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**TO:** Solid Waste Management Select Committee      **MEETING:** July 5, 2018

**FROM:** Vivian Schau      **FILE:** 5370-01  
Zero Waste Coordinator

**SUBJECT:** Preliminary Evaluation of Solid Waste Curbside Collection Options

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## **RECOMMENDATION**

1. That staff be directed to report back on a recommended service option and implementation plan for the following solid waste curbside collection options:
2. That glass collection at curbside be excluded from further consideration.
3. That semi-automated collection service be excluded from further consideration.
4. That staff be directed to conduct a public consultation and evaluation of the service options.

## **SUMMARY**

The current solid waste and recycling curbside contract with Waste Connections of Canada (Waste Connections) is set to expire on March 31, 2020. Given the timeline required for equipment acquisition by any service provider, a *Request for Proposal* for a replacement service should be issued by November 2018. This preliminary report details the service delivery options for the future Regional District of Nanaimo (RDN) curbside collection program.

## **BACKGROUND**

### *Background and Purpose*

The initial 5 year solid waste and recycling curbside contract with Waste Connections was extended for an additional 5 years and will expire on March 31, 2020. The current manual curbside collection has served the region well; however, as the region continues to grow, it is prudent for the region to explore alternate curbside collection options and costs of each delivery model, along with their respective strengths and weaknesses, as well as benefits to the community.

### *Scope of the Evaluation*

The scope of the evaluation is based on the following assumptions:

- Three waste stream collection (garbage, recycling, and food waste) will continue to service approximately 29,000 single family households within the RDN:
  - RDN Electoral Areas A, B, C, E, F, G & H;
  - City of Parksville;
  - District of Lantzville;
  - Town of Qualicum Beach;
  - ❖ Note: The City of Nanaimo operates its own automated curbside collection program;
- The desire to further drive waste diversion to 90% and a per capita disposal rate of 109 kg/year by 2027 consistent with the proposed Solid Waste Management Plan;
- The RDN will to continue to contract with Recycle BC for the collection of recyclables as the most efficient service to the community;
- Consideration should be given to yard waste as part of the curbside collection program; and
- The exclusion of glass as part of the curbside collection program due to the limited diversion impact and contamination concerns to the other recycling streams. The staff report presented to the Regional Solid Waste Advisory Committee projected the cost of a household glass collection program to be \$190,000/year (or an additional \$7/household/year) to achieve an increase of 2.6% overall diversion in the region<sup>1</sup>.

### Collection Truck Types

The 3 types of curbside collection for consideration are detailed below, along with their respective strengths and weaknesses. A summary of benefits and disadvantages, along with images of all three curbside collection options can be found in Appendix A.

#### 1) Manual – status quo

The RDN currently contracts for a service that uses manual collection trucks, generally operated by a 1 person crew who drives, and manually lifts the containers from the ground to the truck hopper to tip the waste into the truck. Occasionally, an additional person is provided to drivers on a return to work program to assist in the retrieval and emptying of the container contents. There are two loading component configurations, rear loading and side loading, the latter being the more ergonomic as the lift height is lower, which is preferable from an operation and safety perspective.

Residents are responsible for the purchase and maintenance of their blue box, and garbage containers (required to meet the volume and weight specifications) and “Beyond Composting” green containers. Yellow recycling bag for newsprint and other household papers are provided free of charge from municipal offices or directly from Waste Connections.

#### 2) Fully Automated

Automated collection trucks consist of an articulated arm used to retrieve standardized carts, generally operated by a 1 person crew who remains in the cab at all times. Fully automated systems are effective in areas with good access to carts such as laneways,

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<sup>1</sup> Jeff Ainge (RDN Staff Report), “Curbside Collection Program – Household Glass Collection”, October 14, 2015

and households with driveways, in order to allow sufficient access for the driver to reach the carts, free of any obstacles (i.e. parked cars, poles).

The main advantage of this method of curbside collection is the reduction of injuries related to the repetitive heavy lifting, walking to retrieve containers, and the frequent ins and outs of the collection truck. Generally, increases in operational efficiency are greater in high density neighborhoods but are reduced in rural areas where the travel distance between households are significantly longer. Automated collection with standardized carts equipped with Radio Frequency Identification (RFID) technology provides better coordination, and real-time tracking to streamline customer inquiries, complaints, and compliance issues.

Costs of an automated collection equipment are higher than manual collection due to: the added expense of the articulating arm and its associated maintenance costs; and initial investment in the standardized carts. It is common practice for local governments to supply the carts which remain with the property rather than the homeowner.

### 3) Semi-Automated

The semi-automated collection system offers the some benefits of both manual and full automation as it takes advantage of the health and safety components of automation by eliminating the need to manually lift containers. This system requires the driver to exit the truck cab to manually move and align the standardize carts to the automated arm (configured either on the side or the rear of the collection truck), to unload the container contents into the hopper. The use of standardized carts is required to ensure compatibility with the collection truck's automated lift.

Semi automation is deemed to be slowest of the three options presented due to the time to enter and exit the cab to retrieve carts, and the relatively slow cycle time of the mechanical arm. System costs are similar for both semi-automated and full automation. Furthermore, entry and exit from the cab remains a common source of injury amongst garbage collection workers.

Based on the preliminary findings of this report, it is recommended that semi-automated collection not be given further consideration.

### Current Collection Systems

The RDN residential curbside garbage, recycling and organics collection program is a compulsory service set up under Local Service Establishment Bylaw No. 793, fully funded by user fees and not augmented by taxation. The current curbside collection service program details are as follows:

- Collection services provided by Waste Connections, under contract to the RDN to approximately 29,000 residential households in all electoral areas, City of Parksville, District of Lantzville, and the Town of Qualicum, 5 days each week (Monday to Friday).
  - Food waste collected weekly
  - Garbage and recycling collected on alternating weeks

- Multifamily dwellings and ICI buildings are not serviced under the RDN contract and are required to make their own refuse removal service arrangements.
- Basic service allows for one standard-size 100 litre garbage can or bag to be collected once every two weeks with a maximum weight of 50 lbs or 23 kgs. Tags for extra containers of garbage may be purchased for \$3 each. A maximum of two additional containers may be put out on scheduled collection days, if a garbage tag is attached to each additional container. Between 2016 and 2017, The RDN sold an average of 14,868 garbage tags per year, equating to 0.5 extra bag tag per household per year.
- The garbage is collected and sent to either the Church Road Transfer Station to be transferred to the Regional Landfill, or directly to the Regional Landfill located approximately 5 km south of downtown Nanaimo.
- Organic food waste is sent to Nanaimo Organic Waste (NOW), the only food waste processing facility in the RDN, where the material is processed in a drum-style in-vessel composting facility and the end product is blended in soil mixes.
- The recycling material collected is collected and sent to the Waste Connections material recovery facility for processing.
- As per Bylaw No. 1591, the user fee for garbage, food waste and recyclable collection is \$144.69 (10% prompt pay discount if paid prior to due date).
- Containers for all waste streams are the responsibility of the residents as per Bylaw No. 1591 with the following requirements:
  - Maximum garbage of 100 litre capacity or 50 pounds gross weight and “tie, or otherwise seal, to prevent spillage or entry of water, any plastic bags placed for collection<sup>2</sup>”;
  - Unlimited quantities of recycling to a maximum of 100 litre capacity or 50 pounds gross weight per container and “tie, or otherwise seal, to prevent spillage or entry of water, any plastic bags placed for collection<sup>3</sup>”;
  - Maximum food waste of 42 litre capacity in RDN approved “Beyond Composting” green bin with the animal proof latch secured.

There are a number of issues identified with the current contract that will be addressed through the upcoming procurement process as summarized below:

1. Revise Bylaw 1591 to specify the use of rigid containers with lids to address safety hazards associated with bags and litter concerns as a result of material being tipped/blown over or wildlife intrusions.
2. Consistent enforcement of weight and number of containers (without extra bag tags) set out by residents.
3. Consistent enforcement of tagging contaminated material.

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<sup>2</sup> [www.rdn.bc.ca/dms/documents/rdn-bylaws/solid-waste/bylaw\\_1591\\_-\\_collection\\_of\\_garbage\\_food\\_waste\\_and\\_recyclable\\_materials.pdf](http://www.rdn.bc.ca/dms/documents/rdn-bylaws/solid-waste/bylaw_1591_-_collection_of_garbage_food_waste_and_recyclable_materials.pdf)

<sup>3</sup> [www.rdn.bc.ca/dms/documents/rdn-bylaws/solid-waste/bylaw\\_1591\\_-\\_collection\\_of\\_garbage\\_food\\_waste\\_and\\_recyclable\\_materials.pdf](http://www.rdn.bc.ca/dms/documents/rdn-bylaws/solid-waste/bylaw_1591_-_collection_of_garbage_food_waste_and_recyclable_materials.pdf)

4. Improve current identification of secondary suites for collection drivers.
5. Improve current customer complaint/validation process.
6. Develop a method to identify residences currently receiving service but are not registered with the RDN for curbside collection (not paying a utility fee).

### Safety Analysis

The current manual garbage collection process is very labour intensive; the collection crew lifts on average 12,000 lbs (5.4 tonnes) per worker per garbage and food waste collection day. The primary sources of injury stems from repetitive motion injuries, slips and trips, and exposure to sharp objects and infectious diseases.

As per the General Conditions in Part 4 of the Occupational Health and Safety Regulation under the authority of the Workers Compensation Act, it stipulates that the employer shall “eliminate or, if that is not practicable, minimize the risk of musculoskeletal injury to workers”<sup>4</sup>. In the past decade, the industry has and is continuing to shift from manual to automated collection, influenced by WorkSafe BC injury claim records for the garbage and recycling industry<sup>5</sup>.

A reduction or elimination of manual lifting through the use of full automation will see the greatest benefit from an injury reduction perspective, decreasing compensation costs, disability claims and work accommodations, which are all factored into the collection contract service pricing.

As a minimum for the future solid waste curbside collection contract, the RDN should limit the variability of containers handled by the collection crews and have a greater emphasis on the enforcement of maximum weights for any manual collection to minimize worker injury.

### Operational Efficiencies

Communities with optimized fully automated waste collection systems, such as Vancouver, Surrey and Toronto, have realized upwards of 30% productivity efficiency in large part due to the reduced variability in the collection containers and the elimination of manual involvement in the retrieval of collection containers, which translates to more pickups in the same timeframe and therefore, the waste contractor can cover the same geographical area/ route with few drivers. The efficiencies gained are largely attributed to optimized routing.

Based on a recent time and motion study of automated garbage/organic waste collection service with City of Nanaimo staff, the collection times in high density suburban areas averaged at 30 seconds per household. Operational efficiencies realized in higher density neighborhood are attributed to the elimination of the need for the collection staff to get in and out of the cab, and manually retrieve and tip the container contents. In the RDN, the length of time required to service each household with manual collection, averages at 37 seconds for suburban areas and considerably longer for more rural areas with longer travels times between residences. Neighbourhood densities vary quite widely in the RDN between the electoral areas and the member municipalities, the efficiency gains are diminished in rural areas.

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<sup>4</sup> [www.bclaws.ca/civix/document/id/lc/statreg/296\\_97\\_02](http://www.bclaws.ca/civix/document/id/lc/statreg/296_97_02)

<sup>5</sup> [www.worksafebc.com/-/media/WorksafeBC/Classifications/2018/2018\\_732018](http://www.worksafebc.com/-/media/WorksafeBC/Classifications/2018/2018_732018)

### Operational Monitoring

The use of RFID tags provide tracking based on the position and status of the carts upon pickup and its subsequent path for final disposal. This value-added administrative component provides the waste collection team with real time monitoring and communication, including but not limited to:

- Route optimization;
- Detailed records for each touch point by container for active accounts;
- Activation of accounts not previously registered in the system;
- Container status (requires replacement/ repair);
- Equipment status;
- Contamination records for noncompliant containers;
- Refused pickup records (blocked containers, open lids, access issues); and
- Automated contamination/refused pickup exception feedback for residents to be used as targeted education.

### Collection Containers and Diversion Implications

If the Board chooses to proceed with either the semi or fully automated option, RDN residents will be required to use standardized wheeled carts to ensure compatibility with the mechanized lifting arm. Based on discussions with a number of municipalities across the BC region with semi or full automation garbage collection service, it is industry practice for regional district/ municipalities to purchase the carts for residents use and they remain the property of the regional district/municipality. The carts are registered to each property receiving collection services rather than the property owner – if the owner moves, the carts remain with the property as they are assigned to the civic address. Alternatively, the option to have the collection contractor own and maintain the carts should also be considered.

The carts are available in various sizes to best suit the RDN's Solid Waste Management Plan diversion goals, and the use of the carts aligns with the user pay model that the RDN currently employs to fund the curbside collection program. In almost all municipalities where there are standardized carts, residents are offered different size garbage carts ranging from 80L to 360L. The RDN's Bylaw currently sets the maximum garbage container size at 100L which has aided with achieving high levels of residential curbside waste diversion. The RDN does not limit the amount of recycling that can be put out which is commonly set out in multiple containers including cans, blue boxes and yellow bags. Communities with standardized containers for automated collection commonly provide 240L or 360L size recycling carts.

The pricing of containers varies widely depending on the quality, warranty coverage, sizing, volume discounts, and timing, as resin cost is impacted by oil prices which is susceptible to pricing volatility. Based on the expected warranties from container suppliers which ranged between 10 – 12 years, the annualized cost for the RDN/contractor to provide collection containers per household is estimated at approximately \$20 per year over the life of the contract. A summary of the container and cost comparison is detailed below in Table 1.

Table 1. Container and Cart Size Comparison

Container Size (Gallons)	Container Size (Liters)	Current 100 Liter Can Equivalent	Estimated Unit Pricing (based on 20,000 volume discount)
21	79	0.8	\$ 45.00
32	121	1.2	\$ 45.00
64	242	2.4	\$ 55.00
96	363	3.6	\$ 66.00
<b>Options</b>			
RFID labels			\$ 1.00
Locking Latch for Green Bins			\$ 20.00
Hot Stamping – RDN logo			\$ 1.00
Hot Stamping – Directional Arrows			\$ 0.30
Hot Stamping – "Garbage Only"			\$ 0.30
Hot Stamping – "Recycling Only"			\$ 0.30
Hot Stamping – "Organic Waste Only"			\$ 0.30
Hot Stamping – "Organic Waste Only"			\$ 0.30
Hot Stamping – "Organic Waste Only"			\$ 0.30
Colorful in mold design on top of lid to describe what goes where			\$ 1.50
Cart assembly and delivery to specified addresses			\$ 6.00
<b>Estimated Total Cost per Household for 3 Containers (garbage, recycling and food waste)</b>			<b>\$ 187.30</b>

With the exception of the District of Oak Bay and the Town of Lake Cowichan where the residents purchase or pay a rental fee for the carts, all other municipalities listed in Appendix B supplied the carts to the residents for use and the carts remain with the property. It is important to note, the treatment of the cost of carts varies between municipalities and therefore, do not reflect the true cost of the total curbside collection program. For example, the City of Coquitlam supplies their residents with carts purchased through a capital contract with an annualized cost of \$28 per residence, which is not included in the annual curbside collection charge to the residents. Similarly with the City of Port Moody, the cost of the carts was not included in the \$360 annual charge.

The RDN Solid Waste Management Plan promotes Zero Waste and also includes the objective of user-pay. Collection carts size selection can incent residents to recycle their waste to reduce as much residual waste as possible. For example, default container size of 80 litre garbage container, 120 litre green waste container, and 360 litre blue recycling container would encourage diversion. Majority of municipalities permit residents the option to upsize their garbage containers at a higher cost, consistent with user pay. In most municipalities, single family homes with secondary suites are automatically upgraded to the larger containers in effort to reduce the footprint required to service these accounts; however, some municipalities permit single family home with secondary suites the option to downsize to the default size containers for each individual dwelling.

The current program has seen great diversion success since the introduction of the garbage 100 L / 50 lbs limits. With either the semi or full automation options, there are no weight restrictions as manual lifting is no longer required and safety requirements with respect to weight are no longer a consideration.

The current extra bag tag program allows residents to dispose of their extra waste along with their regular manual curbside collection, to a maximum of three total garbage containers per collection. Generally, municipalities with automated collection do not permit the use of extra bags as they are not contained within the standardized carts. It is possible to configure an automated collection truck to allow for manual deposits for extra bags beyond the allowable limits, however, this would defeat the primary safety motivation to restrict the driver in the cab of the truck and impact operational efficiency.

### Contamination

Regional districts/municipalities may see an increase in recycling contamination at the onset of a switch from manual to automated collection, which may be attributed to one or more of the following:

- most regional districts/municipalities offer residents a larger capacity cart (usually 240 L or 360 L) to encourage diversion; however, with an increase in participation/recycling quantity is generally accompanied by an increase in contaminants;
- inconsistent recyclers, or residents who did not previously own a recycling bin now have the convenience of a recycling cart and therefore, are learning to recycle on a regular basis;
- when a large capacity recycling cart is coupled with a smaller capacity garbage cart, residents may use their recycling cart to displace their garbage if their garbage container is full to avoid a trip to the landfill to dispose of their waste appropriately; and
- residents may view their covered carts as an opportunity to hide contaminants.

Nevertheless, contamination in single stream automated curbside collection can be effectively managed by:

- determining the optimal size option pairing for garbage, recycling and green waste to best align with the RDN division goals (majority of municipalities studied opt to provide residents with a default size, along with different sizing options to tailor to their waste generation); and
- implementing diligent education and enforcement efforts.

The City of Nanaimo recently switched to automated service and have reported a negligible change in their contamination (as per Recycle BC reporting) in their first 6 months of operation, primarily due to their effective communication strategy. Since the implementation of the first phase of the roll out, the City of Nanaimo has been very diligent in the use of their monitoring software and subsequent follow up to educate residents regarding their non-compliance. The City of Nanaimo report the monitoring component of the curbside collection program has required increased administrative support to handle calls and enquiries from residents. At the onset of a RDN automated program, this administrative work is estimated to amount to 0.4 FTE but may be scaled back to 0.2 FTE once the program has been fully implemented with minimal offenders.



### Yard and Garden Waste

The inclusion of residential yard and garden waste was considered as an option in the recent Solid Waste Management Plan review<sup>6</sup>. The report indicated a bi-weekly 9 month service (March to November) would cost an estimated additional \$50/household/year, plus \$16,500 in staffing costs (0.2 FTE to administer the collection of a fourth waste stream) to provide collection of yard waste to achieve a 0.3% diversion increase to the overall region's disposed waste.

For the purposes of this report, yard and garden waste refers to organic waste materials generated at residential properties, which includes grass clippings, hedge trimmings, garden and flowerbed wastes. For the manual collection option, collection of yard waste would require the use of compostable bags. Due to the high moisture content and frequent rain events in the region, weight and volume limits, and deterioration of the bags will be problematic. For these reasons, consideration of yard and garden collection is not recommended for the manual collection option.

Past surveys indicate between 40 – 60% of resident support for introducing curbside yard waste collection. Support was slightly higher for respondents in urban areas with City of Parksville at 58% (backyard burning is not permitted) and Town of Qualicum Beach at 48% (backyard burning only permitted between October – April). However, this support drops significantly down to 14% when respondents are aware of the associated costs with the program which has been estimated at an additional \$50 per year to the utility fee based on past studies.

Currently, most residents self-haul their yard and garden wastes to: 1) the Regional Landfill and the Church Road Transfer Station where the material is sent to Nanaimo Organic Waste for composting; 2) a number of private operated sites in the region where it is either composted or used as an industrial fuel; or 3) collected by a private hauling services. It is estimated 12,000 tonnes of yard and garden material is being diverted from landfill disposal annually through self-haul, plus an additional 2,475 tonnes through backyard composting and an undetermined amount through backyard burning and illegal dumping activities.

It is estimated that roughly 80% of yard and garden waste generated in the RDN is currently diverted from the landfill. Therefore, the choice is largely a matter of convenience for residents rather than achieving the region's diversion goal, and it may have an adverse impact on the private hauling and collection businesses.

### Curbside Collection in Comparable Jurisdictions

A review of 12 municipalities/regional districts with curbside collection programs in British Columbia was conducted to get a better understanding of their service delivery approach and the associated costs. As shown in Appendix B, all 12 municipalities/regional districts are automated collection with biweekly recycling (bag/blue box to 360 L cart options) and mostly bi-weekly garbage (80L to 360L cart options) collection. The food and yard waste programs are quite varied between the municipalities. Reasons for not offering this program include a lack of a local processor or residents' unwillingness to pay the additional cost to transport and process the organic material.

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<sup>6</sup> Jeff Ainge (RDN Staff Report), "Curbside Collection Program – Yard Waste Collection", October 13, 2015

The annual curbside cost to residents similar to the current RDN service (for all three streams – garbage, recycling and organics) ranged between \$165 to \$360 per household per year, average at \$218 per household per year. A tabular summary of the cost comparisons of curbside collection service provided by other regional districts/municipalities can be found in Appendix B.

#### Contract Length

Optimal financial benefit is realized where the length of the service contract is aligned with the useful life of equipment. The useful service life of waste collection vehicles is 10 years and should be a significant consideration in moving forward with the future curbside collection service contract.

#### Community Engagement

The solicitation of community feedback is recommended on preferred service options, and the inclusion of yard and garden waste in the future curbside collection contract. This is proposed to be done through a focus group session with community representatives planned for August and a region wide survey planned for September.

#### Other considerations

Communities that have implemented automated collection have reported improvement in general neighbourhood aesthetic through the use of standardized carts to prevent litter/odour issues from wildlife and/or being exposed to the elements. Currently, these instances require administrative time to address, and in some cases, requires funds to conduct the required cleanup.

#### Timeline

The current curbside collection contract with Waste Connections expires on March 31, 2020. The procurement process lead time for the successful vendor to acquire equipment is expected to take approximately 18 months. A recommendation on the type of curbside collection service options to be used in the tender will be provided to the Board by October 2018.**ALTERNATIVES**

1. Direct staff to report back on a recommended service option and implementation plan for the following solid waste curbside collection options:
  - a. Manual garbage collection without yard waste or glass collection.
  - b. Fully automated garbage collection without yard waste or glass collection.
  - c. Fully automated garbage collection with yard waste and without glass collection.
2. Provide alternate direction.

## FINANCIAL IMPLICATIONS

The financial costs and implications will ultimately depend on the model selected.

As shown in Table 2, based on the preliminary findings in preparing this report, high level implications for curbside collection by a private contractor are provided below. Refined estimates will be included in the recommendation report in October 2018

- Option 1: Replace with a manual system with garbage, recycling and food waste only (status quo) is estimated at \$166/household/year (15% increase) to offset the cost of new equipment purchase
- Option 2: Replace with a fully automated system with garbage, recycling and food waste only is estimated at \$208/household/year (30% increase) to offset the cost of new equipment and cart purchase
- Option 3: Replace with a fully automated system with garbage, recycling, food and yard waste is estimated at \$256/household/year (63% increase) to offset the cost of new and cart equipment purchase

Table 2. Preliminary cost comparison for manual full automation curbside collection program

Collection Stream		Option 1	Option 2	Option 3
	Current Contract	Manual Collection	Automated without Yard Waste	Automated With Yard Waste
Garbage	Yes	Yes	Yes	Yes
Recycling	Yes	Yes	Yes	Yes
Food Waste	Yes	Yes	Yes	Yes
Yard Waste	No	No	No	Yes
Estimated Annual Utility Fee	\$ 145	\$ 166	\$ 188	\$ 236
Annualized Cart Cost	\$ -	\$ -	\$ 20	\$ 20
Total Estimated Annual Utility Fee	\$ 145	\$ 166	\$ 208	\$ 256
Cost Differential	\$ -	\$ 22	\$ 63	\$ 112
% Increase in Utility Fee	-	15%	30%	63%

The solid waste curbside collection program reserve was originally setup with the intention to meet future financial obligations as it pertains to the next curbside agreement and/or system, specifically to offset a portion of the capital cost associated with the program. There is currently approximately \$340,000 in the reserve, with an estimated total of \$140,000 to be added as part of the 5 year plan. These funds will be factored into the cost calculations in the October 2018 service option recommendation report.

## STRATEGIC PLAN IMPLICATIONS

The RDN's Strategic Priorities formed the basis of the goals of the curbside collection evaluation. Consistent with the "*focus on organizational excellence and services*" as set out in the Strategic Plan. The anticipated increase in diversion of solid waste and recycling are aligned with the diversion goals as defined in the SWMP.

The projected operational and cost efficiencies of an automated collection system speaks to the "*focus on the environment*" initiatives by optimizing the routes to reduce the overall collection vehicles on the road, and thereby minimizing the greenhouse emissions.



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June 21, 2018

Reviewed by:

- L. Gardner, Manager, Solid Waste Services
- R. Alexander, General Manager, Regional and Community Utilities and Solid Waste
- P. Carlyle, Chief Administrative Officer

## Appendix A

Method of Collection	Decision Criteria	Benefits	Disadvantages
Manual	Staffing	1) One person crew size (plus a swamper on occasion)	1) High turnover due to the nature of the job 2) Concerns for the long term ability of staff to perform the function of these roles
	Absenteeism		1) Potentially an issue
	Safety		1) Physically demanding - heavy, repetitive, manual lifting (Collection crews currently lift upwards of 10,000 lbs per worker per day) 2) Required to leave the cab to collect and tip waste containers
	Containers	1) Residents responsible for the purchase and maintenance of their own containers	1) Difficult to enforce container size, weight limits 2) Difficult for the collection crew to handle non rigid container, and exposes them to safety hazards (i.e. needles/sharps) 3) Current bylaws does not have requirements surrounding the need for enclosed containers with animal resistant lids
	Container Placement	1) Less restrictive as containers are retrieved by hand	
	Diversion Implications	1) Currently set at a 100 L / 50 lb limit (although not consistently enforced)	
	Contamination Implications	1) Collection crew have the ability to review contents for contaminates and tag as necessary	
	Flexibility	1) No prescriptive restrictions	
	Operational Efficiency		1) Inferior compared to full automation
	Cost	1) Generally the lowest cost option	

Method of Collection	Decision Criteria	Benefits	Disadvantages
	<b>Implementation</b>	1) Already in place	
<b>Full Automation</b>	<b>Staffing</b>	1) Crew size of 1 2) Generally remains in a climate controlled cab for the entirety of the shift 3) Potential increase in diversity in workforce 4) Potential staffing reduction as a result of improved operational efficiencies	1) Potentially additional cost to wages due to more specialized skills required to operate an automated collection truck
	<b>Absenteeism</b>	1) Reduced attendance issues	
	<b>Safety</b>	1) Few injuries and worker compensation claims 2) Decrease insurance costs 3) Elimination of worker exposure to sharps and biological/chemical hazards	
	<b>Containers</b>	1) Residents are required to restrict their waste consumptions to the predetermined sizing options to align with the waste diversion goals 2) Residents are supplied for containers for all three streams which encourages diversion efforts, especially for residents who did not previously own recycling and food waste containers 3) All containers will be animal resistant to limit wildlife interactions/ spread of litter	1) all containers must be uniform and consistent in order to realize the full benefits of automation 2) Generally the local government/ municipalities bear the cost of the initial investment (but remain with the property rather than the owner) 3) If extra bags are permitted, additional cost is required to lower the frame on the automated collection truck to allow manual tipping into the truck hopper
	<b>Container Placement</b>		1) Very prescriptive as the collection truck's automated arm required a 1 meter clearance between and beside the carts, and 3 meter clearance above the carts to safely operate 2) Limited flexibility as residents run the risk of pickup refusal if containers are placed incorrectly

Method of Collection	Decision Criteria	Benefits	Disadvantages
	<b>Diversion Implications</b>		1) Depending on the container size provided to residents (to be compatible with the automated arm), it will likely be increased capacity which may result in increase waste generation
	<b>Contamination Implications</b>	1) Automated contamination exception feedback for residents to be used as targeted education	1) Recycle BC has data to show contaminants in single stream, automated systems are generally higher compared to single stream, manual systems 2) The operator is limited to the camera view from the hopper for any contaminants
	<b>Flexibility</b>		1) No flexibility for changes to program without significant capital outlay (i.e. container changes, ability to collect material not placed in carts)
	<b>Operational Efficiency</b>	1) Improved efficiency, particularly in higher density neighborhoods	
	<b>Cost</b>		1) Higher equipment cost 2) Higher maintenance cost to the complexity of the truck
	<b>Implementation</b>		1) Requires substantial communication roll out to prepare residents of the requirements and rationale to get buy in 2) Long lead time required for equipment purchase (at least a year)
<b>Semi Automated</b>	<b>Staffing</b>	1) One person crew for side loading or two person crew for rear loading	1) Collection staff is still required to frequently enter and exit the cab to manually retrieve and align containers for tipping
	<b>Absenteeism</b>	1) Reduced attendance issues	

Method of Collection	Decision Criteria	Benefits	Disadvantages
	<b>Safety</b>	1) Minimize worker exposure to sharp waste, chemical/biological hazards	1) Minimal manual lifting is still required 2) Workers are still required to step on and off the collection trucks (a primary cause of injury) 3) If collecting other materials manually in addition to carts, the increased height of the loading compartments will be problematic
	<b>Containers</b>	1) Residents are required to restrict their waste consumptions to the predetermined sizing options to align with the waste diversion goals 2) Residents are supplied for containers for all three streams which encourages diversion efforts, especially for residents who did not previously own recycling and food waste containers 3) All containers will be animal resistant to limit wildlife interactions/ spread of litter	1) In order to realize the full benefits of automation, containers must be uniform and consistent 2) Generally the local government/ municipalities bear the cost of the initial investment (but remain with the property rather than the owner)
	<b>Container placement</b>		1) Very prescriptive as the collection truck's automated arm required a 1 meter clearance between and beside the carts, and 3 meter clearance above the carts to safely operate 2) Limited flexibility as residents run the risk of pickup refusal if containers are placed incorrectly
	<b>Diversion Implications</b>		1) Depending on the container size provided to residents (to be compatible with the automated arm), it will likely be increased capacity which may result in increase waste generation



Method of Collection	Decision Criteria	Benefits	Disadvantages
	<b>Contamination Implications</b>	1) Automated contamination exception feedback for residents to be used as targeted education	1) Recycle BC has data to show contaminants in single stream, automated systems are generally higher compared to single stream, manual systems 2) The operator is limited to the camera view from the hopper for any contaminants
	<b>Flexibility</b>		1) No flexibility for changes to program without significant capital outlay (i.e. container changes, ability to collect material not placed in carts)
	<b>Operational Efficiency</b>		1) Slower compared to fully automation 2) Slower compared to manual
	<b>Cost</b>		1) Existing rear loading collection trucks may be retrofitted to minimize cost 2) Existing side loading collection trucks cannot be retrofitted and would require new trucks 3) Minor cost differential compared to fully automated trucks
	<b>Implementation</b>		1) Requires substantial communication roll out to prepare residents of the requirements and rationale to get buy in 2) Long lead time required for equipment purchase (at least a year)



*Figure 1. City of Nanaimo fully automated green waste and recycling collection*



*Figure 2. Town of Qualicum Beach manual food waste collection*



*Figure 3. City of Punta Gorda, Florida semi-automated garbage collection*



*Figure 3. Container size reference*

## Appendix B

City/Municipality*	Service Provider	Population (2016 Census)	Collection	Materials Collected by Automation				Annual Cost
				Garbage	Recycling	Food Waste	Yard Waste	
British Columbia								
City of Nanaimo	City Staff	90,504	Automated	120 L biweekly	240 L biweekly	120L weekly		\$ 165.00
Town of Lake Cowichan	City Staff	3,226	Automated	80L biweekly	bag biweekly	80 L weekly	NA	\$ 175.80
Cowichan Valley Regional District	City Staff	83,739	Automated	140 L biweekly	240 L biweekly	NA	NA	\$ 143.67
City of Fernie	City Staff	4,850	Automated	120 L weekly	240 L biweekly	NA	NA	\$ 154.99
City of Victoria	Contractor	85,792	Automated(G/O)/Manual(R)	120 L biweekly	box/bag biweekly	120 L biweekly	NA	\$ 218.13
District of Oak Bay	City Staff	18,094	Automated(G/O)/Manual(R)	140L biweekly	box/bag biweekly	120 L biweekly	NA	\$ 210.00
Town of View Royal	Contacto	10,408	Automated	40 kg weekly	NA	40 kg weekly	NA	\$ 185.00
City of Port Moody	City Staff	33,551	Automated	120 L biweekly	360 L biweekly	120 L weekly		\$ 360.00
City of Port Coquitlam	City Staff	58,612	Automated	240 L biweekly	240 L biweekly	240 L biweekly		\$ 189.36
City of Surrey	Contractor	517,887	Automated	240 L biweekly	240 L biweekly	240 L weekly		\$ 287.00
City of Richmond	Contractor	198,309	Automated	240 L biweekly	240 L weekly	240 L weekly		\$ 274.55
City of Coquitlam	Contractor	139,284	Automated	120 L biweekly	box/bag biweekly	120 L weekly		\$ 244.00
City of Vancouver	City Staff	631,486	Automated(G/O)/Manual(R)	75 - 360 L biweekly	box/bag biweekly	120 - 360 L weekly		\$203 - \$368
City of Penticton	City Staff	33,761	Automated	120 L weekly	240 L biweekly	NA	240 L biweekly	\$ 232.00

\* At this point, it is unknown whether municipalities' costs are supplemented by taxation.