

# CIF

## CONTINUOUS IMPROVEMENT FUND



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## Dorset Drop-off Transfer Site Solar Compactors

### CIF Project 840



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## Executive Summary

Algonquin Highlands (the Township) is a rural township located in Haliburton County. It covers 1,000 square kilometers and services 2,000 permanent residents, and between 8-10,000 seasonal residents during the summer months.

The Township experienced significant haulage fees associated with rental and haulage of 20 yd<sup>3</sup> open-top containers for recyclable materials located at the former Dorset Landfill Site, now the Dorset Drop-off Transfer Site. In addition, these bins created challenges for the Township due to weather, nuisance wildlife, and staffing costs to maintain the bins and prepare for hauling.

Staff prepared a proposal for Council in the spring of 2014 recommending the installation of solar compaction bins at the new Dorset Drop-off Transfer Site. The use of solar technology has been a popular choice in the surrounding region, and seemed ideal for the site due to the cost-prohibitive nature of installing a three-phase electrical system (estimated at \$40,000), reduced staffing costs, and the potential reduction in greenhouse gas emissions associated with hauling. This proposal was accepted by Council, and an application for funding assistance from the Continuous Improvement Fund (CIF) was made. The Township purchased (2) TC220 solar compaction units and (4) 40 yd<sup>3</sup> compaction containers for recyclable materials, a Winco 12 kW propane generator, sea-container, and a Pandora Intelligent Network monitor.

The project went to Tender and began in fall 2015, with installation completed January 1, 2016. The installation experienced some delays associated with delivery date of the compaction units. The Dorset Drop-off Transfer Site began full operations with its new solar compaction units as of January 1, 2016.

Equipment was purchased from, installed, and commissioned by Metro Compactor Service Incorporated. The capital cost of the proposal was \$157,842 which included a 15% cost contingency. Actual costs for the project amounted to \$156,142. The variance between actual versus budgeted costs are associated with a price increase of the solar compaction units (\$US Exchange). Due to the isolated nature of the site, some adjustments were made to the project design. Specifically, a 20ft Sea Container was purchased to house all of the Solar Panels and photo voltaic (PV) system, along with the installation of an alternative propane power source. It was recommended that a different generator, than originally specified be used due to its improved performance in cold weather.

The first 8 months of operations did present some challenges. The compactor bins were 'bear-proofed' following an incident where electrical cabling was damaged. Determining bin capacity for hauling, staff and attendant training and troubleshooting issues with the photovoltaic system has been ongoing.

Overall, staff are satisfied with the solar compactors, and have received positive feedback from the public regarding the site design and layout. Haulage savings identified over the first 8 months of operation (January 1, 2016 to August 31, 2016) were nearly \$11,000 compared to haulage costs for the same time period the previous year. Projected savings are anticipated to provide a 12.9 year payback on investment.

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# 1 Background

## 1.1 Community Profile

The Township of Algonquin Highlands is a beautiful, park-like municipality nestled among myriad lakes and rolling hills. The municipality is located on the western side of the Haliburton Highlands and approximately 3 hours north of Toronto. Pristine lakes offer fishing, boating, swimming and sparkling sunsets. Trails, complete with maps and guidebooks, provide endless beautiful vistas, waterfalls, canoeing, snowshoeing, cross-country skiing, cycling and snowmobiling. Arts and heritage are alive and well with museums, galleries and quaint small town shopping. Algonquin Park is nearby, as are dozens of resorts, rental cottages and B&Bs.

The municipality is characterized by small settlements and a significant amount of both waterfront and rural areas known far and wide as "cottage country". The Township includes half the village of Dorset, part of Carnarvon, and the hamlets of Boshkung, Buttermilk Falls, Halls Lake, Little Hawk Lake, Maple Lake, Ox Narrows and Oxtongue Lake, the latter having the pleasure of being nestled up beside, and sharing the history of, Algonquin Provincial Park.

The municipality is home to a permanent population of 2,000 and an additional seasonal population of approximately 8,000 people.

## 1.2 Waste Management System

The municipality provides two-stream recycling and garbage at each of our five landfill sites as there is no curbside collection of waste or recycling. The depots are staffed and open to the public during scheduled hours of operation.

In 2015, the Township used open 20 yd<sup>3</sup> roll-off bins and 40 yd<sup>3</sup> split depots for the collection of blue box recyclables at the Dorset Landfill. That year, the Township recycled approximately 378 tonnes of blue box materials from all 5 landfill sites. Progressive Waste Solutions in Bracebridge, Ontario transported and processed the materials. The municipality does not have a revenue sharing agreement in place with this contractor.

The recycling program accepts:

**Containers:** Glass bottles & jars, plastic containers & lids, metal cans & foil, polystyrene, and plastic bags.

**Fibres:** Newspapers, magazines & books, boxboard & mixed paper, corrugated cardboard, tetra-pak boxes, and gable-top cartons.

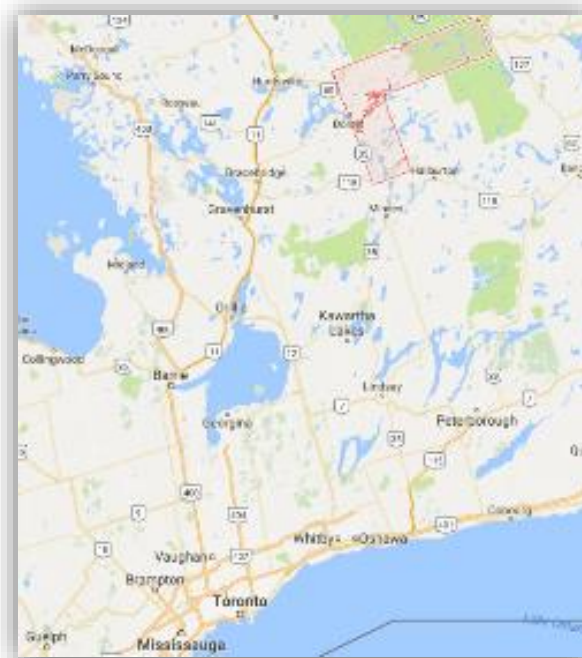


Figure 1: Geographical Map of Algonquin Highlands

In addition, the following diversion programs are in place:

**Electronic Waste:** amplifiers, audio and video players, cameras, cell phones , computers, computer peripherals (keyboard, mouse, etc.), copiers, fax machines, monitors, pagers and PDAs, printers, radios, receivers, scanners, speakers, telephones and answering machines, tuners, turntables, TVs, video projectors.

**Tires:** The Township is a registered collector with the Ontario Tire Stewardship. Residents can now bring used tires – free of charge – to the Maple Lake or Oxtongue Landfill sites, and be assured that they will be diverted from the landfill and recycled into new products. Tires must be off rim to be brought in for free.

**Appliances & Scrap Metal:** Metal recycling is mandatory in Algonquin Highlands. Scrap metal is accepted at the Maple Lake and Oxtongue Lake Landfill sites and the Dorset Drop-off Transfer site.

### *1.3 Program Challenges*

The Dorset Landfill reached its useful capacity and was converted to a drop-off transfer site in the fall of 2015. Prior to conversion, the recycling depot at the Dorset Landfill consisted of 20 yd<sup>3</sup> roll-off bins and 40 yd<sup>3</sup> split depots. There is no electricity to the site.

It was anticipated that the use of compactor units and closed 40 yd<sup>3</sup> bins would allow the Township to collect as high as five times more material per bin than with the previous collection system, and reduce the number of trips to the MRF by an estimated 80%. Remote monitor of the bins was selected to ensure that they are full when shipped. Plus the closed bins would mean that the Township wasn't paying to ship snow and ice in the winter.

Another incentive for the Township when considering the compactor system was the elimination of labour and equipment time for Township public works staff to "pack the bins" with a backhoe. Finally, the District of Muskoka had reported a drop in residue rates when using compactor units, which, if true, would reduce hauling costs further by not paying to ship non-blue-box material to the MRF.

This project proposed to replace the 20 yd<sup>3</sup> containers and 40 yd<sup>3</sup> split depot recycling bins with two solar/generator powered compactor units with 40 yd<sup>3</sup> containers. It was expected that the compactor system would result in a significant increase in the volume of material that could be collected before a bin needed transport to the MRF, thus further reducing haulage costs. Reduction in bin transportation would also lead to lower GHG emissions.





**Figure 2: Former Collection Bins at Dorset Landfill Site**

## 2 Approach

A preliminary cost estimate was received from Efficient Waste Management (EWM) Systems, who have installed similar solar and other compaction systems in several neighbouring municipalities. A detailed budget/cost analysis identified significant savings to the municipality and an estimated return on investment (ROI) of less than 8 years.

On May 1, 2014 Council authorized staff to submit an application to the CIF, in response to CIF's 2014 Request for Expressions of Interest, for funding to purchase recycling compactor systems for the Dorset Landfill/Transfer Site. The Township entered into a formal Project Grant Agreement with the CIF to receive funding to purchase recycling compactor systems for the Dorset Landfill/Transfer Site on November 20, 2014.

A public tendering process was held in the fall of 2015 for the Dorset Drop-off Transfer Site solar compaction project. On October 23, 2015 Council awarded the tender for the Landfill Cap and Transfer Site Construction to BOR Aggregate Company Incorporated and the tender for the Supply and Installation of Waste Compactors with Back-up Power was awarded to Metro Compactor Service Inc.

To provide for the new compaction systems and bins, the depot required upgrades including installation of concrete pads. B.O.R. Aggregate Company Inc. was contracted to complete the upgrades, and the work was completed in November 2015.

The Township did request an extension to the project completion date due to some project delays associated with landfill closure and transfer site construction. The extension accommodated later delivery of the compactors, and several weeks for testing, staff training, and familiarization.



## ***2.1 Monitoring and Measurement Methodology***

There are two primary measurements monitored in evaluating this project: transfer haul costs and load weights. The hauling contractor weigh bills from the first 8 months of 2015 and 2016 are used as the benchmark and post-implementation cases. Secondly, the fuel used for the backup generator and the costs of backhoe, labour, and equipment were used in comparing the two systems.

### **2.1.1 Haul Costs**

In the first 8 months of 2015, the municipality hauled 62 20 yd<sup>3</sup> bins of recyclable material from the Dorset drop-off transfer site to the processing centre at a total cost of \$15,730.64 or \$253.72 per load. As the cost per load did not increase between 2015 and 2016, the total cost of hauling for the 8 month period has been compared in the results section (3) of this report.

Of note, the municipality consulted with the hauling contractor prior to purchasing the new compaction system and bins to make sure that the bins could be hauled using the existing transport fleet and that the cost per haul would not increase in the new system.

### **2.1.2 Tonnages**

In the first 8 months of 2015, the municipality hauled 84.94 tonnes of collected materials to the processing centre, an average of 1.37 tonnes per load from the Dorset Landfill Site. With the two-stream program, this breaks down to 38.86 tonnes of containers and 46.08 tonnes of fibres or 1.18 tonnes per load and 1.59 tonnes per load, respectively.

Of note, the material collected in the 20 yd<sup>3</sup> bins was compacted by staff using a backhoe to ensure optimal load weights were shipped with each haul.

### **2.1.3 Generator Fuel Use**

The new solar compaction units require some type of backup energy source be in place. Given the potential for insufficient availability of solar energy (i.e. overcast/cold weather conditions) the backup source must provide the energy necessary for cycling the compactors, and ensuring the solar battery system is at full charge. As electricity is not currently available at the Dorset Drop-off Transfer Site, a propane backup generator was selected as the backup energy source. The fuel usage and operating hours for this generator are being tracked by staff in an effort to identify operating costs for running the new system and to evaluate system efficiency. Annual fuel costs associated with the generator were budgeted at \$500 per year.

### **2.1.4 Backhoe, Labour, and Equipment costs**

Prior to the installation of the solar powered compaction bins, the 20 yd<sup>3</sup> bin system required a backhoe operator to manually compact recyclable materials in the bins to optimize load weights. The cost of completing this activity was estimated at \$8,202 in 2015 considering staff hours and equipment costs (including fuel, maintenance and amortization) allocated on a per operating hour basis. During 2015, recyclable materials accounted for approximately 1/3 of total waste management expenditures.

### 2.1.5 Monitoring Challenges, Limitations and Solutions

Traditionally, Township staff monitored bin fullness and scheduled pick-ups accordingly with the hauling company. As part of the solar compaction project a remote management system was installed to maximize efficiencies and realize additional haulage cost savings.

The compactor units are monitored remotely through the Pandora Network, in addition to regular checks by staff and site attendants. Monitoring includes readings for hydraulic pressures (PSI), bin capacity (%), and automated notification to both the township and hauler when bin pick-up is required. In addition, the township is alerted if there are any system errors or malfunctions.

## 2.2 Implementation

### 2.2.1 Site Upgrades

Prior to the installation of the solar compaction system, the site needed to be converted from a landfill site to a drop-off transfer site. B.O.R. Aggregate Company Inc. was contracted to complete the upgrades in October 2015 and the work was completed in December 2015.

Site preparation included the placement of final covering materials, topsoil and hydro seeding, installation of a drainage swale, and perimeter fencing. Once this work was completed, B.O.R. Aggregate Company Inc. installed reinforced concrete slabs to create a base for the solar compaction units.

The Township has made further upgrades to the site, with the installation of a new 're-use' centre for gently used goods, and permitted the installation of a collection depot for empty beer and liquor containers maintained by a local service club.



Figure 3: Service Club Bottle Drop-Off

### 2.2.2 Equipment Purchased

Metro Compactor Services Inc. was contracted in October 2015 to provide and install the solar compaction units. Two Marathon TC-220 stationary compactors for recyclable materials were installed at the site along with four 40 yd<sup>3</sup> compaction containers, a WINCO 12kW propane generator, a 20ft sea container, and hardware for the Pandora remote monitoring network. All equipment was installed on the site, and operational prior to January 1, 2016.

## 2.2.3 Promotion and Education

Promotional materials were created by Township staff to notify residents of the change from landfill site, to drop-off transfer site. The primary means of disseminating this information were through the township website, local media, and with the distribution of tax bills to residents.

Public notice and invitation to comment was provided through local media and the township website on May 15, 2014 that the Township had made application to the Ministry of the Environment to close the Dorset waste disposal site to landfilling operations and commence drop-off transfer site operations. The public was also informed at this time that the township was proposing to install compaction units to reduce material haulage to/from the site (see Appendix 1).

The public was updated accordingly as the project progressed. In May 2015, for instance the website was updated to inform the public that approval had been granted by the Ministry of Environment and Climate Change (MOECC) to allow for conversion of the site to a drop-off transfer site. Anticipated construction start dates, site closure dates, and opening of the new site, were also communicated to the public as warranted.

During the spring of 2015, signage was installed at the entrance to the Dorset Drop-off Transfer Site notifying the public of the anticipated changes at the site (see Figure 4). In September 2015, additional signage was installed at Pine Springs Landfill, and Oxtongue Lake Landfill notifying the public of extended hours at these sites to accommodate the temporary closure of the Dorset Waste Disposal Site.



Figure 4: Public Notification of Changes to the Dorset Landfill

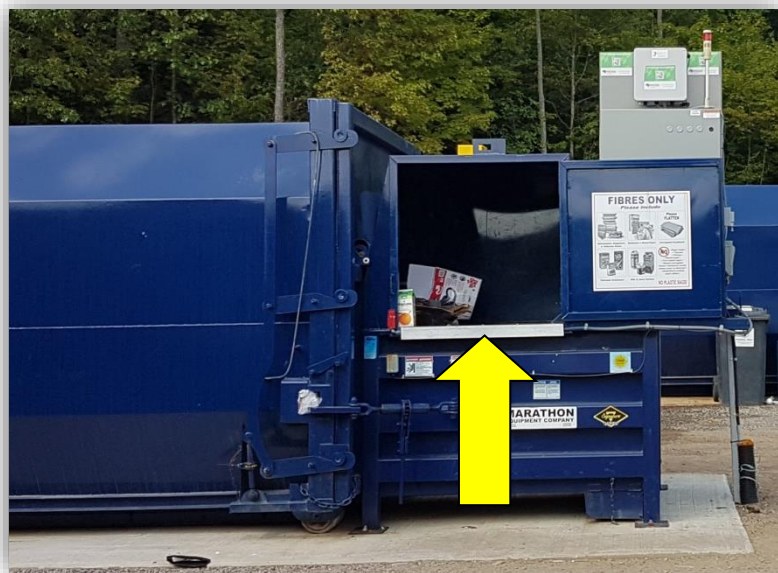
## 2.2.4 Issues with Operations

Staff has experienced some challenges adjusting to the new solar compaction system. Most notably, is the number of hours the propane generator is needed to run for solar battery bank top-up (between 5-8 hours) when the battery voltage is reduced. Similar installation sites in the region are connected to the hydro grid through a 110 V connection, whereas the Dorset site is without a hydro source. This requires the propane generator to come on automatically when the battery bank registers a reduced electrical voltage. Environmental challenges such as light availability, dust and snow may interfere with the charging capabilities of the PV system, in addition to seasonal availability of sunlight. The average fuel costs for the alternative propane power source have exceeded the estimated annual budget of \$500.00.

The compactor units are monitored remotely through the Pandora Network, in addition to regular checks by staff and site attendants. Monitoring includes readings for hydraulic pressures (PSI), bin capacity (%), and automated notification to both the township and hauler when bin pick-up is required. In addition, the township is alerted if there are any system errors or malfunctions. In one instance the system generated a 'false pick-up' indicating that a bin had been changed out. The remote managers worked in conjunction with township staff to quickly address the problem and verify that the system was functioning properly.

Ongoing training has been required for staff and attendants with respect to trouble shooting the PV system. Several instances have occurred where regular maintenance of the generator has possibly impacted the performance of the PV system. It is vital to the operation of the system that staff ensures the automated feature that engages the backup propane generator has been enabled. New trainings will be arranged as warranted by system or staffing changes.

The Dorset Drop-off Transfer Site is not without nuisance wildlife challenges. Following the installation of the new compaction units, damage was caused to the electrical system by a bear attempting to climb into the compaction unit. Staff installed angle iron on each bin to cover the exposed areas, and effectively 'bear proof' this part of the bin, featured in Figure 5 below.



**Figure 5: Bear Proofing**

## 3 Project Results and Analysis

The following is a breakdown of the key performance indicators tracked for this project as identified in the previous section of this report. First, the results are presented comparing the previous 20 yd<sup>3</sup> bin system versus the new compaction system. Then, the results are analyzed to identify the implications of our observations.

### 3.1 Project Results

The key performance indicators tracked for this project were: haul costs, tonnages (load weights), fuel use by the backup generator, and the financial impacts of the new program.

#### 3.1.1 Haul Costs

The first 8 months of haul costs for 2015 and 2016 are presented in Table 1 below.

In the first 8 months of 2015, 62 loads of material were hauled from the Dorset Landfill Site to the processing centre at a total cost of \$15,730.64 or \$253.72 per load. In the first 8 months of 2016, 18 loads of 40 yd<sup>3</sup> compacted material were hauled from the Dorset drop-off transfer site to the processing centre at a total cost of \$4,566.96 or \$253.72 per load. The projected costs for 2016 are compared on the basis of total project costs to date (8-months) multiplied by 1.5 (12-months divided by 8-months).

**Table 1: Recyclable Materials Haulage Cost Comparison**

	Cost per haul	No. hauls	Total cost	No. tonnes	Cost per tonne	Projected Cost
20 yd <sup>3</sup> system (2015)	\$253.72	62	\$ 15,731	84.94	\$185.20	\$ 26,641
Compaction system (2016)	\$253.72	18	\$ 4,567	68.07	\$67.09	\$ 6,850
Difference <sup>1</sup>	\$0.00	44	\$ 11,164		\$118.10	\$ 19,791

<sup>1</sup>3 loads of recyclables using the 20 yd<sup>3</sup> bin set up were hauled at the start of 2016. The projected cost of the compaction system includes an estimate of how much hauling these 3 loads of material would have cost with the new system.

#### 3.1.2 Tonnages

The first 8 months of haul weights and load densities for 2015 and 2016 are presented in Table 2.

In the first 8 months of 2015, the municipality hauled 84.94 tonnes of recyclable materials to the processing centre, an average of 1.39 tonnes per load. In our 2-stream program, this breaks down to 38.86 tonnes of containers and 46.08 tonnes of fibres or 1.18 tonnes per load and 1.59 tonnes per load, respectively.

In the first 8 months of 2016, the municipality hauled 73.38 tonnes of collected materials to the processing centre, an average of 4.25 tonnes per load. In our 2-stream program, this breaks down to 32.42 tonnes of containers and 40.96 tonnes of fibres or 3.60 tonnes per load and 4.55 tonnes per load, respectively. It is important to note here that the compaction system figures include 3 20yd<sup>3</sup> bins (1 containers, 2 fibres) that were used as overflow during the busy summer months.

**Table 2: Recyclable Material Haulage Weights and Load Densities**

	Container tonnes	Container no. hauls	Tonnes per haul	Fibre tonnes	Fibre no. hauls	Tonnes per haul	Avg. Tonnes per haul
20 yd <sup>3</sup> system	38.86	33	1.18	46.08	29	1.59	1.39
Compaction system	32.42	9	3.60	40.96	9	4.55	4.25

### 3.1.3 Generator Fuel Use

The amount of propane for the installed generator had been budgeted at \$500 per year. However, actual fuel use is estimated at \$1,800 to \$2,400 per year based on costs to date. This difference is attributed to increased compactions (high energy use) during busy summer periods, and the automated feature that instructs the propane generator to “top-up” the solar battery bank, during periods of low light/energy. In addition, when the compactor units were first installed they had a heating unit that ran continuously, placing added strain on the PV system.

### 3.1.4 Financial Analysis

**Table 3: Financial Impacts of Project**

ANNUAL OPERATING COSTS	2013 (20yd <sup>3</sup> )	Budget 2016 (40yd <sup>3</sup> )	Actual 8mths	Forecasted 12 mths
Lifts per year*	105	18	18	27
Lift Cost per year**	\$27,412.35	\$6,201.54	\$4,566.96	\$6,850.44
Labour/Equipment costs per year	\$8,202.00	\$0.00	\$1,248.00	\$1,872.00
Remote monitoring costs per year	\$0.00	\$1,080.00	\$400.00	\$600.00
Fuel (for back-up generator)	\$0.00	\$500.00	\$1,179.53	\$1,769.30
<b>Total operating cost per year</b>	<b>\$35,614.35</b>	<b>\$7,781.54</b>	<b>\$7,394.49</b>	<b>\$11,091.74</b>
Amortization of capital	\$2,000.00	\$10,690.67	\$0.00	\$14,419.53
<b>Total annual program costs</b>	<b>\$37,614.35</b>	<b>\$18,472.21</b>	<b>\$7,394.49</b>	<b>\$25,511.27</b>
Cost savings per year		\$19,142.14		\$12,103.08
<b>Payback period (years)</b>		<b>7.3 yr.</b>		<b>12.9 yr.</b>

\*2016 Budget is based on a projected compaction rate 3:1.

\*\*The Hauler indicated that transport cost for compacted 40 yd<sup>3</sup> bins would be 10-20 % higher than the cost for loose-fill bins. The 2016 Budgeted lift cost reflects a higher 20% increase.

## 3.2 Analysis of Results

Between the periods of January 1, 2016 to August 31, 2016, sixteen compacted 40 yd<sup>3</sup> bins were shipped from the Dorset Drop-off Transfer Site with a combined weight of 68.07 metric tonnes. In addition, three 20 yd<sup>3</sup> non-compacted bins were shipped with a combined weight of 5.31 metric tonnes. The calculated equivalent 40 yd<sup>3</sup> bins is 18, as shown in Table 3. The Combined weight of all containers and fibre bins was 73.38 metric tonnes, for a total combined haulage cost of \$4,566.96. When we consider the loads shipped per date, we begin to see the significant savings that have been realized in haulage costs, of nearly \$11,000 in the first 8 months of operation.



Early in the project planning stages the initial estimates suggested that compaction of bins would allow the Township to collect an estimated five times more material per bin than with the previous 20yd<sup>3</sup> open top bins. As Table 2 indicates, the Township is currently shipping an average of 4.55 tonnes per trip in the 40yd<sup>3</sup> compacted bins, compared to an average of 1.59 tonnes per 20yd<sup>3</sup> open top bin. The average tonnes per haul are currently above the standard tonnes per haul for 20yd<sup>3</sup> (1.37 tonnes), and 40yd<sup>3</sup> (4.25 tonnes). These findings indicate that we are currently maximizing our tonnage per haul.

Despite significantly increased weight per bin, the estimated five times more material per bin has not been achieved. Based on the first 8 months of operation with the 40 yd<sup>3</sup> compactor bins, there has been a 47% increase in bin density compared to the 20 yd<sup>3</sup> open top bins. It is important to note here that under the previous system, the 20yd<sup>3</sup> open top bins were being compacted by staff using a backhoe, thus allowing for a greater density and weight of bins at that time. It is reasonable to assume that without the use of a back-hoe to compact the bins, a higher average weight per tonne would have been achieved, and thus a higher density would have been achieved in the end. Staff continue to use the remote monitoring system to monitor bin capacity and pick-up by hauler is automatically triggered when the bin reaches 75% capacity. The 75% capacity trigger allows for 24-48hr delay time in hauler pick-up to ensure that the bin does not achieve over-capacity.

Significant reductions of lifts per year have been achieved by switching from the 20 yd<sup>3</sup> open-top bins to the compacted 40 yd<sup>3</sup> bins. Early in the budgeting stage, it had been indicated by the hauler that a higher price may be applied for the compacted bins, however, at this time the cost per lift has remained consistent (regardless of bin size or compaction) over 2015 and 2016. In the first 8 months of operation this difference in hauling represents 44 less hauls (adjusted to convert any 20 yd<sup>3</sup> bins to 40 yd<sup>3</sup> bins). In the first 8 months the haulage reduction represents a savings of nearly \$11,000.

The hauling reduction is also important when we consider the environmental impact of hauling the materials to the materials recycling facility and the ecological footprint of the township. This reduction in hauling represents a savings of an estimated 13.2 tonnes of CO<sub>2</sub>e emissions when return trips to the hauler and site are considered.

The three main variations in the financial analysis (budget vs. actual) are labour/equipment costs, generator fuel costs, and the lift costs per year. Based on labour costs to date, it is estimated that a total of 32 labour hours for recyclable materials operations at the drop-off transfer site will be completed by year-end. While the initial budget does not include these figures, we have found it necessary to allocate some staffing hours to the maintenance and upkeep of the bins to ensure a sanitary landfill environment, timely transfer of materials, monitoring of the PV System, and servicing of the generator.

The total budgeted fuels costs for the propane generator were estimated at \$500 annually. The actual costs to date are more than double the estimated annual costs, and the actual fuel use for the year 2016 has been revised to \$2,400. An accounting for this increase in fuel usage may be attributed to the PV system underperforming in terms of delivered voltage for the battery bank. If the Solar Panels are unable to keep the battery bank charged then the propane generator automatically switches on and can run for an average of 5 to 8 hours. During the period of January 1, 2016 to August 31, 2016, the generator was operated for more than 1,000 hours.

In consultation with the installer of the PV system, it has been recommended that the Township upgrade the solar capacity by 2kW. The additional generation capacity should reduce reliance on the propane generator during seasonal periods of peak sunlight i.e. spring and summer months, and help us achieve further financial savings over time.

The total budgeted lifts per year (18) was met in the first 8 months of operation. By year end we forecast the total number of 40 yd<sup>3</sup> compacted bins lifted to be 27. The added number of lifts may be attributed to a less than 100% capacity of the container and fibre bins when shipping out, as budgeted. Over the first 8 months for instance, the average capacity of fibre bins when hauled was 85%, with a low of 61%, and a high of 98%. During the same time period, the average capacity of the container bins was much higher when hauled at 95% with a low of 76% capacity when hauled, and a high of 100% capacity at the time of pick-up. Differences in material composition, rate of time between notification to hauler and pick-up may further add to differences in bin capacity.

### ***3.3 Lessons Learned***

The project has been well received by the community, township staff, and attendants at the drop-off transfer site. If the budget had allowed the installation of electricity, it would have been preferred at this location, and may be considered in the future.

The compactor units are monitored remotely through the Pandora Network, in addition to regular checks by staff and site attendants. Some limitations have been noted with regards to accuracy of bin capacity monitoring. In some instances it was noticed that the bin may have reached capacity, despite the monitoring system displaying remaining capacity (%) in the unit. It has been determined that the composition of the compaction material (ex. size, moisture content, and seasonal changes) is likely responsible for this variation. Township staff and site attendants continue to verify bin capacity through visual on-site inspections. As we become more comfortable with the system, we can attempt to extract further efficiencies, aiming towards 100% bin capacity. Our cautious approach to date has kept in mind that any overflow material would then have to be collected and hauled in a non-compacted open top bin on site.

Staff has been in discussions with the electrical company responsible for the installation of the system to identify possible system upgrades. It has been recommended that solar panels providing an additional 2kW could be installed (cost of approximately \$5,000) to increase charging capacity especially in the spring and summer months. An increased solar capacity should reduce the reliance of the PV system on the alternative propane power source.

## **4 Project Budget**

The budgeted project costs versus actual are presented below in Table 4.

Site preparation was completed by B.O.R. Aggregate Company Incorporated. The preparation included capping of the existing landfill, storm water management, installation of perimeter fencing, and reinforced concrete slabs. The site preparation and installation of concrete pads was in line with the original budget.

The Solar Compaction System was installed by Metro Compactor Service Inc. and their electrical sub-contractor. The remote monitoring system was accounted for annually, though the price for installation of the system was not included in the original budget. The original budget included solar & generator costs on the same budget line. Based on the advice of Metro Compactor Service Inc. a different generator than budgeted was selected on its cold weather performance. In addition, the solar component of each compaction unit was included in the actual cost. The inclusion of this cost, in part accounts for a higher actual cost for each compactor unit on the compactor unit budget line.

A 20ft Sea Container was purchased to house all of the Solar Panels, and PV system, along with the alternative propane generator. This decision was made to reduce wear on the system from the elements, prolong the life of the equipment, and to protect the system from wildlife and human tampering.

**Table 4: Budget Comparison to Actual Project Costs**

Project costs	BUDGET	ACTUAL
Site prep for recycling compactors	\$2,000.00	
Concrete pads for recycling compactors	\$9,850.00	\$9,246.00
2x compactor units	\$57,090.00	\$86,200.00
Pandora*		\$7,112.00
Solar + generator	\$17,733.33	
Winco 12 kW propane generator*		\$14,916.67
40-yd containers*	\$29,283.33	\$31,666.67
Delivery, installation + training	\$2,800.00	
20 ft sea container*		\$4,300.00
Sub-total	\$118,756.67	\$153,441.33
Contingency (15%)	\$17,813.50	\$0.00
Total	\$136,570.17	\$153,441.33
1.76% non-refundable HST	\$2,403.63	\$2,700.57
<b>Total Project Costs</b>	<b>\$138,973.80</b>	<b>\$156,141.90</b>

\*2/3 of actual costs applied to project

The solar compactor units and related equipment are being amortized over a 10 year useful life. A capital replacement will rely on monies from the landfill reserve to cover costs associated with the replacement of the compactor units, solar panels, generator and/or related equipment.

## 5 Conclusions

In conclusion, the Township would like to thank the Continuous Improvement Fund, and Stewardship Ontario for supporting the Dorset Drop-off Transfer Site project. The CIF staff were incredibly supportive and understanding throughout the project planning, implementation, and reporting phases. We look forward to partnering with Waste Diversion Ontario's Continuous Improvement Fund and Stewardship Ontario in the near-future.

As previously mentioned, the project has been well received by the public, staff, and attendants. The switch to compaction units, a first for the Township, has realized notable savings in both hauling and staffing costs.

Township staff may look to improve the generating capacity of the solar panels in the near future, to achieve further fuel savings and reduced GHG emissions associated with running the back-up generator. While a three-phase power system would have been preferred, it was deemed to be not-cost effective at the time of installation.


When considering a project of this nature, the following recommendations are offered:

- Ensure bin compatibility with the specifications of the hauling service provider (i.e. locks, tarps).
- Where possible test system components beforehand (model if possible, or site visit) to determine appropriateness. For instance, are both visual and auditory hopper 'full' notifications required?
- With a solar powered compaction system, ensure that compactor heaters are connected to switches that can be engaged by site attendant 30 minutes prior to opening. Otherwise, you run the risk of drawing excessive power from your batteries to run the heaters constantly.
- In bear country, add protective casing to any exterior cabling to prevent damage by wildlife.
- Ensure solar panels are sized accordingly for the application, with sufficient battery storage, to reduce use of alternative power/fuel source.
- Prepare for some minimal staffing expenses associated with keeping concrete bin pads clean, maintenance of site, and monitoring of equipment.

The reduction of transportation costs, and greater efficiency in bin capacity through compaction ensures that this project is transferable to other municipalities.

## APPENDIX 'A'

### Promotional Materials



# NOTICE

## DORSET WASTE DISPOSAL SITE

## TEMPORARY CLOSURE

**This closure is TENTATIVELY scheduled for October 19—December 1, 2015**

The Dorset Waste Disposal Site has reached its maximum permitted landfill capacity. The Township has received approval from the Ministry of the Environment and Climate Change to turn it into a transfer station.

The transfer station operations will change how household waste is handled. Instead of being landfilled on-site, the materials will be transferred off-site for disposal at another location. The Township is installing compactor units for both household waste and blue box recycling, significantly reducing the amount of truck traffic generated at the site.


The Dorset Waste Disposal Site will be closed while construction is underway to change it to a transfer station. During this time, the Oxtongue Lake and Pine Springs Landfill sites will be available. We apologize for the inconvenience and thank you for your patience.

The following landfill sites will be available for use during the closure:

**OXTONGUE LAKE LANDFILL (22 km)**  
North on Hwy. 35 to Hwy 60, right 5km to 3401 Hwy. 60


**PINE SPRINGS LANDFILL (21 km)**  
South on Hwy. 35 to 1326 Pine Springs Rd.

	OXTONGUE	PINE SPRINGS
Sun	10am-3pm	10am-3pm
Mon	10am-2pm	CLOSED
Tue	CLOSED	CLOSED
Wed	10am-2pm	10am-2pm
Thu	CLOSED	10am-2pm
Fri	10am-2pm	CLOSED
Sat	10am-2pm	10am-2pm



For more information contact:  
Mike Thomas, Operations Manager  
Township of Algonquin Highlands  
705-489-2379

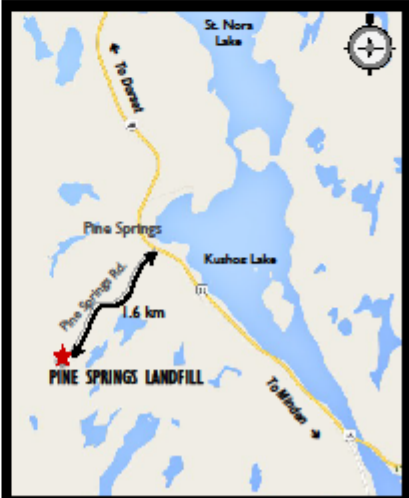
## OXTONGUE LANDFILL



North on Hwy. 35 to Hwy 60, right 5km to 3401 Hwy. 60

Latitude: 45.342335  
Longitude: -78.943288

## PINE SPRINGS LANDFILL



South on Hwy. 35 to Pine Springs Rd., 1.6km to 1326 Pine Springs Rd.

Latitude: 45.1223311  
Longitude: -78.851228

For more information contact: Mike Thomas, Operations Manager  
Township of Algonquin Highlands  
705-489-2379

[www.algonquinhighlands.ca](http://www.algonquinhighlands.ca)

