficient? | 100% said Yes |
| Have you noticed less litter on the streets since the installation of the Big Belly's? | 72.7% said Yes |
| Do you find the Big Belly's need to be emptied less frequently than traditional containers? | 100% said Yes |
| | |
| Public Survey Sample Size = 53 | |
| Staff Survey Sample Size = 11 | |

## 8.0 Other Considerations/Next Steps

As with any similar Project, being one of the first to adopt and apply this technology had a number of positive outcomes as well as outcomes in need of improvement. Some key considerations for Groups looking to implement Big Blue Belly Solar technology in this regard would include, but not be limited to, the following:

Positive Outcomes:

a) The solar technology was very effective and functioned as promised
b) The compaction technology for recyclables also very effective and functioned as promised
c) The acceptance of this technology by residents and Town staff was very good
d) The usability and functionality of the Big Belly solar Control Panel software was very good
e) Town of Markham staff were pleased to observe that bins were not vandalized

Need of Improvement:

a) While the Big Blue Belly units functioned well, Markham found that the lack of technical support available in Ontario needs to be addressed. *Big Belly Solar* needs to provide customer follow up, maintenance assistance and/or a servicing plan. At the moment there are no local (Canadian) maintenance contractors which pose challenges with staff time, inconvenience and cost.
b) Availability of replacement parts – see Section 8.1 below for details
c) Availability of motherboards for units - see Section 8.1 below for details
d) Markham recommends that Big Blue Belly units be ordered with factory wrapped graphics completed and arranged by Big Belly Solar.
e) Big Blue Belly units require specialty size bags that have to be purchased separately
f) Big Blue Belly units must be placed in specific locations to receive sufficient sunlight. Indoor or shaded areas may prove problematic.
g) Training is critical and a challenge the Town of Markham is still working through. Suffice it to say that Big Blue Belly units are sophisticated pieces of technology replacing very low-tech equipment and require training of Operations staff to bring the technology in alignment with those using it
h) Buy in from other departments
**i)** Seasonality is a key component where usage of these outdoor units as well as servicing them varies greatly throughout the calendar year. For a complete understanding of all the impacts of introducing this technology, it may take an entire calendar year or more to make sufficient and accurate pages observations.

**8.1 Recommendations**:

a) Suggest development of a Canadian User Community of Big Belly Solar units so that various groups can share their experiences as well as best practices.
b) *Big Belly Solar* needs to set up a maintenance infrastructure within Canada to be able to successfully service accounts in this area.
c) Big Belly Solar needs to improve their local training programs to enable Operational staff to use and operate their technology in an effective manner.
d) Big Belly Solar needs to provide detailed user manuals and guidelines to greatly reduce their overall learning curve and enable Operational staff to use and operate their technology in an effective manner.
e) Big Belly Solar needs to standardize its locking systems so that when any set of units are purchased, the locking mechanisms of all units are part of a "Master system", not individual pieces to minimize the inconvenience and extra labour in accessing and maintaining units.

**8.2 Challenges:**

Some more detail on specific issues and their impacts are as follows:

1. Availability of replacement parts – each unit has a locking compartment that has a keyed opening with lock mechanisms that are proprietary to the Big Blue Belly unit. On 3 separate occasions, the lock mechanisms for 3 different units were not properly functioning and could not be accessed for a period of a number of weeks to a number of months. This prevented collection of complete and accurate data during that period when local parts were on back order from the distributor in the U.S. This situation has been brought to the attention of the manufacturer who has acknowledged the situation and is currently working towards a solution. In the meantime, all costs for delivery of locks and parts were the responsibility of Town of Markham. Subsequently, *Big Belly Solar* has replaced the locks and installed them under warranty however delivery of parts took a long time. *Canadian Waste Inc.* (*Big Belly Solar's* Canadian distributor) has completed the work on the defective locks on the four Big Belly's with the lock issues. The new version Big Blue Belly units have a different entry key then the first version of Big Blue Belly units which require two keys to open the existing bins on the street. This situation leads to keys being misplaced and not everyone having the proper keys on them and the inconvenience and added expense resulting from it.

2. Big Blue Belly Units come equipped with wireless technology that can communicate with a central monitoring point. Within each bin, this wireless technology is connected to a motherboard (see Appendix 9.1) that performs many functions but primarily monitors bin contents, initiates compaction if necessary and communicates bin status to central monitoring point. Due to delays in delivery, Town of Markham staff only received the motherboards on December 19, 2011 and they were installed on January 11, 2012. So while the bins were functional prior to the installation of the motherboards, they did not

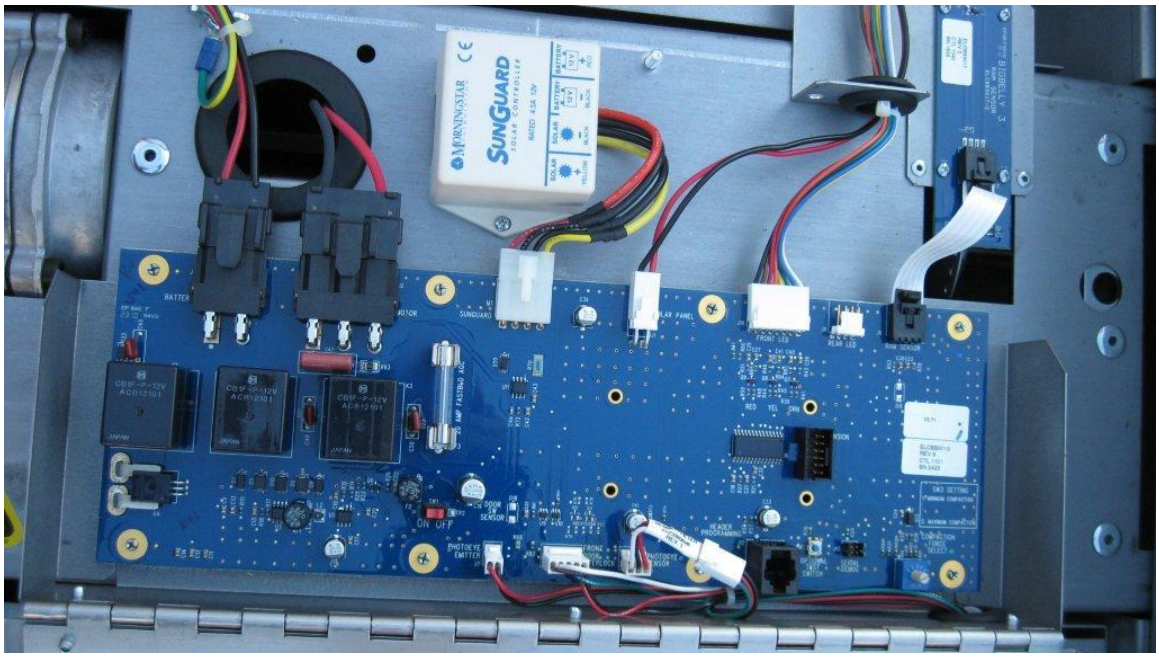
have their most valuable functionality in place – that of communicating their status to a central monitoring point. As such, test results are not optimal as we still only have a relatively narrow window of observation on which to base results.

### 8.3 Next Steps

Overall the Big Blue Belly Project had the anticipated goals met which included improved public participation in public space recycling; reduction in the number of collections required to maintain the bins, therefore reducing green house gas emissions, staff time and cost to empty the bins; decrease in the amount of litter and increase in the amount of recycling collected. Town of Markham will continue to expand use of Big Blue Belly solar technology and will support any changes to address the recommendations made above.

## 9.0 Appendix

Appendix 9.1 – picture of Big Blue Belly motherboard




Appendix 9.2 –Big Blue Belly Survey results

- Public Feedback Survey Results can be found at http://goo.gl/1ZpMJ
- Staff Feedback Survey Results can be found at http://goo.gl/1ZpMJ

Appendix 9.3 –Big Blue Belly Control Panel Screenshots

- Public Feedback Survey Results can be found at http://goo.gl/1ZpMJ
- Staff Feedback Survey Results can be found at http://goo.gl/1ZpMJ

Appendix 9.4 –Big Blue Belly Fact Sheet

# PUBLIC SPACE RECYCLING

## FACT SHEET


## Markham Operations:

- 40 Zero Waste special event containers
- 450 parks recycling cages
- 1,200 Super Mailbox recycling containers
- 182 public space recycling containers

## Big Belly Solar Compactors:


- Improves collection efficiencies
- Solar power used to compact recyclables
- Big Belly Compactors consume four to five times the volume of a standard receptacle
- Notification system alerts staff when container is full

100% Post

MARKHAM

Appendix 9.5 –Big Blue Belly General Committee Presentation

- Big Blue Belly General Committee Presentation May 30, 2011 can be found at http://goo.gl/1ZpMJ

Appendix 9.6 –Big Blue Belly unit picture


Appendix 9.7 –Big Blue Belly Images

- Big Blue Belly miscellaneous pictures can be found at http://goo.gl/1ZpMJ