

# Organics Diversion

## **SUMMARY OF FEASIBILITY STUDY FOR RESIDENTIAL PRE-TREATED ORGANICS DIVERSION PROGRAM**

OCTOBER 2022



## **Brief**

To apply for funding to support a city-wide organics diversion program, the City of Nelson conducted a feasibility study. This feasibility study included preliminary cost estimations, greenhouse gas reduction estimations, and potential waste diversion modelling based on two small Nelson-based pilot programs. The pilot participants comprised of city residents and city staff. The first group was interested in the project, and the second was a diverse group of randomized participants. that tested pre-treatment technology as a means of organics diversion. Highlights from the feasibility study include:

### **1. Pre-treatment could Reduces more GHGs than a Weekly Curbside Organics Program**

The greenhouse gas estimations used in the feasibility study have been verified by the Community Energy Association. The Community Energy Association (CEA) supports local governments in developing and implementing community energy and emissions plans (also known as climate action plans). They also help local governments with carbon-neutral action plans for their operations. The data compiled based on the pilot project demonstrated higher potential reductions than a traditional weekly curbside model. This is due to the transportation emissions that result from weekly hauling and the reduced number of collection days required by a pre-treatment approach.

### **2. Pre-treatment Diverts more Waste than Weekly Curbside Organics Program**

Based on the two small pilot projects, it is anticipated that the pre-treated organics diversion program will divert more waste than a weekly curbside organics program. The average annual food waste diversion rate in Pilot 1 and 2 was significantly higher than the benchmark rate for traditional curbside organics of 120KG/hh/year. This may be due to ease of use, and removal of common barriers to household organics diversion.

### **3. Pre-treatment is More Cost Effective than a Weekly Curbside Program**

Preliminary cost estimations showed that a Pre-treated Organics Diversion Program would cost less than a traditional weekly curbside program. This was due to the avoided cost of weekly collection trips. Note that the initial cost estimations did not include the cost of purchasing a new waste collection vehicle, which would make a traditional weekly curbside collection program even more expensive than the pre-treatment method. The cost of the appliance is similar to the cost of purchasing bear-proof collection bins.

## **Next Steps: 2023 Neighborhood Pilot**

The City has secured funding to support a Pre-treated Organics Diversion Program. To verify the results of the preliminary feasibility study, the City is moving forward with a neighbourhood pilot program. With the help of an external waste management consultant, the next step will be to assess the scalability of the program's environmental, economic, technical, and social elements based on a full-scale neighbourhood rollout. The City will receive 1600 appliances by the end of 2022 to distribute in early 2023.

## Introduction

Responding to climate change requires bold, innovative, and whole-of-community solutions. The City of Nelson has some of Canada's most ambitious climate action targets. To achieve a 75% reduction in community GHG emissions by 2030, as outlined in our Nelson Next Climate Plan, implementing a city-wide pre-treated organics diversion program goes beyond business as usual to reimagine how we divert household food waste. Organics diversion is a high-impact strategy to reduce methane emissions generated by food waste in landfills, which have a warming potential 25 times greater than carbon dioxide.

## Background

In December 2020, City of Nelson adopted a comprehensive climate change action plan entitled Nelson Next. This Plan builds on Nelson's strong foundation of environmental leadership, offering a range of evidence-based and community-grounded strategies and tactics that will reduce greenhouse gas emissions (mitigation) and vulnerability to climate change impacts (adaptation). A key priority tactic within Nelson Next is to "deliver a city-wide, cost-effective, organics diversion program."

Currently, the City of Nelson does not run an organics diversion program. With the exception of backyard composting, all household food waste is sent to landfill. Waste is the third-largest emissions source in Nelson, following buildings and transportation.

In April 2019, Council was presented with the RDCK's Organics Waste Diversion Strategy, which focused on curbside organics collection. The RD requested that the City partner with them to implement the strategy. On May 6, 2019, Council passed a resolution to partner with the RD subject to several conditions. At the same time, conversations at the Council table involved the consideration of alternative options for organics diversion. To determine whether pre-treatment might serve as a viable alternative to curbside organics collection, the City facilitated a pre-treated organics Pilot Program. The pilots' results were outstanding, this included high diversion rates and excellent reviews from participants that ranged from satisfaction with the appliance to the ease of household waste management perspective. After considering the pilot results, Council led to a unanimous vote from to move forward with a pre-treated model in the community.

The City of Nelson will be the first municipality in Canada to implement a pre-treatment program at this scale. Participants will be provided with an in-home appliance to mash and dehydrate food waste. This process is referred to as 'pre-treatment' and substantially reduces the weight and volume of food waste and will utilize drop-off locations to further emissions reductions. Pre-treatment transforms food waste into a dry and odourless soil amendment that can be used to enhance backyard gardens or collected at drop-off locations throughout the community. Soil amendment deposited at the drop-off location will be brought to the regional Central Compost Facility to mature where it then be distributed and sold as Class A compost. The program will include a robust educational component on reducing food waste and how to use the pre-treatment appliances effectively and access program details.

The City will continue to work with the RDCK and consultants as they establish protocols for integrating the soil amendment into the wet organic material from other municipalities at the Central Compost

Facility – which will yield Class A compost. This will provide valuable data to support the over 40 Canadian municipalities that have begun piloting pre-treatment technology and may opt to send the pre-treated soil amendment to a central facility. The methods, techniques, and lessons learned will be shared to support those who adopt a pre-treatment program.

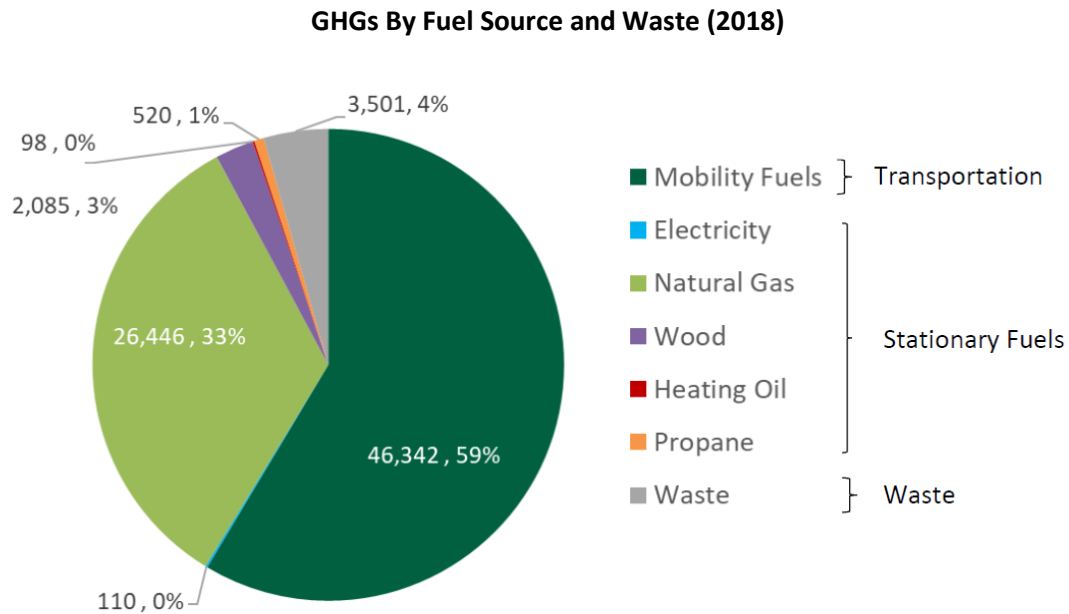
## Greenhouse Gas Emissions Reductions

Greenhouse gas emissions reductions from transportation and methane are key strategies for reducing the municipality’s impact on the natural environment. The following greenhouse gas reduction estimations are based on preliminary analysis only – the City will assess the scalability of the emissions reduction alongside the 2023 neighbourhood pilot. Note that actual emissions reductions will also be reflected in the regular community emissions profile captured by the City every two years.

### Emissions Profile

The emissions reductions achievable through the pre-treated organics program are substantial and will support Nelson in reaching our climate action targets. Baseline information is sourced from Nelson’s Community Energy and Emissions Inventory Report, prepared by the Community Energy Association and published in June 2020<sup>1</sup>.

The CEEI was compiled according to the 2005 IPCC Guidelines for National GHG Inventories. Using supplementary data sources alongside data provided by the Province allows for a much more accurate snapshot of community emissions.



In 2018, Nelson’s community emissions totalled 79,102 tons of CO2e(carbon dioxide equivalent), with waste accounting for 4% or 3,501 tons of community CO2e. Waste is the third largest emissions source, following buildings and transportation. Actual waste generated by residential and non-account businesses was 3,270 tons in 2018, with the remaining 48% of waste from ICI sources. Under a business-

<sup>1</sup> <http://www.nelson.ca/DocumentCenter/View/4920/Nelson-Next>

as-usual scenario, Nelson would produce 22,890 tons of CO<sub>2</sub>e from waste with no interventions over the next seven years. Projected emissions reductions were informed by using the following criteria:

### **Transportation Emissions**

The distance between the City of Nelson and the organic waste facility currently under construction in Salmo, BC, is ~101km return. By reducing the weight and volume of household food waste through pre-treatment, the City can significantly reduce the number of pickups per year. Compared to a weekly curbside collection service requiring 52 trips per year, the pre-treatment program will prevent a substantial amount of diesel fuel emissions from hauling. If the soil amendment were collected at curbside, it would need approximately 8 collections per year based on our volume estimates for a city wide program. There are many co-benefits of reducing transportation, including improved air quality, reduced noise, and decreased traffic.

Transportation emissions were calculated using the Cross Sector GHG Emissions Calculation Tool provided by the Greenhouse Gas Protocol for estimating transportation emissions. Input parameters included activity amount (101km/trip), fuel source (Diesel Fuel), and vehicle type (medium and heavy-duty vehicle). The emissions factor is estimated at 10.22 KG/CO<sub>2</sub>e per km. There is transportation emissions associated with collections from the curbside to the transfer station as well as from the transfer station to the central compost facility.

### **Food Waste Emissions Factor**

The emissions factor for landfilled food waste was calculated at 1,947 KGCO<sub>2</sub>e per ton of food waste. This figure is provided by the EPA WARM model and used by Environment and Climate Change Canada.

### **Embodied Emissions for Pre-Treatment Appliances**

The embodied emissions for the pre-treatment appliances were determined using a GREET methodology prepared for FoodCycler Sciences by the BLOOM Institute in Ontario. The estimation includes the appliance and three filters per year and amounts to 24.17 KG/CO<sub>2</sub>e yearly based on a 7-year lifespan. The emissions from the appliance are not significant in comparison to the whole project's emissions. The program could expect greater emissions reductions due to the elaborate local repair program, which will extend the lifespan of the appliance.

### **Expected Emissions Reductions**

To estimate expected emissions reductions, we have conducted a sensitivity analysis based on high and low percentages of household organics waste with scenarios for 25%, 35%, and 45% of organics in the residential waste stream. Based on the pilot data, we expect household waste to align more closely with higher percentage estimates. However, we have conducted this analysis to present a conservative estimate of GHG reduction potential. Estimations range from 875 tons of CO<sub>2</sub>e abated per year at 25% of organics, and 1,597 tons of CO<sub>2</sub>e abated per year at 45% of total waste.

## Pilot Initiatives Divert More than Weekly Curbside

The greenhouse gas reduction estimations are informed by two preceding Pilot initiatives that investigated the viability of a community-wide pre-treated organics program.

The first pilot consisted of 151 households these participants expressed an interest in the program, while the second was conducted via 31 randomized households, and candidates were requested to participate in the pilot. The second pilot was conducted to collect unbiased opinions. The results of these pilots have been outstanding, with residents rating the solution at 4.5/5 stars and 99% of participants recommending the program to others.

Both pilots consisted of an intake survey where participants committed to monitoring their waste during the trial. After acceptance, residents purchased a FoodCycler pre-treatment appliance from customer service representative at City Hall. Participants recorded their usage for seven days of each trial month for three months. Upon completion of the pilot, residents filled out an exit survey and received a rebate to offset the cost of the unit.

The average annual food waste diversion rate in Pilot 1 and 2 was significantly higher than the benchmark rate for traditional curbside organics of 120KG/hh/year estimated by consultants working with the RDCK. The significant out-performance is likely due to the ease of use of the pre-treatment technology, effective educational component, and elimination of common barriers to food waste diversion such as odours, proximity to collection bins, and pest and wildlife attraction. It is possible that this higher diversion rate was recorded due to more precise measurements at the household level. A robust education and outreach program was delivered to pilot project participants which also could be responsible for the high level of participation.

Because City collection was forthcoming at the time of the pilots, participants used a majority of the soil amendment on-site through gardening applications. A collection bin was sited near the Recycling Centre adjacent to the City's Public Works Department for residents to deposit the soil amendment, which has been composted on site and used to enrich city greenspaces. This demonstrated the feasibility of a circular process for organics diversion within a population subsection. The next phase of the pilot will include an expanded collection service to the RDCK central organics compost facility, where pre-treated soil amendment will undergo aerobic digestion.

The City continues to check in regularly with the pilot project participants to ensure that satisfaction with the appliances and continued use remains very high. Highlights from the group include a reduced odour of organics in the household, addressing rodent and wildlife concerns, and that after five months, all participants were processing the same amount or more organics with their FoodCycler.

Overwhelmingly positive results from the pilots resulted in a unanimous vote from Council to proceed with this option. The benefits of pre-treatment require further evaluation which will be conducted through the neighborhood pilot program with a waste management consultant.

### **Pests and Wildlife**

During the pilots, many residents shared that endangering wildlife and attracting pests is a key concern with household organics collection. Because the end product is dry and odourless, pre-treatment

diminishes attractants for wildlife and pests that can otherwise be problematic in backyard composters and curbside collection of wet organics.

The primary wildlife concern in Nelson is bears, and household food waste is ranked as the third highest attractant for bears by WildSafeBC. Given that animals will return to the site of a food source, measures must be taken to prevent wildlife attraction which is of less concern under a pre-treatment model. Note that WildSafeBC does not recommend backyard composting for this reason<sup>2</sup>.

## Weekly Curbside Model vs. Pre-treatment

The most common approach to diverting waste from landfill is weekly curbside collection of wet organic waste. This may be more suitable for urban centers; however, many rural communities need more support given the high capital cost of constructing waste facilities and the long distance that food waste must typically travel to reach central diversion hubs.

Based on the preliminary analysis conducted from the pilot project results, the Pre-treated Organics Diversion Program is more cost-effective than a traditional weekly curbside model. Collection costs are based on the cost of residential garbage collection and may change as the City explores a local drop-off option for the pre-treated soil amendment. Note that initial cost estimations did not include the cost of purchasing a new hauling vehicle required for the City to pursue a weekly wet curbside organics program or the cost of purchasing bear-proof bins. These are some additional reasons the household pre-treatment method was more attractive for the municipality.

The table below summarizes key criteria used to estimate program effectiveness vs. a weekly curbside service.

	<b>Weekly Curbside Collection</b>	<b>Household Pre-Treatment</b>
Collection Cost	\$416,000	\$88,000
Total Households Served	3,854	5,516 (includes multi-family) *
Annual Collections	52	8
Annual Organics Volume	120 KG/hh/year (Maura Walker and Associates Consultancy)	382.50 KG/hh/year * (Average Pilot Data)
Transportation Emissions	53,675 kg Co2e/year	1,032.2 kg Co2e/year
Estimated Emissions Reductions	957 tonnes Co2e/year	1,597 tonnes Co2e/year
Participation Rate	Estimated 80% (Based on Maura Walker and Associates)	Estimated at 85% (Based on Pilot Data).

*\*The City is currently exploring how to best include multifamily in the organic's diversion program.*

*\*\*The City expects to see lower quantities of diverted organics once a larger neighborhood pilot is undertaken.*

<sup>2</sup> <https://www.nelson.ca/DocumentCenter/View/691/On-Site-Composting-Review-for-Commercial-and-Institutional-Sites---May-10-2015-PDF>

To date, the City has secured ~\$700,000 in funding to support a residential pre-treated organics diversion program. The initial estimations included in the feasibility study related to the program's cost and environmental benefits are very likely to evolve during program development.

## Social Procurement & Appliance Lifecycle

If not appropriately managed, the repair and end-of-life disposal of the pre-treatment appliances would undermine the environmental benefits of the pre-treated organics program. This has been accounted for by integrating sustainability criteria into the public purchasing (or RFP) evaluation criteria. The City will also work with the successful bidder to ensure appliances are fully recyclable upon end-of-life. The City will use a post-consumer-responsibility agreement where the provider takes back appliances to ensure circularity within their lifecycle.

The City will also ensure a comprehensive and easily accessible repair program for residents. The City may partner with local suppliers to ensure repairs are done locally and increase the lifespan of the appliances.

## Program Evaluation

The City will monitor the overall impacts of the neighbourhood pilot to assess whether a further reduction in garbage collections and even greater GHG emissions savings could be achieved. Program performance will be assessed primarily through the following: change in volume of residential garbage from the City of Nelson's curbside collection, change in the number of garbage bag tags sold per year per household, the volume of pre-treated organics collected, recovery rate, resident feedback, and audit results. These measures will be used to track emissions reductions over time, as well as to improve program delivery and maximize diversion.

## Conclusion

To verify the results of the preliminary feasibility study, the City is moving forward with a neighbourhood pilot program. With the help of an external waste management consultant, the next step will be to assess the scalability of the program's environmental, economic, technical and social elements based on a full-scale neighbourhood rollout.

We believe that this new approach to diverting organic waste from landfill will lay the foundation for others to learn from our rollout, support our community to reduce greenhouse gas emissions, and transition to a low-carbon and resilient future.

