Waste management toolboxes for isolated Northern Québec communities

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WM (WASTE MANAGEMENT) GLOSSARY

Characterization: Detailed and quantified definition of each constituent element of waste.

Composting[1,3]: Method of processing solid waste using micro-organisms that decompose putrescible matter in order to obtain an organic, biologically stable, hygienic and humus-rich soil amendment known as compost.

CDR: Construction, demolition and restoration residue (wood, bricks, cement, etc.).

Diagnosis: Examination and analysis leading to the identification of the cause (origin) of a problem or a situation.

Disposal[3]: Any action aimed at the dumping or final disposal of waste into the environment, in particular by landfilling, storage or incineration and including processing or transferring waste for final disposal.

RM flow: Quantity of waste generated in a given period of time and that is representative of known variation (such as seasonal).

WM: Waste management.

NL (Northern landfill): Site for the final disposal of waste managed in accordance with the *Regulation respecting the landfilling and incineration of waste* (RRLIRM) as it applies to lands north of the 55th parallel and to the municipalities enumerated in section 94 (2) of the Regulation.

OM: Putrescible (rotting) organic matter that can be decomposed by bacteria. OM usually includes edible and green or brown (vegetable residues, leaves, branches, etc.) matter. Manure is also considered as OM but requires special management, as do animal carcasses.

Recyclable materials: Waste whose constituent components can be re-used in manufacturing. These materials may be combustible (plastic, paper, cardboard, etc.) or not (metal, glass, etc.).

RM[3]: Waste; residues from production, transformation or utilization processes; any substance, material, product or furniture that is thrown out or so intended by the owner

WMP: Waste management plan; required for each type of RM. (see EQA: Q 2, r. 35.1—Québec Residual Materials Management Policy).

HHW[1]: Household hazardous waste (batteries, oil, tires, etc.); any solid, liquid or gaseous household residue with the properties of hazardous matter as defined in the *Regulation respecting hazardous materials* (leachable, flammable, toxic, corrosive, explosive, combustive or radioactive) or that is contaminated by such.

Salvager[2]: Company that carries out one or more of the following activities: collection, sorting, storage and/or packaging (bundling, shredding, etc.) of one or more types of waste for reclamation purposes.

Recovery[2]: Method of processing waste that consists of collecting, sorting, storing or packaging garbage for the purpose of reclamation.

Recycling[1]: The use of used materials to replace new materials in manufacturing.

Reduction at source[1]: Action that reduces residue during the manufacturing, distribution and use of a product.

Re-use[1]: Repeated use of a product or packaging without changing its appearance or properties.

RRLIRM: *Regulation respecting the landfilling and incineration of residual materials*

Reclamation[3]: Any activity except for final disposal that is aimed at re-use, recycling, composting or reclamation that obtains useful products or energy from waste.

ELV: End-of-life vehicles

PAZ: priority action zone

Sources of definitions

(1) Québec Action Plan for Residual Materials Management, 1998-2008, Ministère de l'Environnement et de la Faune du Québec, 1998, 60 p.

(2) Service de la gestion des matières résiduelles: Internal administrative definition, Ministère de l'Environnement du Québec, 2001

(3) An Act to amend the Environment Quality Act and other legislation as regards the management of residual materials, SQ 1999, c 75, 25 p.

INTRODUCTION: WASTE MANAGEMENT IS A CONTINUAL IMPROVEMENT PROCESS

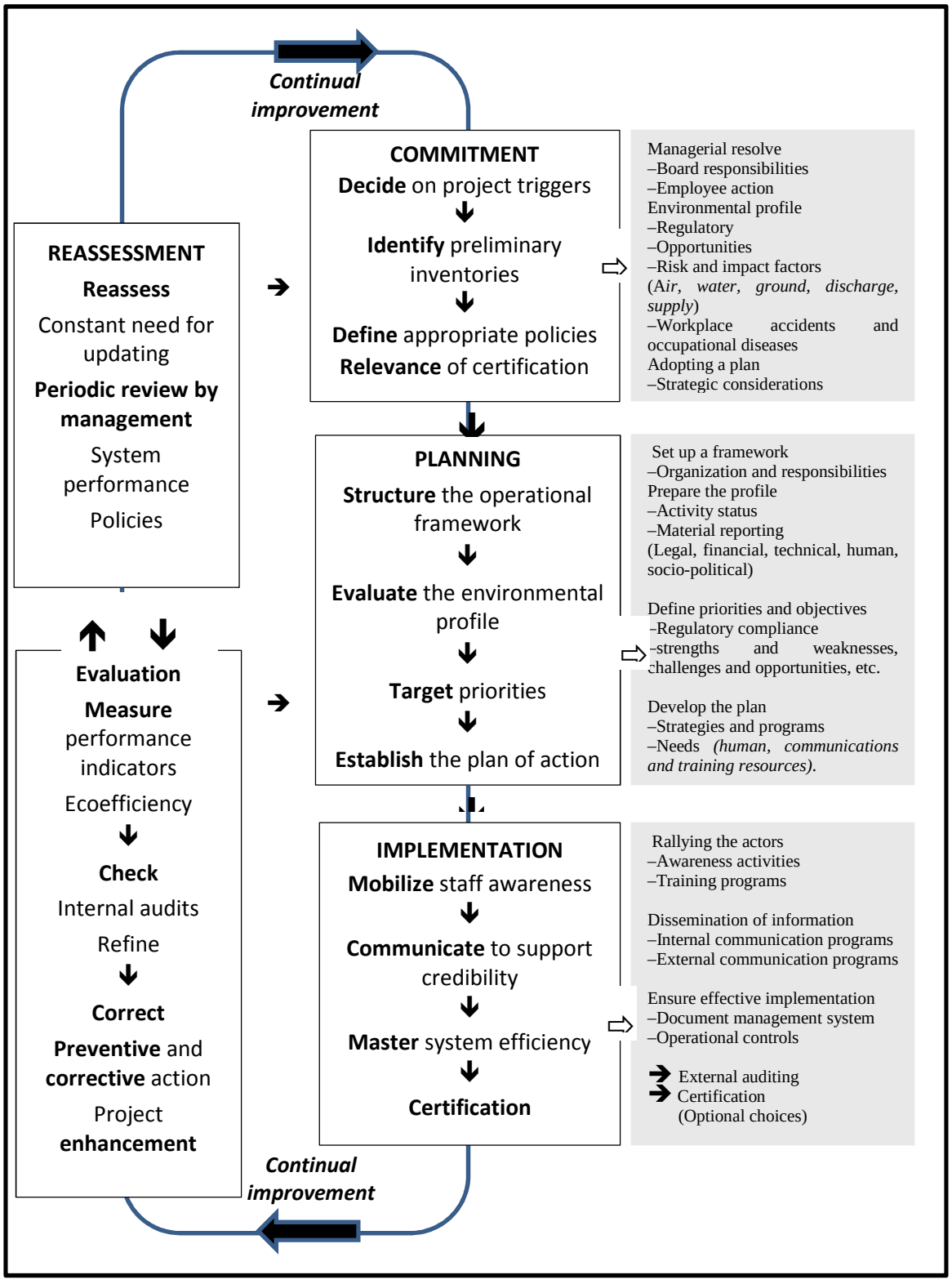
Waste management (WM) in isolated Northern communities involves many challenges, including geographical location, climate conditions, supplies and intake fluctuation, availability of equipment, spatial constraints, cost of transport, and regulations and local culture, to name only a few. Consequently, it is unlikely that workable solutions for Southern Québec can be simply transposed to Northern communities and achieve the same results. Under Action 37 of the *Québec Residual Materials Management Policy — 2011–2015 Action Plan*, the MDDELCC awarded two research contracts to the Chaire en éco-conseil de l'UQAC for improving WM knowledge in Northern and isolated communities and suggesting a set of viable solutions that they can use in accordance with their needs and priorities to improve WM and reduce related environmental, social and economic impacts.

This report is based on the results of research carried out between 2014 and 2017 by the Chair[1]. It is meant for community managers and WM operators, and proposes to consider WM as a continual improvement process or loop (see Figure 1) that starts with political commitment by government authorities, taking note of current status and setting priorities for action**.**

One comprehensive and three thematic toolboxes (organic matter, recyclables, and hazardous and other matter) can be of use in carrying out this continual improvement process while giving consideration to local priorities and community capacity for action.

[1]Chaire en éco-conseil (Villeneuve, C., Dessureault, P.L, Grégoire, V., Côté, H.). Gestion des matières résiduelles en territoire nordique: portrait de la situation. (Residual materials management in the North: overview of the current situation). A study conducted for the MDDELCC. 2014, 157 pp. Available online in French only at: http://www.mddelcc.gouv.qc.ca/matieres/territoire-nordique/GRM-portrait-Nord.pdf (5.8 MB)

Figure 1: The eco-loop or continual improvement process



TOOLBOX #1

A COMPREHENSIVE OVERVIEW OF WASTE MANAGEMENT

1 TOOLS USED IN THE COMPREHENSIVE OVERVIEW OF WASTE MANAGEMENT

Figure 2 shows a decision tree for guiding managers in waste planning, managing or disposal. It takes account of real conditions in Northern communities that are isolated from the road network. This decision tree is generic in nature and shows a process that can start in any of the sections, based on local conditions and problems.

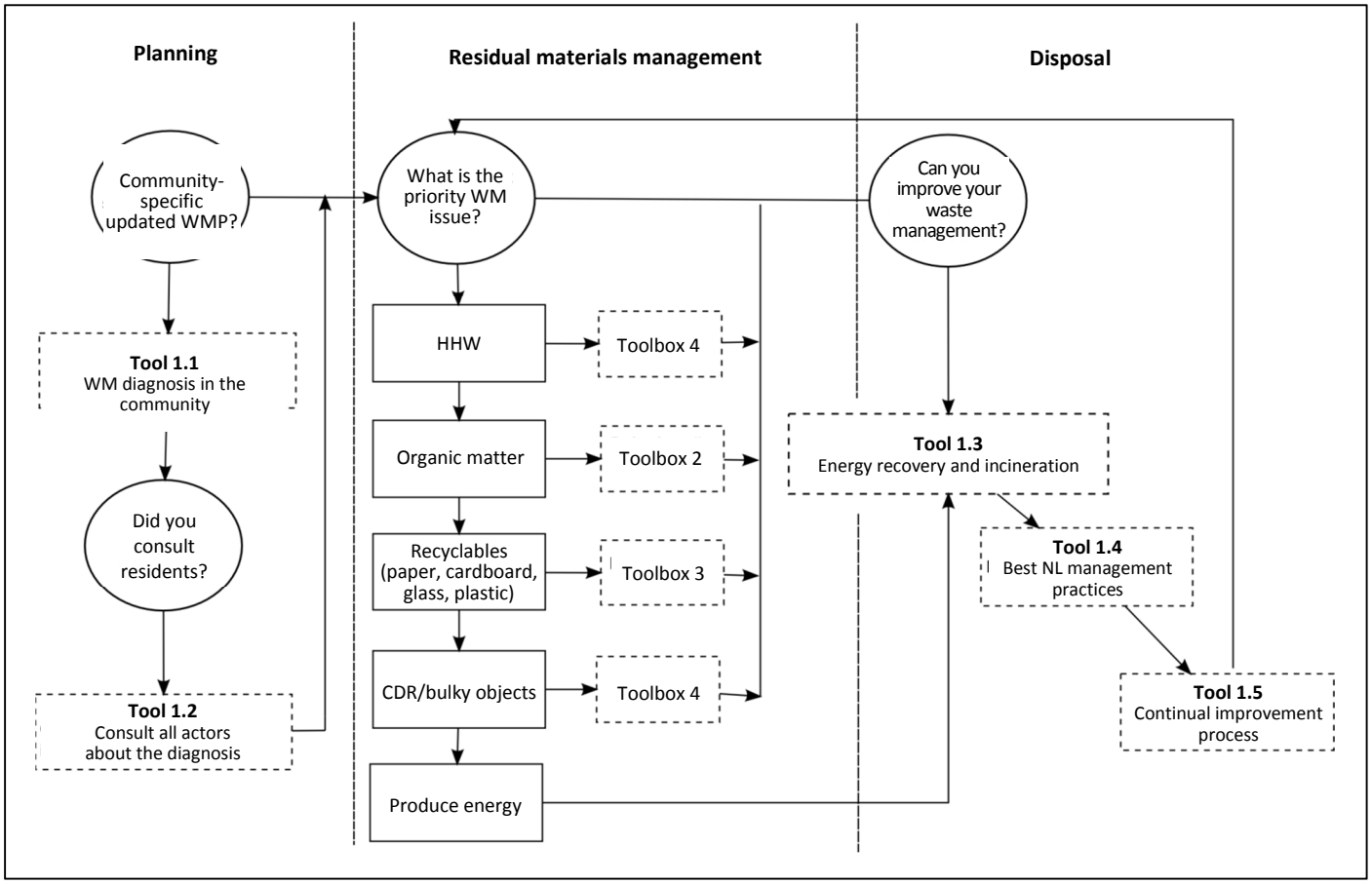


Figure 2: Decision tree — A comprehensive view of waste management for isolated Northern communities.

The decision tree reads as follows:

- From left to right, the decision tree shows tools for reduction at source, recycling and disposal.
- Each circle contains a question and two arrowed output lines to a tool

For example, in the “Planning” column, preparing a community-specific Waste Management Plan involves first conducting an WM diagnostic in the community and consulting residents on the challenges to be tackled by the future WMP (as well as any desired constraints). A characterization of RM flow (quantities generated per season or month) may prove necessary in order to subsequently take informed technology decisions. Both tools (1.1 - WM diagnosis in the community and 1.2 - Consult all actors about the diagnosis) are available in this publication.

If, on the other hand, we look at column three and want to improve an existing Northern landfill (NL), Tool 1.4 provides best practices for NL management. Finally, Continual Improvement Tool 1.5 requires better management of

the steps in column two, which provides management tools for suitable project framework or design, depending on which type of RM will be processed (organic, recyclables, household hazardous waste, construction, demolition and restoration residue, bulky, etc.).

The decision tree should be used in accordance with real local issues.

Example 1: When planning a mining camp or a new facility, it would be more appropriate to start in column one, on the left side of the diagram. If our problem is related Northern landfill (NL) management, for example due to congestion, pests or incineration, the right-hand column would apply. Often, problems encountered in the right-hand column can be resolved by projects that rely on elements located in the centre column that point to the three toolboxes, which are the focus of this guidebook.

Example 2: To resolve a pest problem at a NL, good fencing and incineration practices may be useful, but so can efforts to reduce the quantity of organic matter (ex: food residues) brought to the site. The organic matter management tool box offers a number of different solutions for reduction at source, composting or energy recovery. Of course, all technical, financial and regulatory factors need to be considered in order to decide on the optimal solution, and hence the toolbox. The toolbox technical sheets list these factors.

A more detailed description of the decision tree components

The following paragraphs provide further details on the Figure 2 decision tree components.

Planning stage

The "Planning" stage takes place upstream of WM. It is comprised of questions and tools that become relevant during the design of a waste management system such as for a NL new mining or end-of-life project that involves site size and lifetime decisions. As part of the continual improvement process, it is advisable to review these stages at regular intervals (e.g. every 5 years) for relevance reasons.

Do you have a current WMP that is specific to your community? This plan makes it possible to estimate flow (quantity per period of time) for various types of RM generated on a given territory. An WMP can be general or specific in nature. However, it is important to note that if a regional municipality has access to real data, it must use them in its WMP. On the other hand, it sometimes happens that a general WMP, for example one that a regional county municipality (RCM) uses to evaluate average flow, contains theoretical data based on comparisons with similar cities (rural, recreational, industrial, etc.) with equivalent populations. Whenever a given community has to make choices that necessitate the use of real data, a community-specific WMP is preferable. Community-specific WMPs are based on a diagnosis of the current RM situation (site and expected lifetime, illegal dumping, available equipment, budgets, trained staff, etc.) and, for more precision, may require RM characterization using data taken on site, for example, quantities of each type of residual material (paper/cardboard, metal, etc.) generated by individuals,

businesses and institutions that are representative of their category in the community (see the Community WM diagnosis tool for more details). A specific WMP makes it possible to develop a better understanding of community hotspots, seasonal variations and local challenges, and enables authorities to make informed choices about the right type and capacity of equipment, budget manpower expenses and determine the size and use of storage and processing facilities to optimally meet the community's waste management needs.

Did you consult the population? In project management, community support is vital, as is the involvement of all local WM actors (residents, businesses, institutions, authorities and non-governmental organizations—ONGs). Project development starts with a presentation of the diagnosis of the current situation and a discussion of the anticipated challenges and constraints, potential solutions and how they are connected. For example, the intrusion of wild animals into Northern Landfills (NL) could indicate that separate management of food residues (including organic matter) is necessary. Another example: if RM flows suggest that recycling could be interesting to look at, participation by community residents and businesses may be less strong if they were not consulted and do not understand the usefulness of the efforts asked of them. The simplest solutions—those that are most easily achieved—by the community are often those that enjoy strong public support. We suggest that discussions with the community focus on the following priorities: 1— Management of household hazardous waste such as batteries, oil, tires, etc., due to toxic emissions from combustion; 2— Management of organic matter (food, paper/cardboard, plants, manure, etc.) to reduce the potential for combustion and vermin; 3— Management of residential, institutional, commercial and industrial recyclables, which provide RM flow regularity and require processing as quickly as possible; and finally, 4— Management of construction, restoration and demolition residues and end-of-life vehicles that are more time-specific (ex: seasonality, construction boom, etc.). For more details, see the Consulting all Stakeholders tool. Stakeholder consultations may also help identify problems such as illegal dumping, end-of-life cars, etc., which may require specific projects or be potentially incorporated into WM. Following the initial assessment (diagnosis/characterization + consultations), the WMP can be written simply in the form of a waste management improvement action plan.

Management Phases

This section deals with how to direct priorities to the toolboxes that are specific to the categories of RM to be managed. While reference to the other two toolboxes is not mandatory, it is desirable, since choices will affect them, and as such, a comprehensive view is preferable**.**

1. **Which challenge should be the first WM priority?**

   The order of presentation here is suggested by WM best practices, for reasons enumerated in the text. The Recyc-Québec website (https://www.Recyc-Québec.gouv.qc.ca/) provides further details on the various categories of RM as well as more complete lists, definitions, and documentation.

   - **Household hazardous waste:** HHW (used oil, batteries, end-of-life electronic devices, etc.) and tire management is always a priority because they have the highest toxic potential. They should not be burned at the NL but sent for processing by suitable facilities that are often specified by law or regulation. For more details on action required in this area, see Toolbox 4 (Household Hazardous Waste, Construction, Restoration and Demolition (CRD) Residue, End-of-Life Vehicle (ELV), Tire and Bulky Item Management).

- **Organic matter?** The management of organic matter often follows in the list of priorities because separating this type of waste from other matter at a NL will improve the effectiveness of incineration. Removing organic matter from RM reduces water content and makes combustion more efficient (e.g., less fuel is required for ignition). Toolbox 2 (Organic Waste Management) makes it possible to choose among several possible reduction at source, composting and energy recoveryenergy recovery solutions. In a community that is isolated from the highway network, OM will have to always be managed locally and, if possible, in the following order:

    1. Reduce food waste (the source of edible OM) or manage green residue in better ways to avoid sending it to the NL
    2. Compost OM to take advantage of its fertilization potential
    3. Consider energy recovery as a last resort, since burning OM presupposes ignition problems unless a dryer is used to reduce water content

        - **Recyclables:** Recyclables include combustibles (plastic, paper, cardboard, etc.) as well as non-combustibles such as metal and glass. Managing them by diversion from the NL and recycling makes it possible to reduce the volume of residue processed at the NL and extend the lifetime of the site while reducing toxic atmospheric emissions, which has the added benefit of improving air quality in the community. If you are looking to divert recyclables from your NL, Toolbox # 3: Inventory Management of Recyclables Originating in the Residential, Institutional, Commercial and Industrial Sectors provides workable solutions. Recyclables can be managed locally or sorted and stored until they can be shipped to Southern Québec, based, of course, on type, desired price and carrier or recycler requirements.

        - **Construction, demolition and restoration residue (CDR):** As in the case for recyclables, the aim of construction, restoration and demolition (CDR) residue management is to reduce atmospheric pollution and NL congestion. If you decide to manage these materials locally, you may find Toolbox #4: Household Hazardous Waste, Construction, Restoration and Demolition (CRD) Residues, End-of-Life Vehicle (ELV), Tire and Bulky Item Management useful. When appropriately processed, CDR residue has strong local reuse potential, and, if the area has an ecocentre, can maximize local economic benefits. This type of management is often associated with the repair and re-use of bulky items such as furniture, clothing, computer equipment, household appliances, etc.

NB: Information on matters such as cost, job creation, training, required equipment, etc. can be found in each toolbox.

Disposal Phase

This section helps identify best NL management practices and suggests how to initiate an WM continual improvement process.

2. **NL management best practices:** The first tool that should be used deals with optimal NL management. If all goes well, a second tool suggests how to set up a process of continual improvement.

   a) NL management: Better management of your NL is possible. This involves reducing burn and inventory time and inventorying and sorting waste that is already stored.

   b) **Continual improvement**: WM is a legal compliance requirement for all communities except those in Nunavik. Above and beyond regulatory compliance however, worldwide experience over the last three decades shows that it is feasible to improve the efficiency of the process, significantly decrease the quantities of disposed waste and generate positive economic, educational and social benefits for communities. As such, it is worthwhile to regularly revisit methods and assess potential ways to improve procedures. The continual improvement eco-loop is a tried-and-true method for monitoring progress and supporting communications with residents and authorities. Setting community-profiled reliable indicators and simple follow-up procedures such as volumes delivered to the NL, shipped recycled volumes, benefits to the community, ecocentre evaluation and such all support the accountability process.

WM and Waste liabilities

Unfortunately, the majority of communities that are unconnected to the road network have existing problems, including illegal dumps and RM accumulated over time due to weak or unenforced regulations or the inability of communities to adequately dispose of waste. These problems can be difficult to incorporate into a WMP due to their nature, the state of decomposition, transportation norms and/or the costs involved in reclamation and disposal. The preliminary phase of a project should focus on identifying, locating and characterizing these waste liabilities in order for appropriate disposal to be undertaken. Moreover, the psychological effect of tackling them may be a prerequisite to setting up a new WMP that calls upon participation by residents and businesses or, at the very least, can be a major incentive. This will be developed in a more detailed fashion during discussions about the report.

TOOL 1.1: COMMUNITY WASTE MANAGEMENT DIAGNOSIS

The purpose of the waste management diagnosis is to understand the management life cycle for various types of waste and inventory the following at each stage of the process (use, collection, transport, on-site, ecocentre):

- Residual material flow
- Non-compliance issues (as notified by authorities)
- Citizens' complaints
- Nuisance observed by employees and equipment or site operators
- WM and landfill impact
- Ergonomics for facilitating RM handling
- WM-related health and safety issues
- Required human resources
- Applicable standards and regulations
- Potential costs (liability management, etc.)
- Potential constraints and awareness/motivation efforts to be put in place, etc.

All of the above are very important in developing a WMP or, at the very least, a RM action plan. However, other essential information may remain unknown when the time comes to decide how RM will be processed. For example, "How much RM does the community generate in terms of type, volume and weight? How do these categories vary seasonally and as a function of community activities (vacation, hunting, etc.)?"

Some data can be inferred from averages in comparable communities (similar population, services and industrial structure). On the other hand, if for one reason or another, it is deemed that such information is not a good model of the given community, RM characterization will be needed, as described below. The required budget will vary with the desired degree of accuracy and number of seasons studied, but characterization can avoid costly errors later in the municipal WM and continual improvement process.

The following excerpt[2] confirms the need for careful WM planning and for thorough knowledge of quantities and flow variation before choosing a solution:

"The generator of a waste is responsible for its safe management from cradle-to-grave. Using raw materials efficiently and reducing the amount of waste generated is the most important step in waste management planning. […].Undertaking a waste audit will help to identify the type and amount of waste being generated, the costs of current management options and examine opportunities for better managing the waste. This information will also enable the generator to implement a waste management regime that is tailored to its own unique needs, location and circumstances.

[…]Waste by its nature is usually a mixture of different unwanted materials. The segregation and diversion of different types of waste is an effective way to reduce the amount of waste requiring costly handling, storage, treatment and disposal. Segregation also enables the reuse of certain types of waste for a different purpose. Reuse activities may be undertaken either on-site or off-site.

[2]Government of Nunavut. Department of Environment (2012). Environmental Guideline for the Burning and Incineration of Solid Waste, 38 p. (p. 15).

Treatment and disposal is the last step in effective waste management and should be undertaken only after all other practical reduction and reuse options have been examined. A wide variety of treatment and disposal options exist and each must be examined before deciding on a final method, regardless of whether waste is to be treated and disposed of on-site or off-site. If burning and incineration is the method of choice, equipment must be designed and sized accordingly to accommodate the type and quantity of waste being produced. As described in the following section, open burning is capable of safely destroying a limited number of waste types. While incinerators are capable of safely destroying a wider range of waste, many types of waste must still be diverted. Because of this, on-site segregation remains a critical component of any waste management plan.

Overall, the following principles should be used to guide responsible solid waste management planning:

- *Know your waste by conducting a waste audit.*
- *Reduce the amount of solid waste produced by implementing strategic purchasing policies that focus on the substitution or reduction of purchased products as well as product design, composition and durability.*
- *Reuse waste where different purposes can be identified.*
- *Segregate and divert mixed waste streams enabling waste to be reused or recycled, thereby reducing the amount of waste to be disposed of.*
- *All practical disposal methods should be examined. Burning and incineration of waste should be considered only where other practical methods do not exist.*
- *If burning and incineration is used, the equipment chosen should be designed and sized to accommodate the waste produced, minimize fire hazards and result in the complete combustion of the waste."*

A sustainable waste management concept for Khanty-Mansiysk Municipality, Russia (2012, Elena Lapshina & Michael Angrick) suggests an interesting methodology for choosing the best way of managing waste.

1.1.1 Characterization

The objectives of characterization of residual material flow are as follows:

- Identify the types of produced waste
- Quantify each type of waste, and determine seasonal variation

With this in mind, you first need to make on inventory of the various types of RM and the entities that generate them.

1- **The residential sector**: Households will generate plastic, glass and metal containers, as well as paper, cardboard, batteries, electronics, clothing, and organic matter and other household residue such as diapers.

2- **Food and hardware stores**: This sector will generate large quantities of cardboard, plastic packaging, wooden pallets and food residues. If the food store includes a canteen, there will be metal, plastic and glass containers also, and such locations are also collection points for the management of returnable inventory such as deposit bottles and cans.

3- **Canteens and inns**: Canteens and inns generate edible food residues, organic matter that should ideally be composted, and plastic, metal and glass containers, as well as cardboard boxes and wooded pallets.

4- **The industrial sector (fishing, mining, garages, chicken coops, etc.)**: While this sector will generate a variety of waste consistent with individual circumstances, it is important to take account of HHW, manure and animal carcasses.

5- **The institutional sector**: Institutions such as government schools and offices generate large quantities of paper and cardboard. Hospitals also use large numbers of plastic, paper and cardboard containers. School, office or hospital cafeterias also produce a lot of organic matter.

Once the sources are catalogued, an inventory of waste generated by each will be required. Table 1 provides a sample of information that you might collect.

Table 1: Characterization of the residential sector of the community, mid-July

Date	Sample	Sources	Type of waste	Mass (kg)	Volume (L)	Comments
July 15, 2016	1	Residential sector	Aluminum	2	20	Mainly returnable deposit cans
July 15, 2016	1	Residential sector	Plastic #1	1	15	

Characterization of the residential sector can be conducted by the municipality, but characterization of waste from industries, businesses and institutions needs to be made in partnership with them.

Finally, it is essential to quantify residual material flow, seasonal variation and associated individual residual material management costs and environmental impacts. This information will help you to develop a comprehensive view of residual materials equipment and staffing needs, as well as the required machinery and processing space.

Table 2 breaks out the categories of waste that you can characterize, as well as the potential management sectors. It should be noted that preferably, waste sent to the NL must be combustible, in order to avoid the need for permanent storage.

Table 2: Types of waste that may be subject to characterization; and related management sectors.

Type of residual material	Donation	Prepared foods	Reuse	Recycling/returnable deposit	Composting	HHW	Electronics	Energy recovery	NL
Food residues	X	X			X				X
Organic residues					X			X	X
Glass									X
Plastic #1,2,3,5,7				X				X	X
Other plastics								X	X
Cardboard				X	X			X	X
Paper			X	X	X			X	X
Aluminum				X					
Steel				X					
Other metals				X					
Returnable deposit containers					X			X	
Uncontaminated wood			X					X	X
Gypsum				X	X[1]				X
Shingles								X	X
Other CDR residues									X
Tires						X			
Used oil						X			
Batteries			X			X			
Other HHW						X			
End-of-life vehicles			X	X					
Electronics							X		

(Source: Pierre-Luc Dessureault, Chair en éco-conseil UQAC)

1: Utilization of gypsum for soil pH reduction is common in agriculture. Shipping for recycling in Southern Québec may be considered on a case-by-case basis but does not appear of interest to us at first glance.

http://www.mapaq.gouv.qc.ca/fr/Regions/chaudiereappalaches/journalvisionagricole/avril2014/Pages/Gypsesurlessols.aspx

http://www.recyclegypse.com/

Regional county municipalities and municipalities subject to the LQE are required to prepare and monitor a waste management plan (WMP). They may qualify for the Programme sur la redistribution aux municipalités des redevances pour l'élimination de matières résiduelles (redistribution of waste disposal fees to municipalities), whose goal is to support them in reviewing and implementing waste management plan. Characterization could be deemed a plan implementation measure if envisaged during the review process. It should be noted that Nunavik municipalities do not have access to this program.

You should check potential Recyc-Québec funding opportunities each year at and Municipal Green Fund funding opportunities at .

Characterization can be conducted by the municipality with the assistance of consultants and/or specialized OBNL non-profits.

1.1.2 Relevant literature on characterization

Mots-clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Caractérisation des matières résiduelles	Ce document présente une méthodologie de caractérisation des déchets.	Canada	CCME. (1999). Méthodologie recommandée pour la caractérisation des déchets dans le cadre des études d'analyse directe des déchets au Canada (pp. 64). Conseil canadien des ministres de l'Environnement, http://www.ccme.ca/files/Resources/fr_waste/fr_packaging/pn_1498_waste_char.rpt_final_f.pdf
Gestion des MR	Guide de gestion des matières résiduelles en milieu nordique	Canada	Gouvernement du Canada. (2017). Gestion des déchets solides pour les collectivités éloignées et du Nord : Document d'orientation technique et de planification. Environnement et Changement climatique Canada (pp. 146).
Caractérisation	*« L'objectif de ce document vise à fournir les étapes à suivre pour réaliser la caractérisation des matières résiduelles de votre institution afin d'implanter un programme de gestion environnementale ».*	Québec	Caractérisation des matières résiduelles solides générales : comment s'y prendre, Marilou Maurice, octobre 2011, Université deMontréal, http://www.aqpere.qc.ca/campus/PDF/Articles/Rapport_UDM.pdf

TOOL 1.2: CONSULTING ALL STAKEHOLDERS ON THE WM DIAGNOSIS

Community support is very important in waste management, because participation by the citizenry ensures the proper diversion of waste to the right processing sector. Discussions with the community will initially make it possible to determine challenges, perceptions, concerns and needs. A common goal should emerge from these discussions, to which you can attach potential solutions.

Table 3 introduces various inherent barriers in the consultation process that were identified by Audet, Godin & Tremblay in 2014, which they in turn had adapted from Fisher & Brown (1989).

Table 3: Communication and consultation advice; barriers to communication

Three barriers to effective communication
We think that the discussion is unnecessary.
We only communicate one-way.
We send contradictory messages.
Three ways of strengthening the relationship
Always consult before deciding.
Listen attentively.
Plan communication to avoid sending contradictory messages.
Why consult?
Find a balance between emotions and reason.
Promote two-way communication.
Elicit more confidence.
Avoid presenting interlocutors with a *fait accompli*.
Help achieve project acceptance.

Table 4 presents a checklist of stakeholders to be contacted and consulted (adapted from Audet, L., Godin, J., & Tremblay, M. (2014). *Implanter un projet : 7 règles pour réussir. 1st edition, Concertation ICP, p. 80.*

Table 4: List of stakeholders

Stakeholder checklist
Decision
Municipal, provincial or federal authorities
Municipal, ministerial or other organization officials
Directly affected
Community residents
Social, community and environmental groups
Employees of the organization and relevant trade unions
Infrastructure users
Organizations that could benefit
Indirectly affected
Local/regional media
Local organizations and associations whose interests are not affected
Scientific consultants

Table 5 offers a challenges checklist, also adapted from Audet, Godin, & Tremblay, p. 82, and supplemented with questions drawn from the Chaire en éco-conseil's sustainable development evaluation grid (see also: http://ecoconseil.uqac.ca/). Obviously, these are only examples, and need to be adapted to the needs of Northern communities that are unconnected to the Québec road network. Moreover, awareness is required of the fact that challenges are not necessarily the same in Nunavik, Basse-Côte-Nord and around Schefferville and also depend on community size, geography, and culture.

Table 5: Challenges checklist

Challenges checklist
Health, safety and the environment
Potential for water, air and soil contamination
Risk of major accidents
Effects on fauna and flora
Long-term impact on the environment (climate change, ozone layer)
Reduction of incineration by a WMP centred on recycling, reuse, reclamation, etc.
Reduction of toxic risk (HHW management)
Animal carcass management
Extended producer responsibility
Quality of life and regional planning issues
Noise and/or vibration
Heavy or increased traffic
Odours and smoke
Visual impact
Other annoyances (vermin, pests, etc.)
Economic consequences
Depreciation of property values
The number and quality of jobs created or maintained and other consequences (local or not)
Doubts about the viability of the waste management system
Cost of infrastructure and/or services
Funding and impact on municipal taxes or user costs
Benefits to the community (NL lifetime, landscape improvement vs tourism, etc.)
Credibility
Individuals and organizations who are the principal project supporters (historical non-compliance, unpopular with the government)
Technology proposed for managing each type of material
Widespread mistrust of companies, governments and/or scientists
Involvement of all stakeholders, and partnerships to be established
Transparency of the project process, progress and follow-up indicators
Employee competency (training)
Consistency with current laws and local by-laws
Solid and reliable basic information about current WM (flow, inventory)
Social consequences
Potential for social reinsertion or the creation of social economy enterprises
The use of compost for personal gardens and community greenhouses (food security)

Community kitchens to combat waste (food security)
Individual roles and responsibilities, training and awareness
Low cost reuse and repair of furniture, textiles and building materials
Access to facilities (community aspect, NL business hours, spring cleaning, etc.)
Optimal use of each type of material (reduction at source, reuse, reclamation (compost, energy, etc.), disposal
Dissemination of information in accordance with the linguistic diversity of the community
NL incineration (north of the 55th parallel)
Smoke from burning instead of landfilling bothers residents?
Should the use of burning instead of landfilling be better supervised?
Should burning use an incinerator or an energy recovery device?
NL management issues
Are end-of-life vehicles a problem?
Are construction residues a problem?
Are construction residues sorted for maximum reuse?
Are vehicles adequately sorted, drained of hazardous matter, etc.?
Do local by-laws constrain construction company behaviour?
Are new or recycled building materials found in the NL?
Are clandestine dump sites being used?
Were electric household appliances sorted for repair, spare parts recovery and end-of-life refrigerant draining?
Are reclamation and trenching practices current and legally compliant?
Recycling and composting projects
Is the population aware of recycling and composting?
Do reclamation initiatives exist?
Is funding available?
Are there potential partnerships with various organizations?
Can we require that companies engage in reclamation?
What management equipment is needed and do we already have it in the community?
Hazardous matter management
Has information about waste management been properly communicated to residents?
Do local companies manage HHW responsibly?

1.2.1 Relevant literature on stakeholder consultations

Mots-clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Projet, acceptabilité sociale, communication	Ce livre présente de l'information sur les processus de consultation et les enjeux à tenir en compte.	Québec	Audet, L., Godin, J., & Tremblay, M. (2014). Implanter un projet : 7 règles pour réussir. 1re édition, Concertation ICP.
Consultation, Nunavik, gestion des matières résiduelles	Ce rapport présente les enjeux et les pistes de solution qui sont ressortis des consultations publiques sur la gestion des matières résiduelles.	Nunavik	ARK. (2013). Rapport de consultation publique sur le projet de plan de gestion des matières résiduelles du Nunavik. l'Administration régionale Kativik.

TOOL 1.3: ENERGY RECOVERY AND INCINERATION

Thermal processing of waste by incineration or gasification in a controlled environment is one possible option for RM management. In fact, a bibliographical search determined that this option was almost universally selected worldwide for energy recovery, usually by reclamation, in isolated Northern community waste processing (see reference).

The advantages of this option are as follows:

1. **It reduces the quantity of waste sent to the NL**: Controlled incineration of waste makes it possible to considerably reduce the volume of waste sent to the NL and sometimes consumes less energy than open burning.
2. **It reduces air pollution**: High-temperature incineration reduces the quantity of produced atmospheric pollutants. This kind of equipment can also be provided with a filter to reduce air pollution even more.
3. **Energy production**: Controlled incineration of waste makes it possible to include thermal reclamation and/or energy production systems.

However, this option also has many disadvantages and, as such, WM must be looked at as a whole before considering incineration. The disadvantages are:

1. Installation, maintenance and operation requires specialized manpower and adds costs
2. An environmental authorization and possibly an environmental impact study may be required
3. Operation may be discontinuous (batch) and depends on available flow of RM
4. Energy conversion requires special equipment and well-defined needs such as heating that can tolerate discontinuous operation (e.g., a dual energy boiler that usually operates on fuel oil but can use electricity during waste incineration)

If energy recovery is chosen, it is crucial to carefully set limits during the planning stage.

"[…] Treatment and disposal is the last step in effective waste management and should be undertaken only after all other practical reduction and reuse options have been examined. A wide variety of treatment and disposal options exist and each must be examined before deciding on a final method, regardless of whether waste is to be treated and disposed of on-site or off-site. If burning and incineration is the method of choice, equipment must be designed and sized accordingly to accommodate the type and quantity of waste being produced," c.f. Government of Nunavut. Department of Environment (2012): *Environmental Guideline for the Burning and Incineration of Solid Waste*, 38 p. (p. 15).

It is thus paramount to determine your objectives well and know your combustible material flow before purchasing this kind of equipment. In the extreme case where a community might choose to completely dispense with reclamation, sorting still remains absolutely necessary in order to eliminate household hazardous waste. It is also very desirable to remove glass, which produces more ash and requires more fuel. Similarly, it is also desirable to remove all organic matter, because it impairs burning efficiency due to moisture retention. A sorting centre therefore remains necessary, even for communities that decide to use energy recovery.

Incineration and/or gasification technology can be expensive. As residual material flow determines the size of the equipment and sorting is needed in any event, it is crucial for managers to seek to reduce the quantity of waste to be

burned as much as possible, in order to acquire the smallest possible equipment. In the same way, energy recovery can be optimized by effective sorting and equipment operations in order to prolong the life of the NL and limit toxic emissions.

Knowledge about flow and size of the selected equipment will also determine the type of operation required to accumulate RM (continuous/discontinuous), the need for pre-incineration storage and possible part-time employees, etc. and the potential for energy recovery. It should be noted, for example, that a population of 200 people will not generate enough combustible household waste to enable the continuous operation of an incinerator. Managers will thus need to ensure that discontinuous operation is profitable by taking account of all incurred costs, such as storage, workforce availability, etc.

On the margins of this incineration tool (and the following one: 1.4 on NL management), a case in Nunavut was reported to improve NL incineration efficiency through a pseudo-incinerator called a burn box. However, this type of equipment is prohibited in Québec.

Photo 1: A closed metal burn box

(Source: http://www.gov.nu.ca/sites/default/files/guideline_-_burning_and_incineration_of_solid_waste_2012.pdf, p. 10)

Waste reduction

Waste reduction depends on the type of incinerator used and the quantities of non-combustible waste in the incinerator. Estimated reduction ranges between 90% and 95%[3].

Reduction of atmospheric pollutants

According to the *Environmental Guideline for the Burning and Incineration of Solid Waste* published by the Government of Nunavut Department of Environment in 2012:

> *"Open burning and the improper incineration of solid waste can result in environmental, health and safety hazards from the pollutants found in smoke and exhaust gases and in the bottom ash.*
>
> *[…]*
>
> *The temperature generated is a function of the heating value of the waste and auxiliary fuel, incinerator or burn unit design, air supply and combustion control. Complete combustion requires high temperatures. Generally, temperatures that exceed 650o C with a holding time of 1–2 seconds will cause complete combustion of most food and other common household waste. Segregation of waste is required when using methods that don't routinely achieve these temperatures. Dual chamber incinerators, which are designed to burn complex mixtures of waste, hazardous waste and biomedical waste, must provide a temperature higher than 1000o C and a holding time of at least one second to ensure complete combustion and minimize dioxin and furan emissions.*
>
> *. […]*
>
> *The heating value, wetness and chemical properties of the waste affect the combustion process and the pollutants that are contained in the resulting smoke and ash. The higher the burn temperature, holding time and turbulence that are achieved, the less effect the composition of the waste has on completeness of the burn.*
>
> *[…] In general, open burning on the ground…is actively discouraged by the Nunavut Department of Environment as a method for disposing of unsegregated or mixed solid waste.*
>
> *[…]*
>
> *Batch feed dual-chamber controlled air incinerators currently operate at several remote industrial locations in northern Canada and Alaska. Although they are generally considered to have the highest qualities of all the incinerators and open burning methods mentioned, they must be designed for the type and quantity of waste to be burned. […]*
>
> *Any person considering the purchase of an incineration system should first consult the system's manufacturer or other qualified persons with expertise in the incineration of solid waste."*

[3]Gosselin, G. (2014). *L'incinération des ordures ménagères au Québec comme source d'électricité et de vapeur dans le cadre de ''L'avis sur la sécurité énergétique des Québécois à l'égard des approvisionnements électriques et la contribution du projet du Suroit.*'. ABGG TECHNOLOGIES INC., http://www.regie-energie.qc.ca/audiences/3526-04/MemoiresParticip3526/Memoire_ABGGTechnologies_21avril04.pdf & http://terragon.net/

Energy production

The incineration and gasification of waste can recover energy to heat buildings, produce steam and even electricity. However, this kind of industrial ecology requires prior planning that includes a clear definition of the energy needs of the involved parties.

A 2011 German-Russian cooperative sustainable waste management analysis in the Russian city of Khanty-Mansiysk provided detailed data on the composition of local household and commercial waste heating values. The study estimates that unsorted waste had a heating value of 7 kilojoules per kilogram (Figure 3).

The authors of the study suggest that only 36% of all collected waste (Figure 4) has a worthwhile combustion potential, and that this category of waste has a heating capacity of 16.2 kilojoules per kilogram.

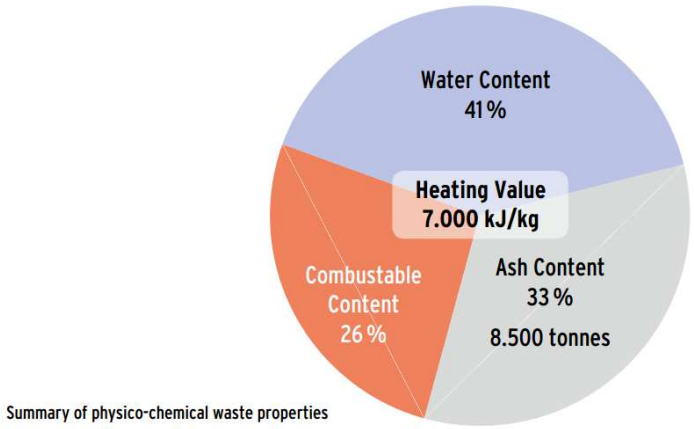


Figure 3: Heating value of unsorted waste
(Source: *A sustainable waste management concept for Khanty-Mansiysk Municipality*, Russia-2012, p. 15)

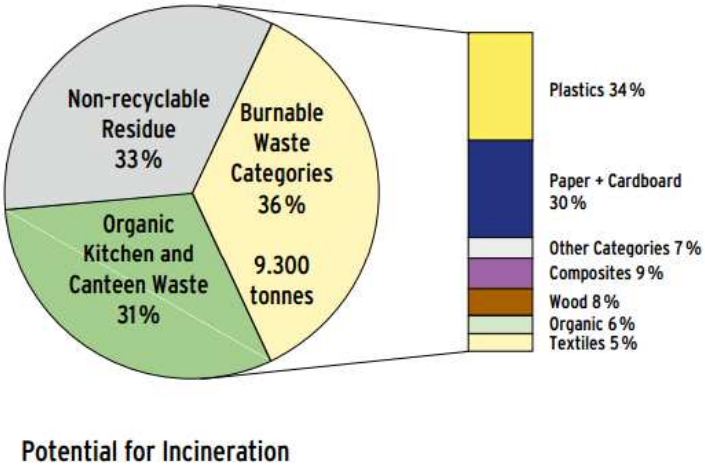


Figure 4: Potentially combustible household and commercial waste
(Source: *A sustainable waste management concept for Khanty-Mansiysk Municipality*, Russia-2012, p. 19)

However, it should be noted that the population of this Russian community was approximately 90,000 while the most populous community in Northern Québec's northeast has 3,000 inhabitants. As such, waste flow in Northern Québec communities will likely be insufficient for the continuous operation of energy recovery equipment, while discontinuous (batch) processing is more difficult in terms of process initialization and stabilization, damage to equipment, etc. (cf http://publications.gc.ca/collections/collection_2010/ec/En14-17-2-2010-fra.pdf

Example of an energy recovery project in Nunavut

Setting up and operating energy recovery technology in isolated Northern communities is not necessarily an easy task, as can be seen from the following excerpt from a 2014 article by Peter Varga: Iqaluit's CanNor-funded gasification scheme gets bogged down, http://www.nunatsiaqonline.ca:

> « *Iqaluit's try at a new garbage-disposal technology is proving to be more complicated than city council expected.*
>
> *Touted as a state-of-the-art technology that reduces household waste to eight per cent of its volume, the 'micro auto gasification system' (MAGS) seemed a perfect fit for the Nunavut capital, where the city's overflowing dump is an environmental hazard.*
>
> *City council received federal funding April 8, from the Canadian Northern Economic Development Agency, to try out the new technology as a pilot project.*
>
> *But the city will not meet its goal of starting the project by the end of this summer, thanks to zoning bylaws and complicated technical specifications. […]*
>
> *The Canadian Northern Economic Development Agency contributed $350,000 towards the $501,500 gasification system, and the city covered the remaining $151,500. […]*
>
> *The system, due to arrive in Iqaluit this summer by sealift, can break down up to half a tonne (500 kilograms) of household garbage per day.*
>
> *This is just a small fraction of Iqaluit's daily garbage production, which according to public works amounts to almost 25 tonnes daily.*
>
> *In theory, the system would be installed in any large building, which it could heat as it consumes garbage daily.*
>
> *In practice, finding such a building in Iqaluit is not as obvious as the city once thought.*
>
> *The system can only be added to a building that is zoned to include waste disposal or waste treatment, Couture said. Even then, MAGS power systems must be compatible with the building it serves. […]*
>
> *The host building 'has to be rewired, to take the generator,' he said.*
>
> *City directors were in favour of installing the system in locations that do not require rezoning, Couture said, such as the landfill and wastewater treatment facilities.*"

It is worthwhile noting that the cost of energy production infrastructure starting from waste can quickly skyrocket. As such, it is important to evaluate the return on investment for the facility and its operational costs prior moving forward with this type of project.

> Infrastructure costs/[(Current building management expenses—forecast building management expenses) + (Current waste management expenses—forecast waste management expenses)] = return on investment period[4].

It should be noted that if the equation results in a negative number, your project will cost more than what you currently disburse. It should also be noted that two parties may be involved and that only one may benefit from the new facility. If this is the case negotiations will be called for between the parties.

[4] Source: Pierre-Luc Dessureault, 2017

1.3.1 Relevant literature on energy recovery

Mots-clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Chaîne de valeur	« *Écotech Québec, qui représente la grappe des technologies propres, réalisait une étude en 2012 qui positionnait différents sous-secteurs québécois en fonction de leur potentiel et des tendances de marché à l'international. La valorisation énergétique se positionnait avantageusement d'autant plus qu'elle offre une solution de rechange à l'enfouissement et à l'incinération dans le respect de la hiérarchie des 3RVE* ».	Québec	Écotech Québec. (2016). *Valorisation énergétique des matières résiduelles : chaîne de valeur de la filière Québécoise.* Écotech, http://www.ecotechquebec.com/documents/files/Etudes_memoires/valo-energetique-ecotech-qc-2016.pdf.
Liquéfaction des déchets de plastique	"*Sapporo Plastics Recycling Co., Ltd., (SPR) started its commercial operation of waste plastics liquefaction in 2000. At first only hydrocarbon oil was reclaimed, this being derived from the waste plastics liquefaction process under the Japanese Containers and Packaging Recycling Law. Presently, thermal degradation residue and hydrochloric acid are being produced as by-products in addition to the hydrocarbon oil. As a result, the SPR plastics liquefaction plant has achieved a high reclamation rate of 96%, and 93% of the recycled products have been reused in Hokkaido, where SPR is located. The technical problems caused by corrosion and clogging have been solved*".	Japon	Fukushima, M., Shioya, M., Wakai, K., & Ibe, H. (2009). Toward maximizing the recycling rate in a Sapporo waste plastics liquefaction plant. *Journal of Material Cycles and Waste Management, 11*(1), 11-18.
Incinération valorisation énergétique	Le Shetland Island Council évalue et met en évidence l'utilisation de l'incinération et de l'efficacité énergétique comme étant les plus appropriées pour la communauté de Shetland qui compte environ 8000 habitants.	Shetland Island, Écosse	Jakobsen, N. (2016). SHETLAND WASTE-TO-ENERGY PLANT. COWI, http://www.cowi.com/menu/project/industryandenergy/energy/shetlandwastetoenergyplant.
Incinération	Le développement de multiples projets d'incinération en Finlande et comment ces derniers ont été jugés controversés. Cet article discute des problématiques et constats dans les projets de mise en place d'incinérateur.	Finlande	Jalava, K., Pölönen, I., Hokkanen, P., & Kuitunen, M. (2013). The precautionary principle and management of uncertainties in EIAs – analysis of waste incineration cases in Finland. *Impact Assessment and Project Appraisal, 31*(4), 280-290.

Valorisation énergétique	"*Sweden has an unusual problem - not enough rubbish.* *With a strong tradition of recycling and incinerating, it now has too many waste-to-energy incinerators and not enough rubbish to meet demand. It has become Europe's biggest importer of trash from other countries, currently mainly from Norway*".	Suède	Ringstrom, A. (2012). Sweden turns trash into cash as EU seeks to curb dumping. Reuters, http://www.reuters.com/article/us-sweden-environment-garbage-idUSBRE8AP0MI20121126.

TOOL 1.4: NL MANAGEMENT

The *Regulation respecting the landfilling and incineration of residual materials*, CQLR c Q-2, r 19 applies to NL RM management in isolated Northern Québec communities. Sections 94 to 98 deal with site design, while section 99 deals with site operation and section 100 covers site closure. The wording of these sections is as follows:

> 94. Landfills may be established in the North, in which only residual material generated in the North are accepted, including sludge which, although generated elsewhere, is treated in the North.
>
> Northern landfills must be sited and operated in accordance with this Division.
>
> For the purposes of this Division, "the North" means the territories listed below:
>
> (1) the territory situated north of the 55th parallel;
>
> (2) Municipalité de Côte-Nord-du-Golfe-du-Saint-Laurent, the municipalities of Blanc-Sablon, Bonne-Espérance, Gros-Mécatina and Saint-Augustin, Ville de Schefferville and the territory within a radius of 10 km from the limits of that town, the Naskapi Village of Kawawachikamach and any other municipality constituted under the Act respecting the municipal reorganization of the territory of Municipalité de Côte-Nord-du-Golfe-du-Saint-Laurent (1988, chapter 55; 1996, chapter 2).
>
> _____
>
> O.C. 451-2005, s. 94; O.C. 451-2011, s. 22.
>
> 95. Northern landfills must be sited at a minimum distance of
>
> (1) 150 m from any watercourse or body of water; and
>
> (2) 500 m from any catchment installation for surface water or groundwater intended for human consumption.
>
> The first paragraph does not apply if the landfill is not likely to alter the quality of the water referred to in that paragraph
>
> _____
>
> O.C. 451-2005, s. 95
>
> 96. Northern landfills must be surrounded by a fence or any other device so as
>
> (1) to prevent wind dispersal of the waste and contain them in the disposal areas;
>
> (2) to prevent animals from entering the landfill; and
>
> (3) to prevent access to the landfill after business hours.
>
> The landfills must also be surrounded by a fire barrier at least 15 m wide devoid of all vegetation.
>
> A conspicuous sign must be posted at the landfills indicating the type of landfill, the name and address of the operator and any other person in charge of the landfill, as well as the business hours.
>
> _____
>
> O.C. 451-2005, s. 96

97. The bottom of the disposal areas of a northern landfill must be above the permafrost line at a minimum distance of 30 cm above the groundwater level. Any lowering of the groundwater level by pumping, draining or otherwise is prohibited.

The removed materials must be stockpiled on the perimeter of the site to be used to cover the waste.

Sludge must be returnable deposited in an area separate from the area in which other waste are returnable deposited so as to facilitate the burning of the waste.

_____

O.C. 451-2005, s. 97

98. Northern landfills must have a surface water collection system to prevent the surface water from being contaminated by waste or from penetrating into the disposal areas. Once collected, the surface water must be discharged outside the landfill site.

_____

O.C. 451-2005, s. 98.

99. Combustible waste returnable deposited in northern landfills must be burned at least once a week, weather conditions permitting.

Waste containing asbestos and animal carcasses or animal parts must be covered with soil or other waste as soon as received. The words “containing asbestos” have the same meaning as in the fourth paragraph of section 41.

The soil used to cover the waste may contain contaminants in a concentration equal to or lower than the limit values set out in Schedule I to the Land Protection and Rehabilitation Regulation (chapter Q-2, r. 37) for volatile organic compounds and in Schedule II to that Regulation for other contaminants. Those limit values do not apply to contaminants that do not originate from human activity.

_____

O.C. 451-2005, s. 99; O.C. 451-2011, s. 23.

100. If all or part of a northern landfill is closed or unused for a period of 6 months or more, the waste returnable deposited in the landfill must be covered after being burned with a layer of soil at least 30 cm thick at the latest by the expiry of the sixth month.

The soil referred to in the first paragraph may contain contaminants in a concentration equal to or lower than the limit values set out in Schedule I to the Land Protection and Rehabilitation Regulation (chapter Q-2, r. 37). Those limit values do not apply to contaminants that do not originate from human activity.

_____

O.C. 451-2005, s. 100; O.C. 451-2011, s. 24.

C.F. chapter Q 2,r. 19.

It is always of interest to see what is done in comparable Northern communities elsewhere that have similar WM management problems.

The Alaska Department of Environmental Conservation issued a guidebook[5] that contains practical advice on locating and siting new landfills:

> *"Locating/Siting New Landfills*
>
> *i. The landfill must be more than 500 feet from a drinking water well head or more than 200 feet from a surface drinking water source.*
> *ii. The landfill should not be placed in a tidal area, wetland, or surface water body.*
> *iii. The landfill should be located at least 1,000 feet from a river or the ocean, if possible.*
> *iv. The landfill should be more than 5,000 feet from an airport unless a waiver is obtained from the Federal Aviation Administration (FAA).*
> *v. The landfill should be more than 500 feet from residential areas, schools, and day care centers and located downwind of the community based on the prevailing wind direction.*
> *vi. The landowner must give permission to construct and operate the landfill on his/her Land."*
>
> *Solid Waste Procedures Manual for Municipal Class III Solid Waste Landfills,*
> Alaska Department of Environmental Conservation (2006), p. 7

[5]*Solid Waste Procedures Manual for Municipal Class III Solid Waste Landfills:* Alaska Department of Environmental Conservation https://anthc.org/wp-content/uploads/2015/12/CEH_SolidWasteGuide.pdf

"Designing New Landfills

i. *The landfill should have a maximum area of 5 acres and a minimum 20-year capacity.*
ii. *The landfill should conform to the area's topography & landscape.*
iii. *Slopes should be graded to prevent erosion.*
iv. *The landfill should not be visible from roadway.*
v. *Trenches, culverts, berms and grading should be used to prevent water from flowing through the waste or ponding on the site.*
vi. *Place signs at the facility telling people: 1) where waste disposal is allowed; 2) what items are prohibited; 3) that open incineration on the ground is prohibited; and 4) how to contact the landfill operator.*
vii. *If the community does not have a domestic wastewater system, a separate area should be designated for disposal of honey buckets and septage that is away from the solid waste disposal area.*
viii. *Wild animals are attracted to landfills. Fences and landfill cover should be implemented to reduce this nuisance."*

Solid Waste Procedures Manual for Municipal Class III Solid Waste Landfills,
Alaska Department of Environmental Conservation (2006), p.11

"Operating guidelines for Class III Landfills

i. *Use a "trench and fill" technique where possible. Area fill landfills should be used only where conditions do not allow disposal of waste below the natural ground surface.*
ii. *Restrict incineration to burn barrels, burn boxes, or incinerators. Incineration must not be conducted when the Bureau of Land Management (BLM), Alaska Fire Service fire danger outlook is high or extreme.*
iii. *Keep prohibited items out of the landfill (regulated hazardous waste, drums with liquid, industrial waste).*
iv. *Keep water out of the landfill to prevent leachate. Use grading, berms, or ditches to direct run-on and run-off water away from the landfill and to keep water away from the disposed waste.*
v. *Compact the working face as often as possible to keep it as small as practical, and cover the waste as necessary to control litter, disease vectors such as insects, animal attraction, and to protect human health and the environment.*
vi. *Stockpile cover material, if available, near the working face.*
vii. *Dust disposed animal carcasses with lime and cover immediately.*
viii. *Dispose of honey bucket waste and septage in a separate trench away from the solid waste disposal area. Add lime to the honey bucket waste or septage. Cover with at least two feet of soil when the trench is nearly full.*
ix. *Gather scattered and windblown litter and place it in the working face at least once in the spring and once in the fall.*
x. *Inspect the landfill on a monthly basis. The owner or operator should do the inspection.*
xi. *Record the location of the individual cells or trenches as they are filled with wastes and covered, and keep a record of the location in the file.*
xii. *Do not accept demolition wastes from large construction/demolition projects, such as school or utility construction or renovation projects at the landfill."*

Solid Waste Procedures Manual for Municipal Class III Solid Waste Landfills,
Alaska Department of Environmental Conservation (2006), p.17

"Good Open Incineration Practices

- *Open incineration is most effective with clean, dry materials such as wood and paper. Household garbage is typically 20%-30% water. Tarping, covering, and frequent incineration will help prevent additional moisture from collecting in the waste.*

- *Non-combustible waste should be separated out as much as possible. This includes glass, metal, and other items that will not burn.*
- *All prohibited or hazardous wastes must be separated out before incineration. This includes batteries, household chemicals, oil, and other hazardous materials."*

Solid Waste Procedures Manual for Municipal Class III Solid Waste Landfills,
Alaska Department of Environmental Conservation (2006), p.42

Table 6 lists types of waste that are suitable for open burning and/or incineration due to their potential impact on human health and ecosystems.

Table 6: Waste that is suitable for open burning and/or incineration

	Method	
Waste type	**Open Burning[4]**	**Dual-Chamber Incinerator**
Paper products	x	x
Paperboard packing including boxboard and cardboard	x	x
Untreated wood including lumber and plywood	x	x
Food waste		x
Food packaging		x
Natural fiber textiles	x	x
Plastic and Styrofoam except plastic containing chlorine[5]		x
Painted wood except wood painted with lead or PCB-amended paint		x
Wood treated with creosote or tar oil		x
Hydrocarbon spill absorbents		x
Animal carcasses except those affected by disease-causing agents		x

(Source: Government of Nunavut, 2012)

"C&D Disposal Options

- *The landfill may agree to accept the waste, and can charge the waste generator for disposal.*

- *The landfill may agree to accept the waste in exchange for assistance at the landfill, equipment use, or other in-kind services in the community.*
- *If the landfill will not accept the C&D waste; the construction company or contractor may pay to have the material backhauled by barge or airplane to a larger community with C&D disposal facilities.*
- *If the landfill will not accept the C&D waste, the contractor may apply to the Alaska Department of Environmental Conservation (DEC) for a one-time disposal permit for the C&D waste. This permit would allow the waste to be buried in a safe manner, in a separate location from the community landfill. The construction company is responsible for ensuring proper burial and management of the C&D landfill."*

Solid Waste Procedures Manual for Municipal Class III Solid Waste Landfills,
Alaska Department of Environmental Conservation (2006), p. 43

"Closing a Landfill

i. *Collect litter and place it in the working face.*
ii. *Cover the total area of the landfill with 24 inches of final cover material.*
iii. *Grade the site to encourage storm water run-off.*
iv. *Spread seeds and fertilizer over the entire area or install a protective cover that will prevent erosion.*
v. *Notify ADEC that the landfill is closed.*
vi. *Survey the location of the landfill and record this with the State Recorder's Office.*
vii. *Inspect the closed landfill annually for signs of erosion, exposed waste, and water ponding for five years after closure."*

Solid Waste Procedures Manual for Municipal Class III Solid Waste Landfills,
Alaska Department of Environmental Conservation (2006), p.25

"Management for Landfills on Permafrost

Landfills located on permafrost may cause melting of the underlying permafrost and the formation of thaw ponds. Melting permafrost, or an increase in depth of the active freeze/thaw layer of ground, is usually the result of stripping the insulation layer (vegetation and soil), excavation below ground level into the permafrost layer, or placing thin layers of gravel that absorb and transfer heat without enough depth to insulate the ground. The owner/operator of a landfill located on permafrost must design or operate the landfill using one of the following BMPs:

- *For communities in areas of discontinuous permafrost choose a landfill location that is not underlain by permafrost;*
- *Build the landfill above ground level using berms to contain the waste. Do not excavate into the ground or strip off or remove the insulating soil and vegetation. Place waste directly on top of the ground and cover with soil or gravel. As an alternative, use a soil or gravel pad at least 12 inches thick as the base of the landfill; or,*
- *Submit a plan to ADEC that allows for waste disposal at a site while ensuring that the permafrost does not melt."*

Solid Waste Procedures Manual for Municipal Class III Solid Waste Landfills,
Alaska Department of Environmental Conservation (2006), p. 33

Landfill Management near Shallow Groundwater

"Landfill locations where the bottom of the waste is less than 10 feet above the groundwater have an increased potential to cause groundwater pollution due to leachate entering the groundwater. Leachate can be a very high-strength liquid that contains high concentrations of pollutants. These pollutants can contaminate groundwater and

therefore adversely affect people that drink or otherwise use the groundwater. To prevent these effects, owners and operators of landfills less than 10 feet above groundwater must design and operate their landfill using one of the following BMPs:

- *Choose an alternative landfill location where the groundwater depth is greater than 10 feet below the proposed base of the landfill;*
- *Build the landfill at least two feet above ground level. The base or pad of the landfill can be constructed using gravel or other inert material. Berms or dikes can be used to contain solid waste. Do not use a trench-and-fill landfill design;*
- *Burn or incinerate all household municipal solid waste, especially food wastes, in a burn box, burn cage, burn barrel, or incinerator. Do not burn waste in an open pile on the ground. Incineration waste will greatly decrease the probability of leachate generation with resulting impacts to groundwater; or,*
- *Submit a plan to ADEC describing an alternative proposal for landfill design or operation that will ensure that groundwater is protected."*

Solid Waste Procedures Manual for Municipal Class III Solid Waste Landfills,
Alaska Department of Environmental Conservation (2006), p.36

1.4.1 Relevant literature on NL management

Mots-clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Gestion des matières résiduelles	Ce document est un document d'orientation en gestion des matières résiduelles pour les petites communautés nordiques du Canada. Le brûlage à ciel ouvert y est traité.	Canada	Gouvernement du Canada (2017). Gestion des déchets solides pour les collectivités éloignées et du Nord : Document d'orientation technique et de planification. Environnement et Changement climatique Canada, http://publications.gc.ca/**:** 146. http://publications.gc.ca/collections/collection_2017/eccc/En14-263-2016-fra.pdf
Procédure de gestion d'un LEMN, Bonnes pratiques	Ce document présente les bonnes pratiques de la gestion de site d'enfouissement en Alaska, site comparable à un LEMN. *"Do not accept demolition wastes from large construction/demolition projects, such as school or utility construction or renovation projects at the landfill […]* *Open burning is most effective with clean, dry materials such as wood and paper. Household garbage is typically 20%-30% water. Tarping, covering, and frequent burning will help prevent additional moisture from collecting in the waste [...].* *If the landfill will not accept the C&D waste, the construction company or contractor may pay to have the material backhauled by barge or airplane to a larger community with C&D disposal facilities.* *If the landfill will not accept the C&D waste, the contractor may apply to the Alaska Department of Environmental Conservation (DEC) for a OneTime disposal permit for the C&D waste. This permit would allow the waste to be buried in a safe manner, in a separate location from the community landfill. The construction company is responsible for ensuring proper burial and management of the C&D landfill* ».	Alaska	Alaska DEC. (2006). Solid waste procedure manual for Municipal Class III solid waste landfills (pp. 48): Alaska Department of Environmental Conservation Mission, anthc.org/wp-content/uploads/2015/12/CEH_SolidWasteGuide.pdf .
Règlement, procédure de gestion	Ce document est le règlement sur l'enfouissement et l'incinération de matières résiduelles. - La localisation - L'aménagement	Québec	Règlement sur l'enfouissement et l'incinération de matières résiduelles. (mise à jour le 1er décembre 2016). Q-2, r. 19 (pp. 76): Gouvernement du Québec. http://legisquebec.gouv.qc.ca/fr/pdf/cr/Q-

	- L'opération - La fermeture	2,%20R.%2019.pdf
Règlement, procédure de gestion	C'est un outil intéressant afin de mieux comprendre la réglementation.	Guide d'application du Règlement sur l'enfouissement et l'incinération des matières résiduelles (REIMR), disponible sur le site internet du MDDELCC : http://www.mddelcc.gouv.qc.ca/matieres/reglement/Guide-application-REIMR.pdf

TOOL 1.5: CONTINUAL IMPROVEMENT

"*Continual improvement is a management mode that fosters the adoption of gradual improvements through a daily search for effectiveness and progress that relies on the creativity of all involved actors*" (c.f., Ministère de l'Économie, de la Science et de l'Innovation (2016). https://www.economie.gouv.qc.ca/)

It is paramount to regularly re-examine opportunities for improving your waste management system process.

Table 7 is a checklist communities can use to improve their waste management procedures. It is worthwhile using it at intervals of between three and five years, or when projects arise that strongly impact WM.

Table 7: Continual improvement process checklist

Community commitment
Community commitment starts from the diagnostic phase of the situation, including waste management needs. Essentially, the ultimate goal sought by the community should be to avoid incineration and storage of waste at the NL as much as possible by means of efficient diversion.
A more exhaustive diagnosis of waste management
A precise portrait of waste management leads to awareness of the true state of the situation in the community and makes it possible to identify any complementary analyses and reappraisals that may be required. It is important to include the life cycle of the management system for each residual material and inventory the following elements at each stage in the process: residual material flows (characterization if needed), non-compliance, complaints, nuisances, impacts, basic ergonomics, associated health and security issues, required human resources, applicable standards and regulations, costs, etc.
Objectives, targets
Using the waste management profile and meetings with stakeholders, clarify waste management challenges by setting priorities for action. Found the choices of priorities and the objectives on well-defined criteria and an analysis of strengths, weaknesses, challenges and opportunities: - Regulatory obligations - Cost/benefit and other socio-economic and environmental impacts - Financial capacity - Etc.
Solutions
Once the objectives and targets have been established, it is paramount to develop potential solutions that comply with regulations and have the best possible socio-environmental cost/benefit result. For each potential solution, identify the facts and circumstances at each stage of the life cycle of the new management system in order to ensure that their implementation will have real benefits then determine measurable targets (indicators) that will enable you to better evaluate and improve your management system.

Action plan
Develop an action plan that identifies the what, who, when, how and where. Do not forget that the training and awareness are paramount and that priorities that are too broad and/or objectives that are too ambitious can often impair continual improvement efforts. The preferred form can use a WMP as a starting point, but a simple structured list can also make it possible to move forward in WM.
Follow-up
Follow-up is important in order to make sure that the system as set up functions well. The basic idea here is to identify progress, variation and situations that require improvement. For example, you could: • Check compliance with legislation • Evaluate system performance • Verify the application of procedures • Verify progress towards targets using indicators, etc.

1.5.1 Relevant literature on continual improvement

Mots-clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Amélioration continue	Ce livre « répond à un besoin de réflexion et d'aide à la décision à chaque étape de l'implantation de ce que l'on appelle […] un système de gestion environnemental ». Le fil conducteur de ce livre est le processus d'amélioration continue.	Québec	Ferrand, D. (2000). Piloter l'environnement dans l'entreprise. Ordre des ingénieurs du Québec.
	Ce site du ministère de l'Économie, Science et de l'Innovation présente le concept d'amélioration continue	Québec	https://www.economie.gouv.qc.ca/bibliotheques/outils/gestion-dune-entreprise/production/amelioration-continue-et-resolution-de-problemes/
Gestion du cycle de vie	Ce livre présente un chapitre 12 une manière de cartographier les « hotspots » ou points chauds/critiques du cycle de vie d'un système de processus.	Québec	Sonnemann, G., Margni, M., Klöpffer, W., Frankfurt, & Curran, M. A. (2015). Life cycle managment. SpringerOpen. P.149

TOOLBOX #2:

ORGANIC WASTE MANAGEMENT

2 ORGANIC WASTE MANAGEMENT TOOLS

The purpose of this toolbox is to help community leaders choose the best possible organic waste management solution for their community. A decision tree (Figure 5) proposes organic matter management options and four useful tools.

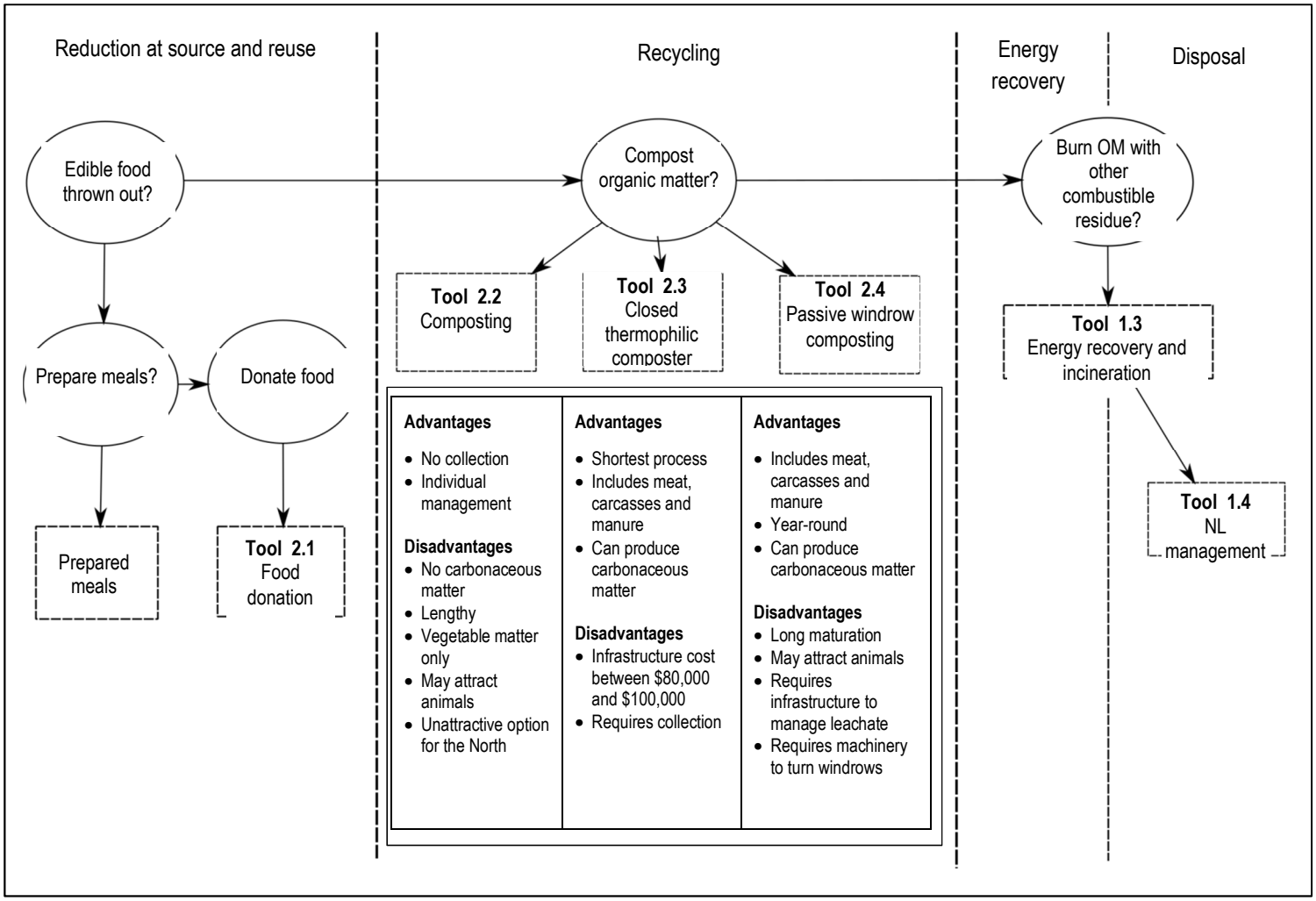


Figure 5: Decision tree — Organic edibles and vegetable/animal residue management choices

The decision tree reads as follows:

- From left to right, the decision tree presents the reduction at source, recycling and disposal options.
- Each circle includes a question and two arrowed outputs to an option for the next potential processing stage.
- The first organic matter management stage is reduction at source and/or re-use. The options here are mainly related to consumable organic matters produced by businesses, cafeterias, etc.):
    1. Prepared meals.
    2. Food donations (Tool 2.1).
- The recycling options are related to composting, as stipulated in the Québec Residual Materials Management Policy. Three tools are provided:
    3. Managing vegetable organic matter through household or collective/neighbourhood small-scale composting (Tool 2.2).
    4. Composting residual vegetable and animal organic matter using a closed thermophilic composter (Tool 2.3).
    5. Composting residual vegetable and animal organic matter at a large-scale municipal location using passive windrow composting (Tool 2.4).
- If composting is not feasible, energy recovery is another possibility for residual vegetable/animal organic inventory management, but is strongly discouraged since this solution is very inefficient due to the high moisture content of these kinds of residue.
- Disposal can also be considered as an option for residual vegetable/animal organic inventory management when no other processing choices are available (see General Tool 1.1).

TOOL 2.1: FOOD DONATION

When we visited Kuujjuaq, we observed that some organic residue recovered at the *Ungava Supervised House* composting site was still edible. This observation led to the idea of reduction at source by food donations.

"*Food donation is the way of managing edible residues that allows the greatest reduction of GHG emissions (Eriksson et al, 2015). Food donation generates savings for distributors, in addition to making it possible to nourish people in need. This solution is thus quite relevant compared to other sustainable development endeavours.*" Adapted from J. Darrieu, *Solutions for reducing food waste in Québec groceries*. Université de Sherbrooke, 2016, p.69-76.

2.1.1 What you need to know about food donations	
How	"*Initially, affirmation of donor non-liability for food poisoning caused by eating donated food is a must. Fear of liability, while widely believed, is unfounded under the terms of the Ontario* Donation of Food Act *and section 1471 of the* Civil code of Québec*. On the other hand, compliance with the rules concerning hygiene and health standards monitoring and low-temperature storage of food must be ensured […]* *The recovery and distribution capabilities of these organizations must be ensured, as well as the implementation of mechanisms that verify that donated food is given to recipients in need and that all food safety standards, including low-temperature storage, are met.(Moisson Montréal Harvest, 2016c; Rodrigue, 2016) […]* *Staff of the organizations that receive food donations must receive training in food hygiene and safety to be able to verify the quality of donated food. In addition, supermarket employees must be made aware of the importance fighting food waste and trained to sort edible food products.*" Adapted from J. Darrieu, *Solutions for reducing food waste in Québec groceries*. Université de Sherbrooke, 2016, pp. 69-76.

Required Infrastructure	Depends on the size of the community; varies from the very small to large-scale project size. For small projects, urban, community or district refrigerators can become viable initiatives that rely on volunteerism and can be located in community centres. Some Nunavik communities already operate hunting freezers. Larger communities require: • A food bank storage infrastructure (buildings, refrigerators, community kitchens, etc.) • Refrigerated trucks.
Training needs	• Training in food hygiene and safety • Awareness of the importance fighting food wasting • Training in sorting edibles.
Applicable regulations and standards	• Ontario *Donation of Food Act* and section 1471 of the *Civil code of Québec*.
Potential job creation	• Driver • Cook • Manager • Volunteers
Preliminary cost analysis	Initial investments - Building (if nonexistent) - Equipment (if not reused) Operating costs - Wages (non-volunteer) - Electricity and heating - Shipping - Office expenses, etc. See Rhissa, Z. O., & Tremblay, D. (2015). *Les Banques alimentaires du Québec : Rapport annuel 2014-2015,* www.banquesalimentaires.org.
Potential partners	• Québec food banks • Stores • Community organizations

Potential sources of funding	Check the Recyc-Québec website each year for potential funding sources: https://www.Recyc-Québec.gouv.qc.ca/entreprises-organismes/mieux-gerer/aide-financiere-entreprises-organismes Québec food banks

2.1.2 Sample food donation consultants and suppliers

Suppliers and consultants	Skills and equipment	Location	Contact information
Food banks of Québec	Foodstuff management	Montréal	https://www.banquesalimentaires.org/ info@BanquesAlimentaires.org
Food banks of Canada	Foodstuff management	Building 2, Suite 400, Mississauga, ON L4W 4Y5.	Tel.: 905-602-5234 Toll-free: 1-877-535-0958

2.1.3 Relevant literature on food donation

Mots-clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Supermarché, gaspillage alimentaire	Cet essai discute du gaspillage alimentaire dans les épiceries : causes, conséquences, situation du Québec, solutions, recommandations. • Recommandation 1 : Favoriser la vente de fruits et légumes déclassés dans les épiceries (p. 67) • Recommandation 2 : Améliorer le système des dates de péremption des aliments (p. 68) • Encourager et faciliter le don alimentaire (p. 69) • Détourner les déchets organiques de l'enfouissement (p. 72) • Étudier et documenter la problématique du gaspillage alimentaire (p. 74).	Province du Québec	Darrieu, J. (2016). Solutions pour réduire le gaspillage alimentaire dans les épiceries du Québec. Essai, Université de Sherbrooke.

Supermarché, gaspillage alimentaire, rapport gouvernemental	Cet article présente un projet de l'ADEME sur le gaspillage alimentaire dans les supermarchés. *"En France, la grande distribution pourrait diminuer son gâchis alimentaire de 22% en trois mois grâce à des actions simples, estime l'Agence de l'environnement et de la maîtrise de l'énergie (Ademe)".*	France	Senet, S. (2016). Les supermarchés peuvent facilement réduire leur gaspillage alimentaire, Journal de l'environnement, 17 novembre 2016, (pp. 1).
Rapport annuel, banques alimentaires	Ce document est le rapport annuel 2014-2015 des Banques alimentaires du Québec. Ce document présente les coûts d'infrastructure et les coûts de gestion liés aux banques alimentaires.	Au Québec	Rhissa, Z. O., & Tremblay, D. (2015). *Les Banques alimentaires du Québec : Rapport annuel 2014-2015*. Les banques alimentaires du Québec, banquesalimentaires.org.
Sécurité alimentaire, gaspillage alimentaire, don alimentaire	Le projet *Agir pour se nourrir* est né d'une concertation entre les partenaires locaux et régionaux dans le but de soutenir les communautés locales mobilisées en sécurité alimentaire.	Région Chaudière-Appalaches	http://www.agirpoursenourrir.ca/intervenants/le-don-d-aliments.php
Frigo collectif	*« Le principe est simple : quiconque peut à tout moment y déposer de la nourriture comestible ou en retirer la quantité de son choix. Aucune autorisation n'est nécessaire. Les fruits, les légumes et les produits emballés en industrie sont les bienvenus, tout comme les plats cuisinés».*	Montréal	http://plus.lapresse.ca/screens/f2a2023c-51f6-4bb2-923f-3da55036c623%7C_0.html
Cuisines communautaires ou collectives	Les cuisines communautaires permettent de cuisiner rapidement certains aliments proches de la date de péremption pour ensuite être distribués aux gens dans le besoin. Le site du Regroupement des cuisines collectives du Québec regroupe de nombreuses informations et documents. Plusieurs régions du Québec comptent aussi des regroupements locaux.	Montréal	http://www.rccq.org/fr/

TOOL 2.2: SMALL-SCALE HOUSEHOLD OR COMMUNITY COMPOSTING

Following reduction at source action, communities can implement organic matter composting.

Composting is the process of aerobic biological reclamation that transforms organic waste into a stable and hygienic matter known as compost.

Household composting is an interesting solution for diverting organic waste from NL incineration. NL combustion is much more efficient when the incinerated waste has low moisture content, which is not the case for organic waste. Household composting can only be used for vegetable organic matter, untreated wood, paper and cardboard.

2.2.1 What you need to know about household or small-scale community composting

How	Individual or community composting generally use wooden or small plastic composters whose useful volume is less than 50 m^3, although some may use a windrow system, as is the case in Kuujjuaq. The advantage of household composting is that it usually forestalls collection. However, for reasons of hygiene and safety, household composters only process vegetable organic matter. Composting raw input cannot exceed 150 m^3 at a time to avoid applying for an environmental authorization certificate. This, however, should not argue against a project, so can be worth the effort. If a composting project having an input volume greater than 150 m^3 is set up, the request for a certificate of authorization should be sent to the appropriate regional office. The certificate of authorization process is much less difficult than obtaining an environmental assessment, and cost $654 in 2016. A guide to the process is available on the MDDELCC website at (http://www.mddelcc.gouv.qc.ca/matieres/reclamation/lignesdirectrices/compostage.pdf). **Location** The importance of choosing an optimal composting site cannot be overstated. The location should be flat, well drained, and at a sufficient distance from wells, waterways and underground drainage pipes. **Collection** There is usually no need for collection, because composting is done right at home. If community composting is the choice, organic matter must be delivered by residents and prepared by volunteers or employees with structuring materials (a source of carbon) in order to obtain an optimal mix that should be regularly stirred.

Composting stages

1. Work the soil where you intend to locate the composter.
2. Once the composter has been set up, cover the bottom with a row of small branches. This will facilitate air circulation and improve drainage.
3. Alternate wet (e.g.: kitchen scraps) and dry residues (e.g.: garden trimmings).
4. Add mature compost to accelerate the start of the composting process.
5. Stir the heap often to aerate it.

A small rotary cylinder can also be used to accelerate composting, but even in this case, mature compost should be added as an accelerant.

For structuring materials, use cardboard and wood chips.

Duration

In Northern environments, composting can last all summer. Winter composting is difficult if the system is not protected from the cold and bad weather, because snow will reduce access and interrupt the bacterial process. You can always pile up organic matter to ripen in winter, allowing extra space for composting.

Required Infrastructure

Three types of infrastructure are suggested for small-scale composting: plastic or wooden composting boxes; windrows or small rotary cylinders.



Ground contact is usually recommended, since this will facilitate decomposing micro-organism acquisition and accelerate composting.

In Northern conditions where the ground freezes over early, a judicious solution may consist of adding mature compost to hasten the start of composting in rotary cylinders. This has the advantage improving heat retention and ventilation, facilitating handling and accelerating the composting process.

Training needs	All site operators need to be trained in the handling of organic matter and the composting process (brown and green matter dosage). Resident and grocery manager and employee awareness campaigns are essential for encouraging participation, and training should be provided in recognizing various kinds of accepted organic matter. High project performance usually involves attitudinal change and, as such, awareness and training programs are essential. Awareness and training programs for individuals and companies can minimize compostable cross-contamination and increasing collection efficiency.
Applicable regulations and standards	Reading the Regulation attentively and discussing it with the MDDELCC regional office is important, since several types of cases are possible. • See the linked MDDELCC publication on oversight guidelines for composting: http://www.mddelcc.gouv.qc.ca/matieres/reclamation/lignesdirectrices/compostage.pdf • See the linked guide to compostable inventory management that includes a section on applicable regulations and standards (applicable to household and closed thermophilic composting) https://www.Recyc-Québec.gouv.qc.ca/sites/default/files/documents/Guide_technique_compost_ici.pdf • See also the linked technical sheet on managing municipal organic matter: http://www.ec.gc.ca/gdd-mw/3E8CF6C7-F214-4BA2-A1A3-163978EE9D6E/13-047-ID-458-PDF_accessible_FRA_R2-reduced%20size.pdf
Potential job creation	**Part-time jobs** • One compost project implementation manager • One composter operator **Full-time jobs (community site)** • One compost site operator • One quality control employee, also to be in charge of organic matter management monitoring and sensitizing community residents and grocery store staff.

Preliminary cost analysis	**Initial investments** • The composter can be built at modest cost using recycled materials • If composting is to continue through the winter months, the equipment should be sheltered from the cold and bad weather. Depending on the type of shelter and whether or not it is used for other purposes, fixed asset investment costs will vary, and there is no reason not to reuse construction material and/or existing infrastructure. • Wood chippers cost approximately $20,000. • For community composting, residents and business will need bins or bags. Bins whose capacity is between 120 and 360 litres cost between $80 and 160.[1] **Operating costs**: - Composting site operations will run around ten hours per week - Structuring materials can be bought if required, but can also come from recovered materials like cardboard or wood - Plastic (including compostable) bags cost between 10 and 60 cents each at grocery stores
Potential partners	• Environmental and sustainable development committees • Social reinsertion organizations • ZIP or community organizations, etc.
Potential sources of funding	Check the Recyc-Québec website each year for potential funding sources: https://www.Recyc-Québec.gouv.qc.ca/entreprises-organismes/mieux-gerer/aide-financiere-entreprises-organismes

1: Unless stipulated to the contrary, estimated costs shown in the tables do not include shipping or handling, which can vary greatly among Northern communities.

2.2.2 Sample household and/or community composting consultants and suppliers

Suppliers and consultants	Skills and equipment	Location	Contact information
Jim Little	Installation of a community composting system in Iqaluit	Iqaluit P.O. Box 1839 IQALUIT NT X0A 0H0 Canada	http://www.companiesofcanada.com/person/279340/jim-little

Comité ZIP Côte-Nord du Golfe	Environmental awareness and education, community RM management actors.		406 Avenue Arnaud Sept-Îles(Québec) G4R 3A9 Telephone: 418.968-8798 Fax: 418.968-8830 Email: info@zipcng.org
Ungava Supervised House	This community organization set up a community composting site for vegetable organic matter only.	Kuujjuaq	P.O. Box 990 KUUJJUAQ, QUÉBEC J0M 1C0

2.2.3 Relevant literature on household and/or community composting

Mots-clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Résidus alimentaires du secteur résidentiel	Cet article précise que le compost par andains est possible au nord du 55^{e} parallèle et que ce type de gestion est utile dans une stratégie globale. *"If compost is to be widely distributed or sold, it must meet certain criteria to be designated as 'Class-A.' It must reach an internal core temperature of 55 ˚C for at least two weeks to kill pathogens like salmonella and E. coli, which are bound to arise from manure, diapers and egg shells.* *"It is illegal to sell compost unless it has met that standard - period," said Little.* *Currently, the program uses the simplest, low-tech method called windrow composting. One of the things Little says he managed to prove was that Class-A compost was possible in the Arctic, much to the surprise of southerners.* *"Nobody here thought that was possible," he said. "Our ambient temperature is below zero for most of the year. We're sitting on permafrost.* *"We've proved that we can.""*	Iqaluit	**Worden, P. (2013). Fertile ground for compost program.** **Northern News Services** **Published Monday, January 21, 2013** **http://www.nnsl.com/frames/newspapers/2013-01/jan21_13fg.html** **IQALUIT**

Matières organiques alimentaires, compostage par andains	Ce blogue présente le compostage d'Iqaluit. *"Here's how it works:* *1. Program participants collect organic waste in green bins (provided by the compost program). A description of what counts as organic material is available on Compost Iqaluit's now defunct blog.* *2. Participants buy into the program ($25 annually) to receive a green bin and have their names added to the pick up list.* *3. Every two weeks, the compost truck drives around town to pick up the waste.* *4. The bins are emptied onto the flatbed of the truck.* *5. Once all the waste is collected, it is brought to the compost site on West 40.*	Iqaluit	**Anubha and Sara, (2014).Composting in Iqaluit: Our firsthand account of a dirty job. Blog: Finding true North. 7 sept. 2014.**
Matières organiques alimentaires	Ce court texte décrit le processus théorique de compostage et comment en faire à la maison.	Alaska, mais concept général applicable partout	**Seefeldt, S. (2015). Composting in Alaska. University of Alaska Fairbanks Cooperative Extension Service, 12**.
Limites et facteurs de succès	Site de compostage de faible envergure	Au Québec	**https://www.recyc-quebec.gouv.qc.ca/municipalites/matieres-organiques/residus-verts/scenarios-gestion/gestion-decentralisee/site-compostage-faible-envergure**

TOOL 2.3: CLOSED THERMOPHILIC COMPOSTERS

The use of closed thermophilic composters are of economic interest in communities where the population exceeds 500 and that want to recover organic waste that includes meat, animal carcasses or even manure. Communities that are interested in this solution will need one or two mechanical composters of 16 to 32 feet in length; depending on generated volume (a 323-foor silo can compost approximately 250 tons/year).

2.3.1 What you need to know about setting up a closed thermophilic composter

How	In communities that have fewer than 2,500 residents and produce around 500 kg/week, a 32-foot mechanical composter can be used to avoid setting up leachate and animal waste processing facilities. Similarly, in communities where the population exceeds 5,000, two mechanical composters can handle requirements. Mechanical composters easily manage leachate without the use of a retention and processing tank and control undesirable animal odours. This type of system can process both vegetable and animal residues as well as manure. If the composter is well managed, the compost it produces can meet the standard for garden use, subject to chemical analysis. The composter can be sheltered or not and the organic waste shredded or not. The use of a shelter and shredding reduces composting time. "Before starting up your composting system, ensure the following: 1— The composter is operational; 2 — Your employees have been properly trained; 3— The collection system, including signage, is in place and operational; 4— The equipment needed for operation is available (portable thermometer for measuring the temperature of the compost, shovels, tools, collection bins, compostable bags, soap, etc.); 5 — A sufficient supply of wood chips and cardboard is available; 6 — The composting recipe is defined; 7— The data acquisition table is ready". Adapted from Fort, A., & Hénault-Éthier, L. (2010). **Location** The closed thermophilic composter must be installed on stable levelled ground. For use in winter, it is preferable (but not absolutely necessary) to shelter it from bad weather. For storing ripening compost, assume that one storage platform will need to be capable of handling 1 yd^3/3 tons of processed organic waste or 40% of the total volume of organic matter, wood chips and cardboard for one month (figures based on information in Fort, A., & Hénault-Éthier, L., 2010). **Collection** Organic waste collection can be performed manually or mechanically. The method of choice will depend on the type of truck used and the type of truck used will depend on the quantity of produced organic waste and collection frequency. In the majority of communities, waste is collected manually due to low population density and the use of manual collection trucks.

	• 50-litre bins should be used for manual collection
	• 120-litre bins should be used for mechanical collection
	Composting steps
	"Some tips for starting up your composting system:
	• Begin in summer ideally, when the composting process starts faster and requires less effort
	• Use semi-ripe compost, ripe compost or compost tea to inoculate your composter. This will also accelerate the start of the composting process. Volumes depend on the size of your system. If you work by batches, keep some compost from the preceding batch to inoculate of the new batch. Compost inoculators or accelerators sold commercially are often expensive as well as unnecessary
	• Start with organic waste with a low odour release potential such as raw fruits and vegetables or coffee grounds.
	• Make a multistage timetable such as the following:
	  • Stage 1 (1 month): raw fruits and vegetables, coffee grounds and filters
	  • Stage 2 (1 month): cereals
	  • Stage 3 (1 month): pastries and baked goods
	  • Stage 4: cooked meat and food
	• Leave time to monitor the composting process and adjustments and modifications
	• Establish a good communication relationship with the supplier of composting equipment."
	
	Adapted from Fort, A., & Hénault-Éthier, L. (2010).
	
	Generally speaking, the composting stages are as follows: 1—Collect the organic waste; 2 — Place the organic waste, wood chips and cardboard in the composter; 3 — Place the ripening compost in the designated area.
	
	Duration
	Compost should remain in the mechanical composter for approximately 1 month and then be stored for another month to finalize ripening (information obtained from the manufacturer and from the data sheets listed in 2.3.3). The demand for oxygen drops during the compost's stabilization and ripening stages. The compost should be stirred once or twice during this 4-week phase.
	"*Ripening areas are often made of gravel, concrete or crushed asphalt and grounds are stabilized with lime or cement. Clay operating areas covered with a layer of topsoil or shavings have also been used. Usually, surfaces used for compost ripening are lined with clay or synthetic material to protect groundwater. […]The surfaces used for ripening should always have a slope of from 0.5 to 2% to foster surface water flow.*"

Required infrastructure	• Control system: programmable manual or automatic rotation • Loading method: sliding door or adjustable height shutter(see optional equipment list below) • Temperature monitoring: manual or digital with recorded values. More than one probe can be used, depending on need • Ventilation system (optional)

	• Bio-filter(optional) • Optional equipment: bio-filter, grinder, mixer, conveyer belt, bin lift, chimney ventilator, digital thermometer with automatic readout, platform, deflector, sieve, sleeve, tipping bin, customized stainless steel equipment • Compost ripening platform
Training and awareness needs	All site operators need to be trained in handling organic waste and composting procedures (organic matter/wood chip/cardboard balance). Residents should be offered an awareness program to encourage them to take part in the project and train them in distinguishing the various types of accepted organic waste. The same program should be made available to grocery store managers and employees. Education and training are essential for project performance, since behavioural changes are usually involved. Awareness and training programs for residents and businesses reduce contamination of organic matter and increase collection efficiency.
Applicable regulations and standards	• Closed thermophilic composters require a project notice. Environmental certificates are required when storage capacity exceeds 150 m^3/196 yd^3 • Compost organic waste analysis required for potential use in gardens if meat is composted.
Potential job creation	**Part-time jobs** One composting implementation project manager **Permanent jobs** One composting site operator (approximately 15 hours/week). One quality control and organic waste management control manager, also responsible for awareness and training for residents and grocery store employees (approximately 15 hours/month).
Preliminary cost analysis	**Example of costs for Kuujjuaq (2,500 residents)** **Infrastructure** - Appendix 1 provides a sample RFP for a community like Kuujjuaq (≈$100,000) - Bins of 120 to 360 litres in volume cost between $80 and $160 - Tractor (equipment may be locally available) - Collection truck (equipment may be locally available) **Recurring expenses** - Site manpower: 15 hours/week - Electricity: 2 Watts, 168 hours/week - Tractor: 30 litres/hour ≈ 1 h/week - Collection: 2 employees≈ 24 h/week

	- Collection truck: 30 litres/h ≈ 24 h/week
Potential partners	Environmental and sustainable development committees Social reinsertion organizations ZIP or community groups, etc. Mechanical composter suppliers
Potential sources of funding	Check the Recyc-Québec website each year for potential funding sources: https://www.Recyc-Québec.gouv.qc.ca/entreprises-organismes/mieux-gerer/aide-financiere-entreprises-organismes Programme d'aide au composteur domestique et communautaire: http://www.mddelcc.gouv.qc.ca/programmes/acdc/index.htm

2.3.2 Sample closed thermophilic composter consultants and suppliers

Suppliers and consultants	Skills and equipment	Location	Contact information
Groupe commercial Paul Larouche	Rotary mechanical composters, training and monitoring programs	Cowansville	244, Jeanne-Mance Cowansville QC J2K 5C1 Tel. 450-574-2000 http://www.compost-gcpl.com/contact/
X ACT Systems	Rotary mechanical composters	Consecon, Ontario	5448 Prince Edward Rd. 1 Consecon, ONE, K0K 1T0 T: 613-399-5686 http://xactsystemscomposting.com/contact-us/
Hotrot Composting Systems	Mechanical composters	Europe	Hatch, Gerald Tibbo, Director, Solid Waste Division, (902) 442-2020, http://www.hotrotsolutions.com/
École de Technologie supérieure	Mechanical composter expertise	Montreal	Jérémie Forget 1100, rue Notre-Dame Ouest Montreal, QC H3C 1K3 Jeremie.Forget@etsmtl.ca (514) 435-0715
R4.CONCORDIA.CA	Mechanical composter expertise	Montreal	Alexis Fortin R^4 Compost project manager Health and safety Department, Concordia University R4compost@gmail.com 514 - 848 - 2424 ext. 5139

2.3.3 Relevant literature on closed thermophilic composters

Mots-clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Composteur Brome, La Romaine, fiche d'information	*« À la fin de l'été 2009, un premier composteur modulaire de 6 x 32 pieds, d'une capacité d'environ 200 tonnes par année a été installé au campement Kilomètre 1 afin de pouvoir transformer les résidus alimentaires de la cafétéria en compost. Hydro-Québec a arrêté son choix sur un composteur rotatif modulaire BROME fabriqué au Québec principalement pour sa simplicité d'utilisation et sa facilité d'installation. Ce système leur permet de composter une grande quantité de matière organique à un moindre coût que l'enfouissement. Le composteur est installé à proximité de la cafétéria sur quatre blocs de béton* ».	La Romaine Hydro-Québec	Fortin, A., & Hénault-Éthier, L. Guide technique pour le compostage sur site en ICI. Recyc-Québec: https://www.recyc-quebec.gouv.qc.ca/sites/default/files/documents/Guide_technique_compost_ici.pdf. p. 260-261
Composteur Brome, Université, fiche d'information	*« Avant l'acquisition d'un composteur Modulaire Brome par l'université, c'était la compagnie Sani-Estrie qui effectuait les collectes des matières compostables et GSI Environnement traitait les matières à ses installations de Bury. En 2007, environ 11 tonnes de déchets alimentaires ont été envoyées au site de compostage. En 2008, le double, voire le triple, de cette quantité était prévu.* *Fin 2009, l'université s'est dotée d'un composteur industriel pour composter ses matières organiques sur son site. Jusqu'à maintenant, environ 20 tonnes de matières ont été compostées depuis 7 mois d'opération. En plus du composteur, une plateforme couverte et étanche en béton a été installée pour la maturation du compost. L'université désirait composter toutes ses matières incluant les produits d'origines animales et à ce moment, le MDDEP exigeait une plate-forme de maturation dans ces conditions. Le compost aurait pu maturer dans le composteur, mais ceci aurait diminué le rendement de l'équipement et il était plus économique de terminer la maturation en dehors du composteur ».*	Université de Sherbrooke	Fortin, A., & Hénault-Éthier, L. (2010). Guide technique pour le compostage sur site en ICI. Recyc-Québec: https://www.recyc-quebec.gouv.qc.ca/sites/default/files/documents/Guide_technique_compost_ici.pdf. p. 222-226.
Composteur Brome, Université, fiche	*« L'objectif à long terme de cette installation est de composter 100 tonnes de matières organiques par année. Le modèle rotatif sélectionné*	Campus Loyola,	Fortin, A., & Hénault-Éthier, L. (2010). Guide technique pour le compostage sur site en ICI. Recyc-

d'information	*mesure 16 pieds de long et 8 pieds de diamètre et a un volume utile de 14m^3. L'avantage du système choisi est qu'il permet de traiter non seulement les résidus végétaux préconsommation, mais aussi les résidus postconsommation parce qu'il fonctionne en continu, qu'il assure une bonne homogénéisation du compost et un bon suivi des températures. Le système est jumelé à un lève-bac hydraulique afin de permettre des opérations ergonomiques et sécuritaires tout en traitant des volumes importants.[…]* *Un étudiant travaille 15 heures par semaine aux opérations de compostage. Cette personne est en charge de faire un suivi des quantités compostées, d'intégrer les matières organiques dans le composteur selon une recette préétablie, de laver les bacs vides, de faire un suivi des températures et des autres paramètres du compost. Lorsque le compost quitte le composteur rotatif, il est accumulé dans une benne versante de 2 verges cubes. Celle-ci est manipulée par un tracteur muni de fourches pour élever le bac.* *Le compost stabilisé est accumulé en tas accumulés sur le sol (terrain gazonné) dans un endroit reculé du campus pour une période de maturation de quelques mois. Des tuyaux de PVC de 4 pouces et perforés sont enfouis dans les piles pour permettre l'aération passive des tas. Les piles sont aussi recouvertes de bâches de polyéthylène pour limiter l'évaporation et l'exposition aux intempéries. Périodiquement, des échantillons de compost sont testés en laboratoire pour assurer leur innocuité et leur maturité. Lorsque le compost est mature, il est utilisé pour l'aménagement paysager du campus.* *[…]* *Globalement, le coût relié aux infrastructures représente un investissement d'environ 70,000 $. Le coût de la main-d'œuvre est relativement faible puisque la majorité des participants réorganisent simplement leurs tâches journalières et que seul un étudiant à temps partiel supplémentaire a dû être engagé (10,000 $ par an, partiellement subventionné). Notez que pour l'élaboration de notre projet, un coordonnateur de compostage a été recruté pour aider à l'implantation, au développement et à la résolution de problèmes (20,000 $ par an pour 5 ans) […]*	Montréal	Québec: https://www.recyc-quebec.gouv.qc.ca/sites/default/files/documents/Guide_technique_compost_ici.pdf. p. 217-221.

	Les opérations demandent aussi très peu d'investissements chaque année pour assurer un entretien de la machinerie, acheter les sacs compostables et les copeaux de bois, faire les tests de laboratoire, etc. (jusqu'à 12,000 $ par an en 2012)».		
Fumier, résidus de poisson, résidus de table	Ce court texte propose une marche à suivre en 7 étapes pour composter les matières organiques. Le texte propose également les ratios de mélange brun et vert pour différents types de matières organiques. 4 à 12 semaines de compostage	Alaska, mais concept applicable partout	Rader, H. (2012). The Compost Heap Basic Composting in Alaska. University of Alaska Fairbanks Cooperative Extension Service, 4.
Animaux de ferme	Ce rapport discute des avantages et inconvénients de la gestion des résidus d'abattoir. Plus spécifique aux processus de compostage mais touche également : gazéification, incinération, brûlage et digestion anaérobique. Le document parle également d'exigences en matière de sécurité alimentaire et de risque de transmission de maladies.	Yukon	CAAP. (2012). Analysis of waste Management strategies for on-farm meat processing. Canadian Agricultural Adaptation Program.
Carcasses de dindes	Cet article montre la faisabilité de composter des carcasses animales dans des conditions climatiques froides. « *On-farm composting in North Dakota showed that colder temperatures may lengthen the composting process, but the process still is viable. Locally available sunflower hull-based turkey litter was able to sustain a temperature of 131 degrees Fahrenheit that is required to kill most pathogens. However, managing the moisture content in the compost is very important, especially when nontraditional carbon additives such as sunflower hulls are used in combination with turkey litter* ».	Dakota du Nord	Rahman, S., & Stoltenow, C. (2010). On-farm Turkey Carcass Composting and Management Issues Under North Dakota Climatic Conditions. NDSU agriculture, North Dakota State University, 4.
Tous les types de matières organiques	Cet article discute des risques liés à la gestion des matières organiques pour le traitement par compostage ou par méthanisation, et ce pour différents types de matières organiques. « *Les éléments de protection seront à prendre en compte par le concepteur (C) ou l'employeur (E) selon le cas. Par exemple :* • *Adapter le poste de travail (C+E) et le temps de travail (E) à la*	France	Zdanevitch, I. (2011). Les conditions de travail dans les installations de compostage et de méthanisation, Colloque national ADEME -Prévention et gestion des déchets dans les territoires (pp. 7). Nantes, France: ADEME. Angers.

	pénibilité et à la répétabilité des tâches; • *Former le personnel (E), lui fournir en tout temps les protections adaptées (EPI : E, mais aussi protections collectives au niveau des zones du process : C)* • *Assurer le suivi du personnel en termes de santé, y compris dans le temps (E),* • *Maintenir les locaux propres : E (action facilitée si elle a été prévue dès la conception : C)* »	
Limites et facteurs de succès	Site de compostage de faible envergure	https://www.recyc-quebec.gouv.qc.ca/municipalites/matieres-organiques/residus-verts/scenarios-gestion/gestion-decentralisee/site-compostage-faible-envergure
Fiche d'information	La collecte municipale des matières organiques	https://www.recyc-quebec.gouv.qc.ca/citoyens/matieres-organiques/collecte-municipale
Rapport, compostage, collecte,	Collection « Logistics and cost »	Rapati, K. (2014). Feasibility of Centralized Composting in Hay River, Northwest Territories, Canada. Ecology North: The Town of Hay River, Choice North Poultry Farm, the Territorial Farmers Association and Environment Canada. p.27 à 33 http://www.ecologynorth.ca/wp-content/uploads/2014/09/Hay-River-Composting-Study-of-Options-March-2014.pdf
Collecte dans les supermarchés et restaurants	Le projet ComposTable, instauré en 2006, visait à intégrer de manière permanente la collecte des matières compostables dans les commerces de restauration et d'alimentation de la ville de Saguenay.	http://ecoconseil.uqac.ca/wp-content/uploads/2012/05/Guide-dapplication_Mise-en-oeuvre-dun-programme-de-collecte-de-mati%C3%A8res-compostables.pdf

TOOL 2.4: WINDROW COMPOSTING

A windrow composting site with leachate management is required when the volume of waste to be composted exceeds 150 m^3 and community wants to include meat, carcasses and/or manure. It should be noted that the volume of organic waste produced by the largest of the three communities in this study does not exceed the thermophilic limits of two closed composters and that the cost of this kind of system is lower than industrial windrow composting. This kind of system also limits animal access and impacts due to bad weather.

2.4.1 What you need to know to set up a windrow composting site

How	If feedstock is sufficient, windrow composting can process vegetable waste as well as animal carcasses and manure. However, if the volume of stored organic waste and chips exceeds 150 m^3, a system for processing leachate is required by law and, consequently, an application for environmental authorization is needed. Even when no certificate of authorization is needed, a project notice must be submitted, and compost analysis must be conducted to determine how it can be used. **Location** Windrow composting requires more space than a closed thermophilic composter. As such, a surface must be set up that is sufficient in area to accommodate organic waste, wood chips and cardboard, windrow composting, ripening, the leachate treatment basin and storage of the finished compost. **Collection** Organic matter can be collected mechanically or manually. The choice of the method will depend on the type of truck used, and the type of truck used will depend on the quantity of produced organic waste and collection frequency. The majority of communities collect waste manually, because of low population density and the type of truck used. • For manual collection, 50-litre bins should be used • For mechanical collection, 120-litre bins should be used **Composting stages** Generally speaking, the composting stages are as follows: 1 — Collect the organic waste; 2 — Place the organic waste, wood chips and cardboard in windrows; 3 — Place the ripening compost in the designated area. **Duration** Windrow composting can require between 2 and 3 months (more than 6 months in winter), after which the compost must be stored to finalize ripening. The demand for oxygen drops during the compost's stabilization and ripening stages. The compost should be stirred once or twice during this 4-week phase.

	"*Ripening areas are often made of gravel, concrete or crushed asphalt and grounds are stabilized with lime or cement. Clay operating areas covered with a layer of topsoil or shavings have also been used. Usually, surfaces used for compost ripening are lines with clay or synthetic material to protect groundwater. […]The surfaces used for ripening should always have a slope of from 0.5 to 2% to foster surface water flow.*" Available documentation is vague about windrow duration for Northern climate conditions. When we visited Kuujjuaq, windrow composting lasted from all summer to a full year, depending on the temperature.
Required Infrastructure	See: *Rapati, K. (2014). Feasibility of Centralized Composting in Hay River, Northwest Territories, Canada.* Ecology North: The Town of Hay River, Choice North Poultry Farm, the Territorial Farmers Association and Environment Canada.
Training needs	All site operators need to be trained in handling organic waste and composting procedures (relative balance of brown/green matter). Residents should be offered an awareness program to encourage them to take part in the project and train them in distinguishing the various types of accepted organic waste. The same program should be made available to grocery store managers and employees. Education and training are essential for project performance, since behavioural changes are usually involved. Awareness and training programs for residents and businesses reduce contamination of organic matter and increase collection efficiency.
Applicable regulations and standards	• You will need an authorization certificate if you store more than 150 m3 of organic waste (including wood chips) at any given time on your s composting site • You will need a compost analysis for gardening end-use if meat is included in the feedstock
Potential job creation	See: *Rapati, K. (2014). Feasibility of Centralized Composting in Hay River, Northwest Territories, Canada.* Ecology North: The Town of Hay River, Choice North Poultry Farm, the Territorial Farmers Association and Environment Canada.
Preliminary Cost Analysis	See: *Rapati, K. (2014). Feasibility of Centralized Composting in Hay River, Northwest Territories, Canada.* Ecology North: The Town of Hay River, Choice North Poultry Farm, the Territorial Farmers Association and Environment Canada.
Potential partners	Fédération des Coopératives du Nouveau-Québec Waban-Aki Energy

Potential sources of funding	Programme d'aide aux composteurs domestiques et communautaires : http://www.mddelcc.gouv.qc.ca/programmes/acdc/index.htm

2.4.2 Sample windrow composting consultants and suppliers

Suppliers and consultants	Skills and equipment	Location	Contact information
Englobe	Englobe hires organic waste management consultants skilled at contaminated soil stabilization in Northern environments. *The following information was gleaned from conversations with the Englobe site in Saint-Henri (Montréal): "We recover in excess of 400,000 tons/year of municipal biosolids and paper mill sludge and residues. Our composting sites produce more than 100,000 tons/year of compost and humus for use by horticultural, municipal and commercial clients. We also use composting to produce fertilizing waste or FRMs."*	Québec	Englobe Telephone: 450-929-4949, www.englobecorp.com
Waban-Aki Energy	Waste consultants for indigenous communities.	Québec	Don Murray, Eng. Don.murray@emispec.ca

2.4.3 Relevant literature on windrow composting

Mots clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Collecte, gestion des nuisances, normes et qualité du compost, systèmes de traitement, équipement	Ce document présente des informations techniques sur la mise en place de différents modes de traitement et de gestion des matières résiduelles organiques.	Québec	Environnement Canada. (2013). *Document technique sur la gestion des matières organiques municipales*. Environnement Canada, http://www.ec.gc.ca/gdd-mw/3E8CF6C7-F214-4BA2-A1A3-163978EE9D6E/13-047-ID-458-PDF_accessible_FRA_R2-reduced%20size.pdf.
Collecte, matières organiques, traitement des matières organiques, contrat, pratiques d'appels d'offres	Ce document dresse le portrait des meilleures pratiques d'appels d'offres en matière de traitement et de collecte des matières organiques.	Québec	Recyc-Québec. (2016). *Meilleures pratiques d'appels d'offres pour la collecte et le traitement des résidus verts et alimentaires* Recyc-Québec, https://www.recyc-quebec.gouv.qc.ca/sites/default/files/documents/Rapport%20DAO_ACC_VF%20%281%29.pdf.
Installations de compostage	*« A summary of the scenarios, base pad sizes and costs is in Table 11. Base pad sizes are based on the assumption that materials will be on-site for a total of two years, including active and curing stages. Proposed base pad sizes include areas for feedstock storage and finished compost storage ».*	Nunavut	Rapati, K. (2014). Feasibility of Centralized Composting in Hay River, Northwest Territories, Canada. Ecology North: The Town of Hay River, Choice North Poultry Farm, the Territorial Farmers Association and Environment Canada. P. 43 à 50 http://www.ecologynorth.ca/wp-content/uploads/2014/09/Hay-River-Composting-Study-of-Options-March-2014.pdf
Rapport, collecte	Collection « Logistics and cost »	Nunavut	Rapati, K. (2014). Feasibility of Centralized Composting in Hay River, Northwest Territories, Canada. Ecology North: The Town of Hay River, Choice North Poultry Farm, the Territorial Farmers Association and Environment Canada. p.27 à 33 http://www.ecologynorth.ca/wp-content/uploads/2014/09/Hay-River-Composting-Study-of-Options-March-2014.pdf
Guide, critères d'exploitation, équipement requis	Autorisation et exigences pour les nouveaux lieux de compostage	Québec	MDDELCC. (2012). Lignes directrices pour l'encadrement des activités de compostage. Développement durable, Environnement et Parc: Direction des matières résiduelles et des lieux contaminés. http://www.mddelcc.gouv.qc.ca/matieres/valorisatio

			n/lignesdirectrices/compostage.pdf
Méthode de collecte, traitement, étape d'implantation	Guide sur la collecte et le compostage des matières organiques du secteur municipal.	Québec	SOLINOV. (2006). Guide sur la collecte et le compostage des matières organiques du secteur municipal (pp. 129). Recyc-Québec. https://www.recyc-quebec.gouv.qc.ca/sites/default/files/documents/Guide-collecte-compost-mo-mun.pdf
Fumier, résidus de poisson, résidus de table	Ce court texte propose une marche à suivre en 7 étapes pour composter les matières organiques. Le texte propose également les ratios de mélange brun et vert pour différents types de matières organiques. 4 à 12 semaines de compostage	Alaska, mais concept général applicable partout	Rader, H. (2012). The Compost Heap Basic Composting in Alaska. University of Alaska Fairbanks Cooperative Extension Service, 4.
Animaux de ferme	Ce rapport discute des avantages et inconvénients de la gestion des résidus d'abattoir. Plus spécifique aux processus de compostage mais touche également : gazéification, incinération, brûlage et digestion anaérobique. Le document parle également d'exigences en matière de sécurité alimentaire et de risque de transmission de maladies	Yukon	CAAP. (2012). Analysis of waste Management strategies for on-farm meat processing. Canadian Agricultural Adaptation Program.
Carcasses de dindes	Cet article montre la faisabilité de composter des carcasses animales dans des conditions climatiques froides. « *On-farm composting in North Dakota showed that colder temperatures may lengthen the composting process, but the process still is viable. Locally available sunflower hull-based turkey litter was able to sustain a temperature of 131 degrees Fahrenheit that is required to kill most pathogens. However, managing the moisture content in the compost is very important, especially when non traditional carbon additives such as sunflower hulls are used in combination with turkey litter* ».	Dakota du Nord	Rahman, S., & Stoltenow, C. (2010). On-farm Turkey Carcass Composting and Management Issues Under North Dakota Climatic Conditions. NDSU agriculture, North Dakota State University, 4.
Tous les types de matières organiques	Cet article discute des risques liés à la gestion des matières organiques pour le traitement par compostage ou par méthanisation, et ce pour différents types de matières organiques. « *Les éléments de protection seront à prendre en compte par le*	France	Zdanevitch, I. (2011). Les conditions de travail dans les installations de compostage et de méthanisation, Colloque national ADEME -Prévention et gestion des déchets dans les territoires (pp. 7). Nantes, France: ADEME. Angers.

	concepteur (C) ou l'employeur (E) selon le cas. Par exemple : • *Adapter le poste de travail (C+E) et le temps de travail (E) à la pénibilité et à la répétabilité des tâches;* • *Former le personnel (E), lui fournir en tout temps les protections adaptées (EPI : E, mais aussi protections collectives au niveau des zones du process : C)* • *Assurer le suivi du personnel en termes de santé, y compris dans le temps (E),* • *Maintenir les locaux propres : E (action facilitée si elle a été prévue dès la conception : C)* »		
Municipalité, cas à succès, fiche technique	Ce document présente plusieurs cas à succès de différents organismes municipaux qui font la gestion des matières organiques.	Québec	Hénault-Éthier, L. (2012). *Gestion des matières organiques : cas à succès municipaux*. Recyc-Québec, https://www.recyc-quebec.gouv.qc.ca/sites/default/files/documents/Cas-succes-municipaux-mo.pdf.
Collecte dans les supermarchés et restaurants	Le projet ComposTable, instauré en 2006, visait à intégrer de manière permanente la collecte des matières compostables dans les commerces de restauration et d'alimentation de la ville de Saguenay.		http://ecoconseil.uqac.ca/wp-content/uploads/2012/05/Guide-dapplication_Mise-en-oeuvre-dun-programme-de-collecte-de-mati%C3%A8res-compostables.pdf

TOOLBOX #3

INVENTORY MANAGEMENT OF RECYCLABLES FROM THE RESIDENTIAL, INSTITUTIONAL, COMMERCIAL AND INDUSTRIAL SECTOR

3 MANAGEMENT TOOLS FOR RECYCLABLES

The goal of this toolbox is to help community leaders choose the optimal inventory management system for their domestic, institutional, industrial and commercial recyclables. The following decision tree (Figure 6) is useful in the decision-making process since it identifies the best management option for recyclables on the basis of the community's social realities and cultural values by taking account of real encountered issues.

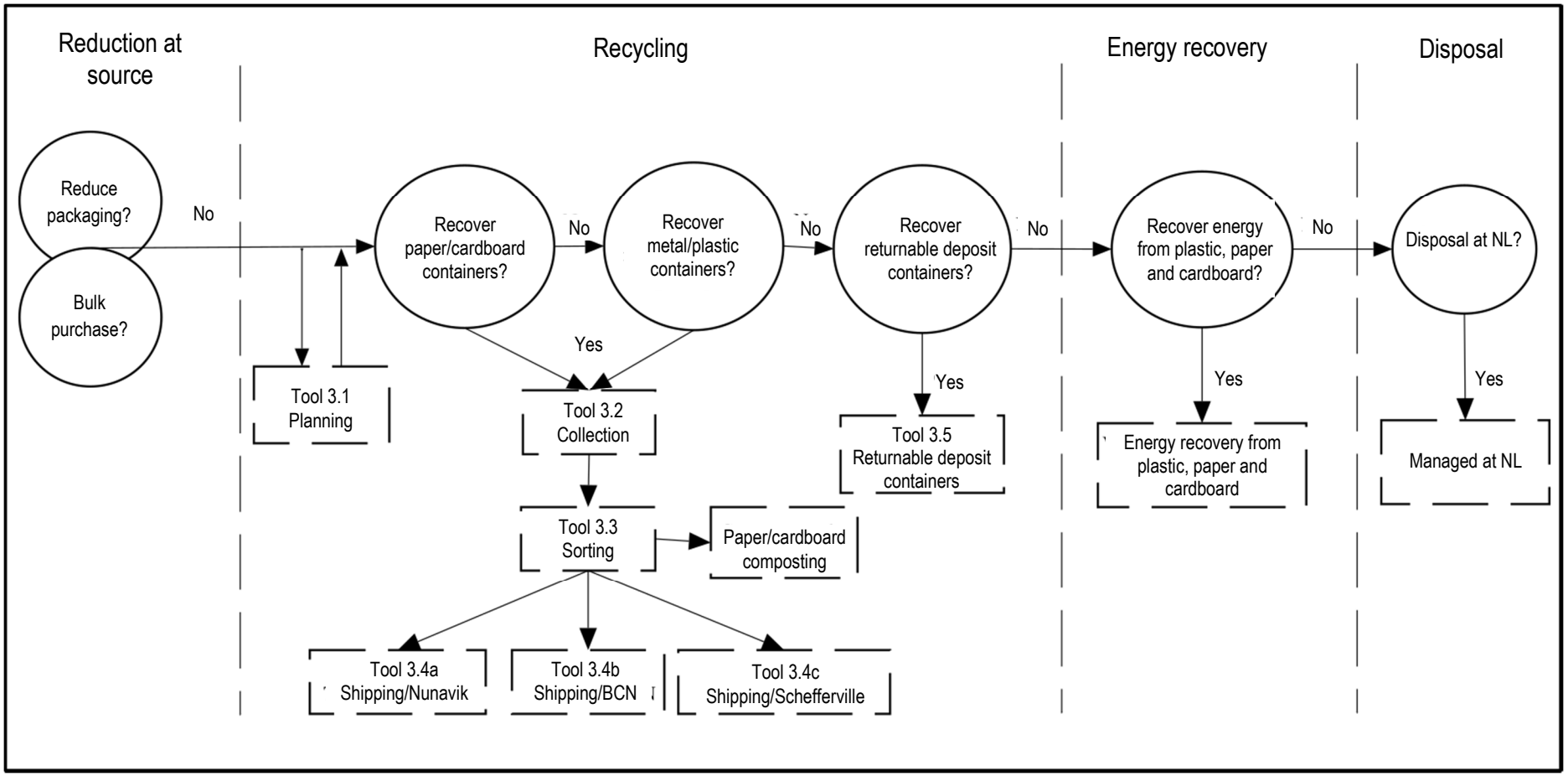


Figure 6: Decision tree — Inventory management for recyclables

The decision tree reads as follows:

- From left to right, the decision tree provides the reduction at source, recycling and disposal options
- Each circle contains a question and two arrowed YES/NO outputs towards a tool in dashed-line box
- The first stage of recyclables inventory management is reduction at source and/or re-use. The options at stage are mainly related to reducing packaging and, in general, bulk purchasing and container reuse.
- There follows recycling. This option can be done at various stages and even evolve over time, but implementation must be planned (Tool 3.1). Various recycling-related stages are described in three additional tools:
    6. Tool 3.2: Collecting recyclables
    7. Tool 3.3: Sorting recyclables
    8. Tool 3.4: Shipping recyclables
- If for any reason recycling proves impossible in a given period, energy recovery can be envisaged, in compliance with current standards. Plastic, paper, cardboard and wood recyclables can all be used for energy recovery.
- Disposal is also discussed as an option for recyclables inventory management if no other solution is available.

TOOL 3.1 PLANNING A MANAGEMENT SYSTEM FOR RECYCLABLES

The first stage of a waste management system is planning.

3.1.1 How to plan inventory management for recyclables

How	The first step in developing a management system for recyclable waste is an action plan. The planning stage can take between 6 months and 1 year. **What do you want to recover?** The following answers describe an evolutionary management process in a spirit of continual management improvement, from minimal to ideal. 1. The community wants to recover returnable deposit containers. 2. The community wants to recover metal containers to reduce materials stored at the NL. 3. The community wants to recover metal containers, paper and cardboard to reduce materials stored at the NL and produce structuring materials for the composting process. 4. The community wants to recover metal, plastic and cardboard containers, paper and cardboard to reduce materials stored at the NL, produce structuring materials for the composting process and reduce burning. **What can you recover?** It is sometimes difficult and/or too expensive to recover some types of recyclables. As such, a feasibility study should be prepared, or your action plan adjusted. 1- Discuss your issues with potential recovery enterprises: waste brokers, sorting centres, management organizations, etc. 2- Identify materials handling issues [see tools on Collection (3.2), Sorting (3.3) and Shipping (3.4)]. 3- Evaluate the costs and value of the materials (see the cost/benefit calculation tool). 4- Become familiar with current standards and regulations. It is very important to contact more than one recycler in order to determine who you will contract to acquire your recyclables, and set terms and conditions. For example, unsorted recyclables will cost at least $50/ton in disposal costs. However, some types of materials may be more profitable to recover than others and may therefore "fund" part of the process and compensate for the less profitable ones. For example, recovery by type of material consists in manufacturing bundles that have a commercial value. The following list provides the average value of bundles of different materials, based on Recyc-Québec 2016 information. The prices are indicative only and vary according to market conditions, time of receipt and quality. 1. Mixed plastics ≈ $287/ton 2. Plastic bags and film ≈ $114/ton 3. Plastic #2 ≈ $596/ton 4. Plastic #1, containers only ≈ $274/ton 5. Ferrous metals ≈ $167/ton 6. Aluminum, cans only ≈ $1,436/ton 7. Aluminum cans and packaging≈ $783/ton

	Still, it is essential to ensure that recyclers interested in a specific type materials specify their shipping requirements (bundles or bulk, dimensions, portside collection or not, hauling costs, etc.). Everything must be confirmed in writing or by means of a contract that will be of use in negotiating sea freight or railway costs (see tools 3.4 a-c on shipping issues). The preliminary discussions will have an impact on the number of containers needed for sorting, the dimensions of the sorting centre used for sorting, manipulating and/or storing, and equipment clearance height, required equipment, budget, etc. Proper planning will facilitate implementation and budget optimization. Similarly, this kind of discussion can make it possible see the various evolutionary stages of an ecocentre (Toolbox #4) that starts modestly with the recovery of only selected materials and eventually diverts everything possible from the NL, long-term. **Who is involved, and will they buy into the process?** While implementing a management system for recyclables requires participation by various organizations (see list below), community residents are especially important. Whatever your infrastructure, stakeholder support is vital to a functional recovery system: 1- Residents 2- The municipal body 3- The carrier 4- Institutions, business and industry 5- The recovery organization
Required infrastructure	Does not apply to planning. See the "sort" table below.
Training needs	Waste management training Ensure WM knowledge acquisition and monitoring (relevant articles, conferences and seminars on the subject for communities and municipalities)
Applicable regulations and standards	See http://www.mddelcc.gouv.qc.ca/matieres/loi-reg/index.htm The following is a partial list of relevant WM laws and regulations that were in effect when this study was made (2017). However, it is always necessary use the most recent versions, available on the LégisQuébec website. • *Environment Quality Act* • *Act to amend the Environment Quality Act and other legislation as regards the management of residual materials*, SQ 1999, c 75) • *Act to amend the Environment Quality Act, Draft Bill 25*, SQ 2001, c 59 • *Act to amend the Environment Quality Act* and the Act respecting the Société québécoise de récupération et de recyclage, *Draft Bill 102*, SQ 2002, c 59) • *Act to amend the Environment Quality Act and other legislative provisions, Draft Bill 130*, SQ 2002, c 53

	• *Act Respecting the Société Québécoise de Récupération et de Recyclage*, CQLR c S-22.01
	• *Act Respecting the Sale and Distribution of Beer and Soft Drinks in Non-returnable Containers*, CQLR c V-5.001
	• *Regulation respecting compensation for municipal services provided to recover and reclaim residual materials*, CQLR c Q-2, r 10
	• *Clean Air Regulation*
	• *Regulation respecting the recovery and reclamation of products by enterprises*, CQLR c Q-2, r 40.1
	• *Regulation respecting the recovery and reclamation of discarded paint containers and paints*, RRQ, c Q-2, r 41
	• *Regulation respecting the recovery and reclamation of used oils, oil or fluid containers and used filters*, RRQ, c Q-2, r 42
	• *Regulation Respecting Used Tire Storage*, CQLR c Q-2, r 20
	• *Regulation respecting the landfilling and incineration of residual materials*, CQLR c Q-2, r 19
	  • Amended—May 2011
	  • Since coming into effect, this regulation replaces the *Regulation Respecting Solid Waste*.
	• *Regulation respecting the reuse of water containers with a capacity exceeding 8 litres*, CQLR c Q-2, r 44
	• *Regulation Respecting Solid Waste*, CQLR c Q-2, r 13
	• *Regulation respecting financial guarantees payable for the operation of a residual organic materials reclamation facility*, CQLR c Q-2, r 28.1
	• *Beer and Soft Drinks Distributors' Permits Regulation*, CQLR c V-5.001, r 1
	• *Regulation respecting the charges payable for the disposal of residual materials*, CQLR c Q-2, r 43
	  • Amended - May 2011
	• *Regulation respecting environmental impact assessment and review*, CQLR c Q-2, r 23

Potential job creation	One project manager
Preliminary cost analysis	Project manager expenses For the cost of infrastructure see the "sort" table below. Since it is likely unprofitable to recycle Nunavik paper/cardboard in the South, the remaining two viable options are composting and reclamation/burning. This option should be considered for Basse-Côte-Nord and Schefferville but will probably not be optimal due to costs and emissions
Potential partners	Local social reinsertion and environmental organizations, as well as businesses Carriers Universities and colleges that offer RM training and/or research programs
Potential sources of funding	Recyc-Québec Municipal Green Funds The Basse-Côte-Nord and Caniapiscau RCMs can access the government levies compensation system If there is composting, two programs can be accessed - Aide aux composteurs domestique et communautaires

(http://www.mddelcc.gouv.qc.ca/programmes/acdc/) and Programme de traitement des matières organiques par biométhamisation et compostage (applies to large urban centres) () Forthcoming deadlines: Preliminary project – September 2017 – Final project – December 2017

3.1.2 Sample recyclables inventory management suppliers and consultants*

Suppliers and consultants	Skills and equipment	Location	Contact information
Gaudreau environnement	Sorting centre (multi-material bundles) for Nunavik and Basse-Côte-Nord communities	Rimouski, Victoriaville, Québec	365, boul. De la Bonaventure, P.O. Box 662. Victoriaville, QC G6P 6V7 Telephone: 819-758-8378
Federation des Cooperatives du Nouveau-Québec	Recycling in Nunavik	Montréal, Québec	19950 Clark-Graham Ave., Baie-d'Urfé, QC H9X 3R8 Tel. 514-457-4626
Desgagnés Transarctik Inc.	Sea freight/Nunavik	St. Catherine, Québec	Operations management 6565 Boulevard Hébert, suite 201 St. Catherine, QC J5C 1B5 Telephone: 450-635-0833 info@transarctik.desgagnes.com
NEAS	Sea freight/Nunavik	Salaberry-de-Valleyfield	Operations Luc Nadeau - term@neas.ca Claudia Iskra - term@neas.ca Toll-free: 1-888-908-0000 Telephone: 1-450-373-3379
Group Bouffard	Sorting centre (multi-material bundles) for Nunavik and Basse-Côte-Nord communities	Matane	561 Rue du Port Matane, QC G4W 3M6
Relais Nordik Inc.	Sea freight/Basse-Côte-Nord	Rimouski	Rimouski, QC Relay Nordik Inc. Tel.: 418-723-8787 Toll-free: 1-800.463-0680 http://relaisnordik.com/

Chaire en éco-conseil	Waste management consultant for isolated communities	Chicoutimi	555 boulevard de l'Université Saguenay (Québec) G7H2B1 Tel. 418-545-5011, ext. 2569
Services-conseils GMR	Sorting centre consultant for isolated communities	Chicoutimi	5904 Boulevard Talbot, Saguenay, QC Canada, G7N 1W1 (418) 817-1353
Solrec	Waste broker	Montreal	Jean-Michel Pinguet 1001 rue Lenoi, suite A-503, Montréal, Qc H4C 2Z6 1-438-795-9065 Jmp@bramidan.com
Recyclage Direct Inc.	Waste broker	Ville Ste-Catherine	

***Check the recycler directory for more details: https://www.Recyc-Québec.gouv.qc.ca/points-de-recuperation**

3.1.3 Relevant literature on planning recyclables inventory management

Mots clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Centre de tri	Annexe 2 : Expérimentation sur la gestion des matières résiduelles	Chicoutimi	Rapport sur la gestion des matières résiduelles en milieu nordique et isolé, en rédaction.
Contenants récupérables, frais, statistiques	Ce document est un rapport d'un projet pilote sur la mise en place d'un système de gestion de contenants recyclables.	Iqaluit	Strong, G. (2010). Evaluation of Recycling Pilot Projects - Final Report. Department of Environment, Government of Nunavut, http://www.gov.nu.ca/sites/default/files/Evaulation%20of%20Recycling%20Pilot%20Projects%20-%20Final%20Report%20-%20March%202%202010.pdf
Collecte, porte-à-porte	Guide sur les options de collecte pour les matières organiques. Certains éléments pourraient être repris pour la collecte des matières recyclables. À évaluer.	Québec	https://www.recyc-quebec.gouv.qc.ca/municipalites/matieres-organiques/residus-verts/documents-outils-pratiques-planification/guide-options-collecte
Prix de la matière recyclable	Ce site présente les indices de prix des matières recyclables	Québec	https://www.recyc-quebec.gouv.qc.ca/municipalites/collecte-selective-municipale/indice-prix-matieres
Inventaire, guide de	Ce site présente les différents outils pour la réalisation d'un plan de	Québec	https://www.recyc-

concertation	gestion des matières résiduelles. Les outils doivent cependant être évalués dans l'optique d'un environnement nordique.		quebec.gouv.qc.ca/municipalites/mieux-gerer/plan-gestion-matieres-residuelles/boite-outils-pgmr
Lignes directrices, plan de gestion des matières résiduelles	Ce document présente les étapes menant à un PGMR : *« Les lignes directrices pour la planification régionale de la gestion des matières résiduelles visent à établir le cadre permettant au ministre du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC) de juger de la conformité des plans de gestion des matières résiduelles (PGMR) que doivent produire les municipalités régionales en vertu de la Loi sur la qualité de l'environnement (LQE) ».*	Québec	Ministère du Développement durable de l'environnement et de la lutte contre les changements climatiques (MDDELCC). (2013). *Lignes directrices pour la planification régionale de la gestion des matières résiduelles, version révisée en février 2015*. Québec, ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques, Direction des matières résiduelles, 63 pages.

TOOL 3.2: COLLECTING RECYCLABLES

The collection of waste is the first stage in the recovery of recyclables, but it is essential to have initially established adequate sorting facilities and firm agreements with recyclers.

3.2.1 How to collect recyclables

How	Collection can either proceed by door-to-door pickup or resident self-delivery of waste to a drop-off point. Here are our suggestions, based on the size of the local population: ➢ If the population is less than 500: self-delivery is the right choice ➢ If the population is between 500 and 1,000: self-delivery to collection points (perhaps by neighbourhood) is as valid as door-to-door pickup ➢ If the population exceeds 1,000 inhabitants: door-to-door collection is the more appropriate method When self-delivery is used, collection points (a container, bin or designated area of a building) are needed for residents to drop off their bagged recyclables. Whatever the choice, the signage must be easy-to-understand. Recyc-Québec does propose signage at https://www.Recyc-Québec.gouv.qc.ca/citoyens/mieux-recuperer/pictogrammes-signalisation, but signage colour and shape should be adapted to local customs. Ideally, the central collection point will be near the current or future sorting centre or a location that residents pass frequently, such as close to a business. Smaller communities may use an adapted pick-up truck for door-to-door collection, as we saw in Chevery in the Basse-Côte-Nord. Larger municipalities such as Kuujjuaq may use a dump truck specifically kitted out for residual material collection. Door-to-door collection of recyclables is similar to waste collection, but done separately to avoid mixing organic waste into the recyclables. One estimate, using information from the municipality of Kuujjuaq, is that the collection process carries 4.6 m^3 (6 yd^3) per hour. This figure can be used to evaluate collection shipping needs once RM flow is well-known.  **A collection truck in Aupaluk (source: Pierre-Luc Dessureault, Chaire en éco-conseil)**

	The ideal recyclable management system involves residents performing initial sorting of waste at home or in their industrial, commercial or institutional place of work and placing each type in the appropriate bag or bin. Transparent bags or open bins are preferable. We recommend that the containers are clean and pre-compacted if possible. Consumer container compacting (see the case cans below in section 3.4) or the use of a manual baler costing approximately $30 on site reduces domestic/institutional storage volume and makes it possible to ensure that liquids and food matter have been removed. This in turn reduces pest problems later in the process. Consumer compaction is not absolutely necessary but is useful if recyclables are processed in bulk without compaction at the sorting centre (See the reports of our Basse-Côte-Nord visits). Usually, compaction is handled at the sorting centre using a baler whose capacity is at least 30 tons. If a less powerful baler is used (e.g., a cardboard baler) overload charges may be added by the regional sorting centre. If the voluntary drop-off option is used, residents will have to bag or bin their recyclables and leave them at the drop-off points. If door-to-door pick-up is used, residents will have to place the pre-sorted bags by the curb (if composting is involved, it would be preferable to separate out paper and cardboard) where collection is carried out using a truck. Debagging is then performed at the sorting centre. The first stage is comprised of training and awareness for residents on the new waste management system, taking account of: - Community values with respect to RM - identified priorities (see tools 1.1. and 1.2 on consultations with residents and the WMP in the general toolbox)
Required infrastructure	360-litre, 1,110-litre bins; or containers Collection truck(s) Manual baler (optional)
Training needs	Training program for residents on how to sort recyclables Training the collection truck driver
Applicable regulations and standards	Guide to collection options for organic waste, some of which could also apply to recyclables: https://www.Recyc-Québec.gouv.qc.ca/municipalites/matieres-organiques/residus-verts/documents-outils-pratiques-planification/guide-options-collecte
Potential job creation	Several hours of collection time
Preliminary cost analysis	**Fixed overhead** • Manual baler ≈ $30 each (optional) **Recurring expenses** • Collection employee: ≈ 4.6 m^3/hr (6 yd^3/hr) = $13 to $16/6 yd^3

	• Diesel fuel ≈ 4.6 m^3 X 7.5 litres (6 yd^3 X 1.65 g); the price of diesel fuel can vary greatly by municipalities.
Potential partners	La fédération des coopératives du Nord-du-Québec Municipalités Local social reinsertion and environmental organizations
Potential sources of funding	Recyc-Québec Federal government

Sample recyclable collection suppliers and consultants*

Suppliers and consultants	Skills and equipment	Location	Contact information
Solrec Concept Inc.	Sells cardboard balers; waste broker for Nunavik communities	Longueuil	1001 rue Lenoir, suite. A-503 Montreal, Québec Tel. 1-438-795-9065, ext. 208
Services-conseils GMR	Sorting centre consultant to isolated communities	Chicoutimi	5904 Boulevard Talbot, Saguenay, Québec G7N 1W1 418-817-1353

****Check the recycler directory for more details: https://www.Recyc-Québec.gouv.qc.ca/points-de-recuperation**

3.2.2 Relevant literature on recyclable collection

Mots clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Contenants récupérables, frais, statistiques	Ce document est un rapport d'un projet pilote sur la mise en place d'un système de gestion de contenants recyclables.	Iqaluit	Strong, G. (2010). Evaluation of Recycling Pilot Projects - Final Report. Department of Environment, Government of Nunavut, http://www.gov.nu.ca/sites/default/files/Evaluation%20of%20Recycling%20Pilot%20Projects%20-%20Final%20Report%20-%20March%202%202010.pdf
Collecte, porte-à-porte	Guide sur les options de collecte pour les matières organiques. Certains éléments pourraient s'appliquer également à la collecte des matières recyclables	Québec	https://www.recyc-quebec.gouv.qc.ca/municipalites/matieres-organiques/residus-verts/documents-outils-pratiques-planification/guide-options-collecte

TOOL 3.3: SORTING RECYCLABLES

Waste collection is the first stage in recovering recyclables, but it is dependent on your sorting and recycling facilities.

3.3.1 How to sort recyclables

How	Sorting recyclables is preferably done sheltered from bad weather. The shelter will have to be large enough to accommodate collected matter and a sorting table, storage containers, pallets and a baler. A forklift truck should also be used if quantities require it and it can circulate freely in the shelter, which does not need to be heated but should be ventilated for the comfort and the security of the employees. The shelter can evolve over time, starting out as a temporary shelter for managing RM. A community of 200 can use a 20 X 20 Ft. winter car shelter costing ≈ $1,500, while an industrial-type shelter for use with greater quantities of collected materials costs between $60,000 and $100,000.   http://www.lesabrishercule.com/ http://affairesextra.com Even if residents sort their recyclables, a second sorting should be envisaged in the centre before the recyclables are placed in the appropriate storage containers. This step will facilitate single- or multi-material bailing and/or palletization of non-compacted materials to be recycled. This will necessitate the use of a sorting table and one container for each type of recyclables (metals, glass, plastic, etc.), ready to be shipped. The choice of the type of sectors will depend on investment and management costs, quantities and negotiations with recyclables brokers or the sorting centre (see Planning Tool 3.1).   Source: Chaire en éco-conseil

Now the recyclables have to be prepared for shipping. There are two options:

1. Ship unsorted to the sorted centre
2. Ship by category to the recyclables broker

For unsorted recovery, plastic, cardboard and metal containers and metal film, paper and cardboard should be baled or bulk-loaded in a container. This kind of recovery will cost you approximately $50/ton at the sorting centre. You will also need to ask if the sorting centre accepts compacted recyclables (usually, it will). Palletization of recyclables is preferable due to lower containerization costs, and baling will reduce shipping costs if the carrier invoices by volume. Even so, discussions with the carrier are inevitable, because costs and discounts are set on a case-by-case basis.

Ideally, unsorted baled recyclables should be separated by layer, each layer separated by a cardboard sheet (e.g. 1 – metal containers 2 – plastic containers 3 – cardboard containers 4 – loose paper and cardboard. Stability of the baled pile will be improved by starting and finishing with a layer of cardboard.

Source: Chaire en éco-conseil

Recovery by type of recyclables consists in preparing bales that have market value. Here again, a thin cardboard bottom and top layer will add stability. Make sure there is enough material to be baled.

The choice of unsorted or single recyclable type baling has a significant impact on storage capacity. Remember too that winter storage can last more than 6 months. Here some useful conversion ratios:

- 1,000 cans ≈ 1.70 m^3
- 1,000 compacted cans≈ 0.53 m^3
- 1,000 cans ≈ 17 kg
- 1,000 plastic bottles (<1l) ≈ 4 m^3
- 1,000 compacted plastic bottles (<1l) ≈ 0.82 m^3
- 1,000 plastic bottles (<1l) ≈ 25 kg
- 1,000 compacted plastic bottles (=>1l) ≈ 3.05 m^3
- 1,000 plastic bottles (=>1l) ≈ 50 kg

Length 10 ft. X width 7 ft. X height 4 ft. 10 yd^3	Approximately 80% of 10 yd^3 (7.65 m^3) is needed to produce a single bale.  Source: http://triobac.com/
Required infrastructure	One shelter Sort table: 3 feet wide, variable length Containers: 360-litre or 1,110-litre bins or 10 yd^3 containers Forklift truck Cardboard baler
Training needs	Sorting centre employee training on how to sort recyclables Forklift truck training
Applicable regulations and standards	The following regulations may be relevant. The list is indicative only. You should see the latest versions at http://www.mddelcc.gouv.qc.ca/matieres/loi-reg/index.htm: *Regulation respecting compensation for municipal services provided to recover and reclaim residual materials* *Regulation respecting the charges payable for the disposal of residual materials*
Potential job creation	Job creation will depend on the size of the facility: - For a population of 250, sorting time is estimated at 1–2 h/day - For a population similar to Kuujjuaq, a full-time sorting centre position can be necessary
Preliminary cost analysis	**Fixed costs** • Forklift truck: between $30,000 and $50, 000 • Shelter: an industrial dome can cost ≈$100,000, but an unused warehouse or even car shelter can also be used (Tempo) • Sort table: very easy to build from recycled materials • Storage bins: between $80 and $1,000 • Containers: ≈ $6,000 • Cardboard baler ≈ $20,000

	Recurring expenses • Sorting employee: ≈ 0.84 m^3 or 1.1 yd^3/hr • Mixed recyclable recovery ≈ $50/ton • Bale value • Metal straps: ≈ $160/roll • Pallets (recovered) • Packaging straps: ≈ $14/roll, one roll covers around 10 pallets
Potential partners	La fédération des coopératives du Nord-du-Québec Municipalities Sea/rail shipping: Relais Nordik and Transartik/Arctic Sealift (see tools 3.4 on sea and rail shipping)
Potential sources of funding	Recyc-Québec Federal government

3.3.2 Examples of suppliers and consultants contacted about sorting recyclables during the study*

Suppliers and consultants	Skills and equipment	Location	Contact information
Solrec Concept Inc.	Sells cardboard balers; waste broker for Nunavik communities	Longueuil	1001 rue Lenoir, suite. A-503 Montreal, Québec Tel. 1-438-795-9065, ext. 208
Services-conseils GMR	Sorting centre consultant to isolated communities	Chicoutimi	5904 Boulevard Talbot, Saguenay, Québec G7N 1W1 418-817-1353

*For more details, see the directory of recyclers at: **https://www.Recyc-Québec.gouv.qc.ca/points-de-recuperation**

3.3.3 Relevant literature on sorting recyclables*

Mots clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Contenants récupérables, frais, statistiques	Ce document est un rapport d'un projet pilote sur la mise en place d'un système de gestion de contenants recyclables.	Iqaluit	Strong, G. (2010). Evaluation of Recycling Pilot Projects - Final Report. Department of Environment, Government of Nunavut, http://www.gov.nu.ca/sites/default/files/Evaulation%20of%20Recycling%20Pilot%20Projects%20-%20Final%20Report%20-%20March%202%202010.pdf
Matière recyclable, collecte, centre de tri,	L'objectif principal de cet essai est d'identifier des avenues pour améliorer la récupération, le tri et la commercialisation des matières recyclables d'origine résidentielle dans la province.	Québec	Paquet, R. L. (2015). Optimiser la récupération, le tri et la commercialisation des matières recyclables au Québec Université de Sherbrooke, Centre universitaire de formation en environnement et développement durable.
Rendre le tri plus efficace	« Améliorer la collecte se prépare en amont, lors de la conception des produits, mais aussi au moment du geste du tri, en clarifiant les messages délivrés aux consommateurs ».	Québec	Actu-Environnement. (2014). Quels outils pour optimiser la collecte des déchets ? Rendre le tri plus efficace. Actu-Environnement. http://www.actu-environnement.com/ae/dossiers/collecte-dechets/optimisation.php
	Ce document vise la construction d'un centre de tri pour des municipalités ayant une beaucoup plus forte densité de population que celle étudiée.	France	Éco-Emballages. (2005). Concevoir, construire et exploiter un centre de tri. Éco-Emballage, http://www2.ecoemballages.fr/fileadmin/contribution/pdf/instit/etudes/concevoir-centre-de-tri.pdf.

*See also, this study's appendix of the Report on waste management experience in winter conditions for small communities

TOOL 3.4: RECYCLING RETURNABLE DEPOSIT CONTAINERS

The easiest type of recovery is for returnable deposit containers. Moreover, the Fédération des Coopératives du Nouveau-Québec already recovers returnables in the majority of Nunavik communities. For communities that already recycle returnable deposit containers, the major question is one of optimization.

Consumers have two choices: 1) Return containers to the supermarket for a refund; 2) let the municipality recycle and receive the value of the metal from the RM broker.

Returnable deposit containers are already managed throughout Québec by Consignaction, which enables consumers and supermarkets to receive several cents per can when bagged, not baled.

On the other hand, brokers require baling containers: prices will vary considerably depending on whether bales contain recyclable cans only (approximately $1,000/ton) or include other types of metal containers (approximately $150/ton).

A cost analysis (including shipping) and discussions with recyclers are thus necessary before a final choice can be made. The municipality will need very accurate quantitative information, and this depends on whether they choose the "Consignaction" program that does not accept compacted returnables, or a recycler who will accept compaction. The choice must depend on the cost of shipping as compared to the price paid by the recycler or the deposit refund.

3.4.1 How to recycle returnable deposit containers

How	There is only one company in Québec that recycles returnable deposit cans and bottles: Boissons gazeuses Environnement (BGE) CONSIGNaction is an umbrella organization offering a variety of programs that promote and maximize the recovery of returnable deposit containers in Québec, particularly by facilitating access to different residential and non-residential recycling infrastructures. Consignaction was set up in 2001 by Boissons Gazeuses Environnement (BGE), a non-profit organization created by the Québec soft drink industry to administer the deposit system for non-refillable soft drink containers. See the http://www.consignaction.ca/en/ website. **Location** Returnable deposit containers are preferably recovered in grocery stores that have reshipment agreements with carriers. **Collection** The recommended type of collection recommended for this type of recyclable is consumer self-delivery to drop-off points. **Stages** The first stage in the recovery of returnable deposit containers is to promote the system to members of the community. Although the Fédération des Coopératives du Nouveau-Québec already has a system of returnable deposit container collection in some communities, a significant quantity of these containers still end up in landfills. The rate of recovery in Québec is approximately 75%, but one estimate for Kuujjuaq was lower than 50%. No data is available for other Northern communities. Getting a handle on the true recovery rate facilitates both

	determining a target and motivating residents to reach it. The rate of recovery can be estimated by dividing the number of deposits paid by the total number of containers sold and multiplying the result by one hundred. This information should be disseminated in the community, along with an improvement target, with awareness especially concentrated near collection points and in stores that sell drinks in returnable deposit containers. The results can then be communicated through local media (community radio, websites, etc.) Residents need to bring their containers to the drop-off point and separate aluminum cans from plastic bottles. We suggest that returnable deposit containers be compacted as much as possible in order to reduce storage and shipping volume. Manual can and plastic balers are available commercially. Automatic balers require a lot of maintenance and are not suggested. However, if automatic equipment is selected, maintenance training will be needed for several employees. Collected returnable deposit containers must be compacted for shipment. Consignaction can provide instructions. Arctic Sealift also has a guide to prepackaging: http://uploads.visionw3.com/sitefiles/arcticsealift.com/PDF/guide_emballage_2016.pdf that can be used in dealing with other carriers (always contact your carrier first to check details). Consignaction does not accept baled containers.
Required infrastructure	- Manual or automatic can baler - Transparent plastic bags - Forklift truck - Shipping containers - Packaging plastic
Training needs	- Awareness training team - Returnable deposit container packaging training - Returnable deposit container baler use and maintenance training
Applicable regulations and standards	- *Act Respecting the Sale and Distribution of Beer and Soft Drinks in Non-returnable Containers* - Arctic Sealift booklet 19 of the guide to packaging and shipping http://uploads.visionw3.com/sitefiles/arcticsealift.com/PDF/guide_emballage_2016.pdf. - https://www.Recyc-Québec.gouv.qc.ca/entreprises-organismes/mieux-gerer/consigne - List accredited packagers: https://www.Recyc-Québec.gouv.qc.ca/sites/default/files/documents/liste-conditionneurs-recycleurs-mars.pdf - Guide to labelling and packaging: http://relaisnordik.com/wp-content/uploads/2016/10/Guide-d%C3%A9tiquetage-et-demballage-NEW.pdf
Potential job creation	- Across-the-board WM awareness teams - Container handling (bailing, packaging)
Preliminary cost analysis	- Plastic bags: between $.50 and $1.50/bag - Manual baler: approximately $30 - Automatic baler: $100 to $1,000, depending on model - Forklift truck; already available portside

	- Wooden crates for bulk shipping; reusable and/or made from repurposed wood.
Potential partners	- Consignaction - La Fédération des Coopératives du Nouveau-Québec - Northern
Potential sources of funding	None. See deposit container system: retailers (ex: supermarkets) receive 2 cents per can for storage and handling.

3.4.2 Examples of returnable deposit container recovery consultants and suppliers contacted during the study*

Suppliers and consultants	Skills and equipment	Location	Contact information
Consignaction	CONSIGNaction is an umbrella organization offering a variety of programs that promote and maximize the recovery of deposit-refund containers in Québec, particularly by facilitating access to different residential and non-residential recycling infrastructures. Consignaction was set up in 2001 by Boissons Gazeuses Environnement (BGE), a non-profit organization created by the Québec soft drink industry to administer the deposit system for non-refillable soft drink containers.	Montréal, Québec	100, rue Alexis-Nihon, suite 406 Saint-Laurent (Québec) H4M 2N9 1-877-CANETTE
La Fédération des Coopératives du Nouveau-Québec	Operates general stores in Northern communities	Montréal, Québec	19,950 Clark-Graham, Bay-d'Urfé, QC H9X 3R 8, Tel. 514-457-4626
Northern	Operates general stores in Northern communities		info@northwest.ca 1-800-563-0002

For more details, see the directory of recyclers at: https://www.Recyc-Québec.gouv.qc.ca/points-de-recuperation**

3.4.3 Relevant literature on returnable deposit containers

Mots clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Vidéo, sensibilisation, publicité	Compagnes de sensibilisation	Québec	http://www.consignaction.ca/fr/campagnes/nos-campagnes
Loi, obligations, responsabilités	Programme de consignation	Québec	https://www.recyc-quebec.gouv.qc.ca/entreprises-organismes/mieux-gerer/consigne
Les coûts, les types de collecte	Analyse de la récupération des contenants de breuvage au Canada	Canada	http://www.cmconsultinginc.com/wp-content/uploads/2014/07/WPW2014.pdf

TOOL 3.4A: SEA SHIPPING OF RECYCLABLES - NUNAVIK

Two companies handle shipping Nunavik recyclables to the Montréal area: Desgagnés Transartik Inc. (Arctic Sealift) and NEAS. Both offer comparable waste shipping services.

Desgagnés Transarctik Inc., in partnership La Fédération des Coopératives du Nouveau-Québec (FCNQ) formed a Taqramut Transport, which offers sea freight services in Nunavik. The FCNQ has run a can recycling program in each of the 14 regional villages for many years through local cooperatives. Taqramut ships the recovered items by container to Southern Québec on a seasonal basis. A hazmat recovery program is also available in co-operation with SOGHU.

NEAS is Inuit-owned and also includes Nunavut Eastern Arctic Shipping. The group also offers waste shipping under the hazmat recovery program in co-operation with SOGHU.

Open water sealift functions from late June to late November, which means that no supplies arrive and no RM gets shipped the rest of the year.

Source: Desgagnés Transarctik Inc.

3.4.1A What you need to know about shipping recyclables by sea from Nunavik

How	**1) Baling** The first stage in planning the shipment of recyclables (plastic, glass and metal containers) is packing. If you ship recyclables to a waste management broker or sorting centre and freight forwarding costs are volume-related, containerization is advisable. Baling and palletizing will maximize available container volume. 1. Bale recyclables in bundles of approximately 90 cm (3 feet) in height and less than 400 kg in weight with a layer of cardboard above and below to stabilize the bundle 2. Palletize bundles, two (2) per pallet 3. Wrap bundles with plastic film for greater strength 4. Attach the two bundles to the pallet using with metal straps 5. Use a forklift truck to load up to 8 pallets per container The following photo shows an example of bundled recyclables.  Source: Jean-Michel Pinguet (2016) This will optimize available container volume. On the other hand, managers need to be conscious of monthly recyclable flow in order to plan for storage while awaiting container departure. Technical details on material preparation are available in the Arctic Sealift guide to labelling, packing and forwarding • For labelling, see booklet 1 of the guide • If you ship reusable deposit soft drink containers to BGE, see booklet 19 of this guide Important note: If you ship your reusable containers to Consignaction, do not compact. Desgagnés Transarctik assists Nunavik communities in recovering deposit cans, which can be packed in wooden boxes or containers. Instructions are included in the above guide (booklet 19). *Soft drink cans shipped in large quantities must be packaged in prefabricated sealed boxes or 20-foot containers. In the latter case, individual bundles should be piled up in four rows, with lighter cargo on top. Pallets must be able to resist 3 times their loaded weight.* Adapted from Arctic Sealift booklet 19. Impact on storage space will need to be considered when no preliminary baling takes place.

	2) Containerization The second phase consists in loading the recyclables into a container for shipment to Southern Québec. Containerization requires the use of wooden pallets. A standard wooden pallet (17mm planks) can support from 400 to 800 kg. In order to optimize recyclables shipping, baling and bundling is advisable (see above). Two bundles can be piled one on top of the other using a forklift truck and metal straps. This method makes it possible to load 8 pallets to a container. 3) Port-to-recycler shipping Finally, recyclables that arrive in Southern Québec must be delivered to the recycler. As such, prior written agreement with your recycler is required, because you will need to negotiate advantageous local delivery rates with your carrier. Potential discounts are often on a case-by-case basis, and it is advisable to choose a waste broker as close to the port in order as possible, to reduce GHG emissions and hauling costs.
Infrastructure and equipment	Containers for sea shipping
Training needs	Baler and forklift truck training
Applicable regulations and standards	Arctic Sealift guide to labelling, wrapping and shipping
Potential job creation	Not applicable
Preliminary cost analysis	• Shipping ≈$4,000/container, possible discounts a case-by-case basis • Prep time (labelling, handling, etc.)
Potential partners	• Desgagnés Transarctik inc. • NEAS
Potential sources of funding	• Desgagnés Transarctik inc. • NEAS • Fédération des coopératives du Nouveau-Québec (FCNQ)

3.4.2A Examples of shipping consultants and suppliers for Nunavik

Suppliers and consultants	Skills and equipment	Location	Contact information
Desgagnés Transarctik Inc. (Arctic Sealift)	Sea freight/Nunavik	Sainte-Catherine (Québec)	Operations Management Nadine Blacquière 6565, boulevard Hébert, suite 201 Sainte-Catherine (Québec) J5C 1B5 Telephone: (450) 635-0833 info@transarctik.desgagnes.com
NEAS	Sea freight/Nunavik	Salaberry-de-Valleyfield (Québec)	Operations Management Luc Nadeau - term@neas.ca Claudia Iskra - term@neas.ca Toll-free: 1-888-908-0000 Telephone: 1-450-373-3379

3.4.2A Relevant literature on shipping to Nunavik

Mots clés	**Exemple d'informations ou citations importantes**	**Localisations**	**Sources et liens**
Coûts de transport de Transartik	Les frais de transport d'un conteneur vide du Nord vers le Sud sont de 3 913,96 $. Les frais de transport pour des matières résiduelles hors conteneur du Nord vers le Sud sont de 254,15 $ par tonne ou par 2,5 m^3.	Ste-Catherine (région de Montréal)	http://uploads.visionw3.com/sitefiles/arcticsealift.com/nunavik_tarifs_2016.pdf
Emballage et étiquetage, boissons gazeuses pour Transartik	Matières consignées envoyées à Boissons gazeuses Environnement	Ste-Catherine (région de Montréal)	Desgagnés Transarctik Inc. (2016). Guide d'emballage et d'expédition. Desgagnés Transarctik Inc., fascicule 19.*http://uploads.visionw3.com/sitefiles/arcticsealift.com/PDF/guide_emballage_2016.pdf*
Emballage NEAS	Guide d'emballage hors conteneur de NEAS	Salaberry-de-Valleyfield	http://neas.ca/fr/pdf/guide_emballage.pdf
Coûts de transport de NEAS	Vous devez communiquer avec l'entreprise pour connaître les prix.	Salaberry-de-Valleyfield	http://neas.ca/fr/tarifs.cfm

TOOL 3.4B: SEA SHIPPING/BASSE-CÔTE-NORD/SEPT-ÎLES/RIMOUSKI

Recyclables shipping from Basse-Côte-Nord already exists in this area.

Relais Nordik Inc. offers discounts for shipping recyclable materials (paper, cardboard, plastic, glass, metal, tires, batteries, oil and computer hardware) and single use empty containers from île d'Anticosti or Basse-Côte-Nord on a case-by-case basis. Sea freight operates from early April to the end of January.

3.4.1B Useful information about sea shipping of recyclables in Basse-Côte-Nord

How	Recyclables collection and shipping is already in use in Basse-Côte-Nord, with easy-to-follow terms and conditions: • Place metal and glass together in cardboard boxes • Place plastics, paper and cardboard together in transparent bags • Place boxes on pallets first • Pile bags above the boxes • Wrap pallets with plastic film • Eight (8) pallets to a container    Source: Chaire en éco-conseil

	Recyclables are shipped to the Groupe Bouffard sorting centre in Mont-Joli (Gaspésie), which recovers mixed recyclables and possibly compacted materials. Winter sea freight stops from January to April. As such, you will have to recyclables during those months, and if space is limited, compacting is a reasonable choice. Fabric shelters can also be used to add storage space and should be considered, while remembering that RM may need to be easily moved with a forklift. 1. Bale recyclables in bundles of approximately 90 cm (3 feet) in height and less than 400 kg in weight, with a layer of cardboard above and below for added stability. 2. Bundles should be palletized (2 per pallet). 3. Wrap bundles with plastic film. 4. Attach the bundles to the pallet using metal straps. 5. Pack 8 pallets to a container using a forklift truck.
Infrastructure and equipment	Sea shipping containers
Training	Baler and forklift truck training
Applicable regulations and standards	Relais Nordik labelling and wrapping guide for shipping: http://relaisnordik.com/wp-content/uploads/2016/10/Guide-d%C3%A9tiquetage-et-demballage-NEW.pdf
Potential job creation	Not applicable
Preliminary cost analysis	• Shipping: ≈$4,000/container, possible reduction on a case-by-case basis • Packing: see sorting centre information
Potential partners	• Relais Nordik Inc.
Potential sources of funding	• Relais Nordik Inc.

3.4.2B Sample Basse-Côte-Nord sea shipping suppliers and consultants

Suppliers and consultants	Skills and equipment	Location	Contact information
Relais Nordik Inc.	Sea freight for Basse-Côte-Nord	Rimouski	Rimouski (Québec) Relay Nordik Inc. Tel.: 418-723-8787 Toll-free: 1-800-463-0680 http://relaisnordik.com/

3.4.3B Relevant literature on Basse-Côte-Nord shipping

Mots clés	**Exemple d'informations ou citations importantes**	**Localisations**	**Sources et liens**
Horaire	Information sur l'horaire de la Bella Desgagnés	Rimouski	http://relaisnordik.com/je-veux-expedier/
Emballage et étiquetage, boissons gazeuses	Les consignes d'emballage	Rimouski	http://relaisnordik.com/wp-content/uploads/2016/10/Guide-d%C3%A9tiquetage-et-demballage-NEW.pdf

TOOL 3.4C: RAIL SHIPPING/SCHEFFERVILLE

"The Uashat Mak Mani-Utenam, Matimekush-Lac John and Kawawachikamach First Nations started the Tshiuetin Rail Transportation Company to ensure the long-term economic and social development of their communities and operate a rail link between Emeril Junction, Labrador, and Schefferville, in Québec. The company's mandate is to provide its customers with a safe, reliable, high quality and competitive train service that meets the demands of the communities it serves and created sustainable employment for community members."

3.4.1C What you need to know about shipping recyclables by rail from Schefferville

How	**Baling** The first stage that needs to be planned for shipping recyclables (plastic, glass and metal containers) is packaging. If you ship recyclables to a waste management broker or sorting centre and the cost of freight is based on volume, it is advisable to ship by container and to maximize available space by baling the recyclables and filling containers to the brim with pallets. 1. Recyclable baled bundles should be approximately 90 cm (3 feet) in height top and weigh less than 400 kg, stabilized by a top and bottom layer of cardboard. 2. Bundles should be palletized, three (3) to a pallet. 3. Bundles should be plastic-wrapped for added strength. 4. Attach the bundles to the pallet with metal straps. 5. Place up to eight pallets by container using a forklift truck.  The following photo shows an example of bundled recyclables.  Source: Municipality of Îles-de-la-Madeleine

	This method will maximize available container space. On the other hand, managers need to be aware of the monthly flow of recyclables in order to plan for storage while awaiting shipment. **Container Loading** Phase two is the containerization of recyclables for trucking to piggyback freight train shipment to Southern Québec. The use of containers requires wooden pallets. A standard wooden pallet (17mm planks) can support from 400 to 800 kg. In order to optimize recyclables shipping, baling and bundling is advisable (see above). Two bundles can be piled one on top of the other using a forklift truck and metal straps. This method makes it possible to load 8 pallets to a container. **Port-to-Recycler Delivery** Finally, once at the Sept-Îles port, containers must be delivered to the sorting centre or waste broker. Re-using empty containers will enable you to reduce shipping costs.
Infrastructure	None
Training	Baler and forklift truck training
Applicable regulations and standards	Railway company norms
Potential job creation	Not applicable
Preliminary cost analysis	Shipping costs vary according to storage mode. As far as we know, there is no available price list on the Web and prices are confirmed on a case-by-case basis. Contact 418-585-2333 for further information.
Potential partners	Tshiuetin Rail
Potential sources of funding	None

3.4.2C Sample hauling suppliers and consultants/Schefferville

Suppliers and consultants	Skills and equipment	Location	Contact information
Tshiuetin Rail	Carrier	Schefferville	Telephone: 418- 585-2333 Fax: 418-585-2344

3.4.3C Relevant Literature on hauling/Schefferville

Mots clés	**Exemple d'informations ou citations importantes**	**Localisations**	**Sources et liens**
Plan de gestion des matières résiduelles	Le plan de gestion des matières résiduelles des Îles-de-la-Madeleine est un exemple intéressant pour le transport des matières résiduelles avec un système de ferroutage. Section 2.3.4 : Description des services par catégorie de matières	Îles-de-la-Madeleine	http://www.muniles.ca/wp-content/uploads/2015-11-17_PGMR.pdf

TOOLBOX #4

HOUSEHOLD HAZARDOUS WASTE, CONSTRUCTION, RESTORATION AND DEMOLITION (CRD) RESIDUES, END-OF-LIFE VEHICLE (ELV), TIRE AND BULKY ITEM MANAGEMENT

4 HOUSEHOLD HAZARDOUS WASTE; CONSTRUCTION, DEMOLITION AND RESTORATION (CDR) RESIDUES; END-OF-LIFE VEHICLES (ELV); USED TIRES AND BULKY ITEM MANAGEMENT

This toolbox is intended to help community leaders choose the optimal management system for construction, demolition and restoration (CDR) residues and household hazardous waste, end-of-life vehicles (ELV) and used tires. The decision tree (Figure 7) identifies management options based on the social realities of the community and real local problems.

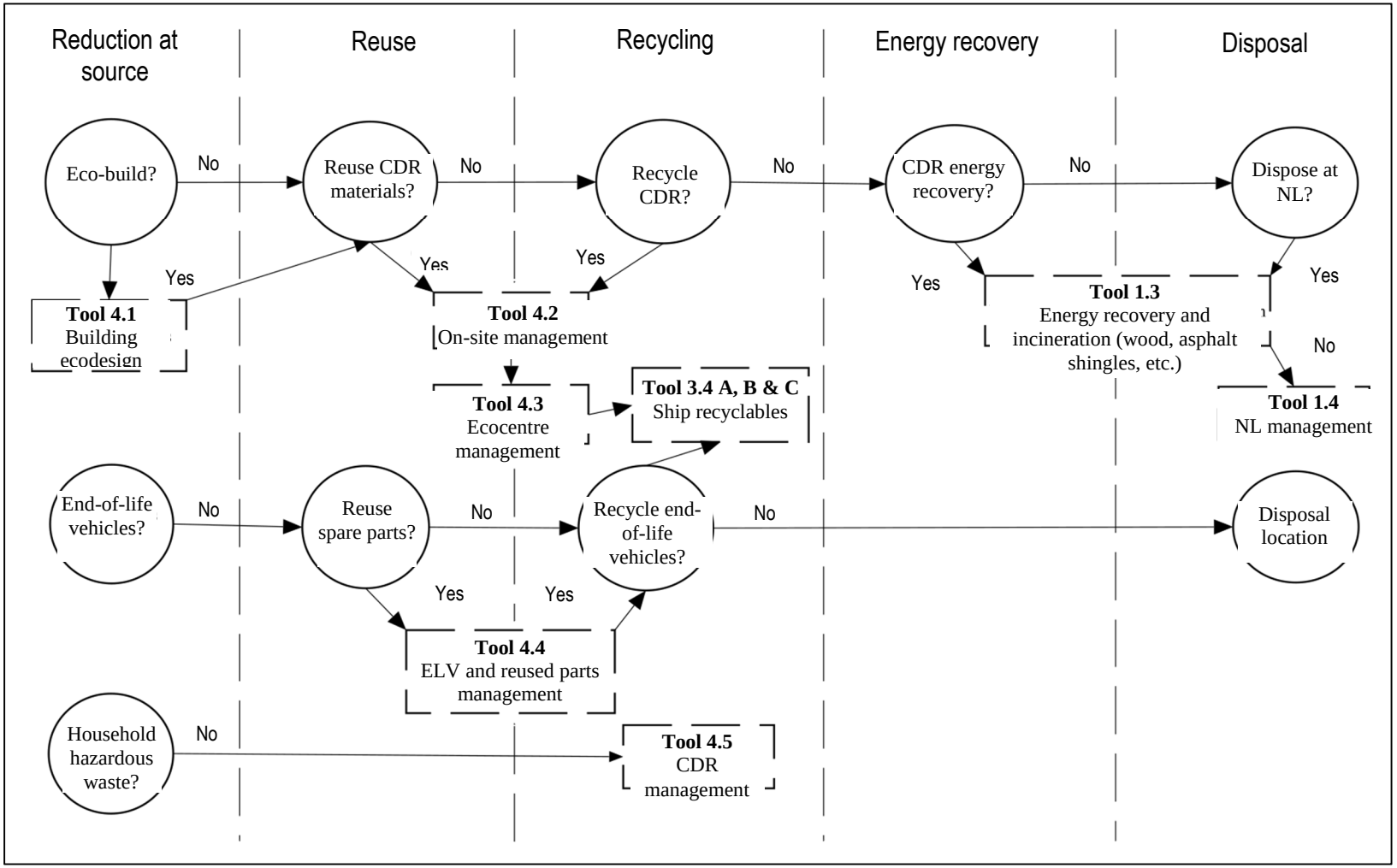


Figure 7: Decision tree – Household hazardous waste; construction, demolition and restoration (CDR) residues; end-of-life vehicles (ELV); used tires and bulky item processing

The decision tree reads as follows:

- From left to right, the decision tree provides the major option categories: reduction at source, reuse, recycling, energy recovery and disposal
- Each circle contains a question and two arrowed YES/NO outputs towards an already existing or preceding toolbox tool (created by the Chaire en éco-conseil) in a dashed-line box
- The first stage of CDR management is reduction at source. The options at this stage are mainly related to building ecodesign that employs reusable flexible, recyclable materials with longer life expectancy. Tool 4.1 provides added information on ecodesigned buildings and includes examples
- The next stage is the potential reuse of CRD residues such as doors, windows, wooden planks and metal beams. Tools 4.2 and 4.3 deal with CDR management at construction sites and ecocentres.
- Whatever cannot be reused can be either recycled in the community or shipped to a recycler in Southern Québec. For example, untreated wood can be chipped; uncontaminated gypsum dry wall can be shredded and composted[6]. Scrap metal and aluminum sheets can be compacted and shipped to a recycler in Southern Québec. Tools 3.4 A, B and C deal with shipping options
- Post-recycling, some materials like wood and asphalt shingles have a high heat value and can be used for energy recovery[6] (Tool 1.3)
- If none of the above solutions are viable, the last option is disposal at a NL (Tool 1.3)
- Finally, periodic review of continual procedures is important and should be undertaken from the point of view of multi-year planning (Tool 1.4)

Tool 4.4 summarizes the process and provides links to two guides for managing end-of-life vehicles in Northern communities, while Tool 4.5 provides links to useful Nunavut initiatives for the management of household hazardous waste.

Note: Backlog vs current RM flow or quantity

When planning bulky item and ELV WM, it is important to note whether waste liabilities is included in the WMP, because quite often, when documentation speaks about new residual materials, waste liabilities is not included.

According to Recyc-Quebec, WMPs can cover more than what is minimally required based on regional realities, since regional planning is intended to deal with regional challenges.

The only reason why waste liabilities might not be included in the WMP is because it includes residual materials that are specifically excluded from regional planning under government WM guidelines.

Excluded residual materials are as follows:

- hazardous materials, except those of household origin (LQE, section 53.6)
- biomedical waste (LQE, section 53.6)
- mine tailings (LQE, section 53.2)
- soils containing contaminants in quantities or concentrations exceeding those fixed by regulation (LQE, section 53.2)
- gaseous substances, except those contained in another residual material or produced by the treatment of such a material
- waste snow, waste water, animal manure (administrative exclusions or control by other regulations)
- resource sector residue producer-managed onsite (for example, logging)
- Institutional, commercial and industrial residues used to replace raw materials in manufacturing

Whenever environmental liabilities constitutes a serious WM challenge, it should be incorporated into the WMP. There is no regulatory provision that prevents an WMP from being improved over and above minimum requirements.

Two major approaches are possible for appreciably reducing building material volume in isolated Northern communities.

1) Building ecodesign, to change building types and construction methods
2) Construction site management, to change the rules of traditional construction by adding contractual clauses stipulating that the builder has an obligation to recover all unused materials, or changes to municipal by-laws to add penalties when recyclables are sent for disposal at the NL.

Note that the two approaches can be used singly or in parallel, depending on the wishes of the community and WMP targets.

It would be useful for Recyc-Québec, which is currently working on improving CDR recycling performance, to realize a study on which types of construction site management programs would be best accepted by contractors and the population in general and which measures should be looked at by municipalities in order to produce information and achieve the best possible results.

TOOL 4.1: BUILDING ECODESIGN

Ecodesign constitutes both a sustainable development plus and an intelligent approach to waste management. We can summarize ecodesign using basic references and the particular features of construction in isolated Northern communities.

Ecodesign seeks to reduce the environmental impact of a product throughout its life cycle, from raw material extraction to production, distribution, use and end-of-life. An ecodesign approach makes it possible to optimize the use of resources (less energy and raw material requirements and reduced pollution and disturbance. Ultimately, the goal of ecodesign is to preventively reduce environmental impact while preserving product quality. Adapted from CGPME, (2015). Guide pratique de l'éco-conception. Confédération des PME, http://www.cgpme.fr/upload/ftp/cgpme-guide-eco-conception-ld.pdf[6].

Building ecodesign takes account of environmental aspects[7], starting from the urban development stage and involving architects, engineers and residents. From the point of view of waste management, ecodesign seeks to construct and make use of modular buildings with materials that can be easily reused and recycled.

- Modular: buildings that can be easily upsized by adding parts
- Reusable: buildings that can be easily dismantled and whose parts and materials can be easily reused
- Recyclable: materials and parts that cannot be re-used, can be recycled.

When a building is designed to allow deconstruction, it is better adapted to future changes and meets market needs because it allows for flexibility, convertibility and the addition and the removal of elements, as well as minimizing complete or partial destruction. Adapted from Millette (2010).

Advanced framing (optimal engineering value) consists in implementing measures for reducing the use of lumber and construction waste. Among other features, this technique employs building design based on dimensions that as much as possible are multiples of 60.96 cm (24 inches). Since most building materials (wood, panels, plasterboard, sheetrock) are also sold in these multiples, this helps reduce losses associated with non-standard formats. Adapted from Boisvert, Bosniak & Dallaire, (2014). *Gestion des résidus du secteur de la construction, de la rénovation et de la démolition (CRD). Ministère du Développement durable, Environnement et Lutte contre les Changements Climatiques, http://www.mddelcc.gouv.qc.ca/matieres/FicheInformationCRD.pdf.*

An important aspect to be considered in Northern communities is outside surface weather exposure.

"*Have you ever wondered why tract homes look boxy? The basic "box" of low-cost design goes back thousands of years and reoccurs in every age. Frank Lloyd Wright was a proponent of the modular box in his Usonia Homes, meant to be affordable. This shape works so well in construction because it yields the highest floor-to-shell ratio. In other words, it provides the smallest area of exterior surface to cover a given living space. Exterior surfaces with siding, weather barriers, and insulation represent an expensive component. They also represent weather exposure, which is why this most basic trick of designing low-cost structures as a small square or, for larger structures, a rectangle doubles as the most energy-efficient design strategy.*

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[6] A new publication on construction in Nunavik is available at http://www.habitation.gouv.qc.ca/fileadmin/internet/publications/0000024197.pdf

[7] Site choice is important, and in the current climate change context, "good" sites are becoming rarer. Current construction uses large amounts of gravel to compensate.

To understand this concept, picture an imaginary square house of only 625 square feet with four 25'-long exterior walls. This simple structure has a floor-to-wall ratio of 1.28 (the number of square feet of 8' exterior wall that it takes to enclose each square foot of interior floor). Now picture the same 625 square feet of living space enclosed within a rectangular footprint of 12.5 by 50 linear feet. This structure has a floor-to-wall ratio of 1.60 – a whopping 25% drop in efficiency. By limiting the total area of exterior wall, the box eliminates the additional foundation, framing, insulation, siding, and other components that make exterior walls an expensive element," Web excerpt from Ruiz, F.P. (2012). *Optimum Value Engineering*, http://buildipedia.com/aec-pros/from-the-job-site/optimum-value-engineering.

A sample building

The Saguenay uNIPI company has developed a modular ecobuilding design concept for isolated Northern communities that uses aluminum and wood that can be assembled and dismantled for reuse, reducing the quantity of CDR residue GHG emissions related to the production of component parts. Building sections are designed to fit into sea shipping containers and are thus easily transportable.

See http://unipi.ca/

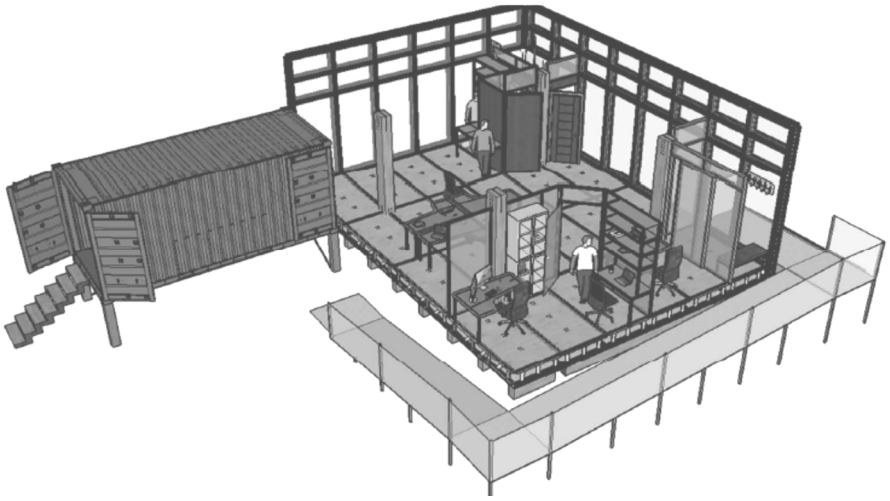

Figure 8: A sample eco-building

Source: http://unipi.ca/ (2016)

An important resource in this area is Guide technique sur la construction modulaire en bois, whose purpose is to assist engineers and architects in designing modular wood buildings.

Photo 2: An example of modular construction

(Source: http://locusi.com)

TOOL 4.2: CONSTRUCTION SITE AND WORKFLOW MANAGEMENT

Construction, demolition and restoration (CDR) residues come from construction and work sites. Waste from this type of work include aggregates, paper, cardboard, wood, glass, metal, plastic, gypsum, composites, etc. Some are reusable, while others can be recycled. To facilitate their reuse or recycling, it is vital to have on-site deconstruction and preliminary sorting.

4.2.1 How to organize construction site management

How	Selective deconstruction is a dismantling practice that consists in separating and sorting waste in order to improve quality and support their reuse. In general, the deconstruction proceeds as follows: 1- Identify potentially contaminated materials such as asbestos 2- Identify potentially reusable materials 3- Identify materials that can potentially be recycled 4- Prepare dismantling plan 5- Install sorting equipment 6- Train employees on sorting procedures 7- Dismantle the building A promotional program (including information meetings) on best CDR residue management practices, selective deconstruction techniques, recycled materials, green building construction and certification programs like Leadership in Energy and Environmental Design (LEED) is essential.
Infrastructure	• Containers 4 feet in height or sea shipping containers divided in two to facilitate container loading and unloading or • Pile management (no infrastructure)
Training	• Training on CDR residue reuse and recycling
Applicable regulations and standards	• Québec Guide de bonnes pratiques pour la gestion des matériaux de démantèlement. New edition being prepared. • *The City of Vancouver supports CDR residue reclamation when single-family dwellings are demolished with two types of permits:* 1) a *demolition permit and 2) a deconstruction permit. In order to encourage contractors acquire deconstruction permits, they are issued faster and include lower landfill charges (50% for the first 15 tons).* Adapted from Boisvert, Bosniak & Dallaire, 2014.
Potential job creation	Non-applicable, added tasks

Preliminary costs analysis	**Infrastructure** Container: $6,000. Not mandatory, because pile management can be used. **Service fee** Slight increase in operational expenses: difficult to assess Lower landfill disposal charges: applicable costs depend on whether the municipality proceeds by by-law. See example of Vancouver. http://www.mddelcc.gouv.qc.ca/matieres/FicheInformationCDR.pdf page 12 **Taxation** CDR residue NL disposal fees so selected by the municipality.
Potential partners	Municipality RCM or ARK Fédération des Coopératives du Nouveau-Québec (major sea freight client and shareholder)
Potential sources of funding	Recyc-Québec Environment and Climate Change Canada

4.2.2 Sample construction site management suppliers and consultants

Suppliers and consultants	Skills and equipment	Location	Contact information
Éco-bâtiment	Website offering ecological design and construction solutions	Québec City	http://www.ecobatiment.org/ 870 Avenue De Salaberry Suite 224, Québec, G1R 2T9 Tel.: 418-781-2463 info@ecobatiment.org
Le regroupement des Récupérateurs et des Recycleurs de Matériaux de Construction et de Démolition du Québec	Association that promotes the recovery, recycling, re-use and reclamation of non-fermentable products	Montreal	9501 Avenue Christophe-Colomb Suite 203, Montreal, Qc, H2M 2E3 514-382-3RCMDQ info@3RCMdq.qc.ca

4.2.3 Relevant literature about construction site management

Mots clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Déconstruction sélective	Cet article présente un projet de déconstruction collective : « *Entreprises de construction Panzini – aura donc dû se conformer à des*	Montréal	Fortier, R. (2012). La déconstruction du 11401 Pie-IX : le bilan, Voirvert.ca, http://www.voirvert.ca/projets/projet-

	façons de faire spécifiées très précisément au devis, comme trier les matériaux sur le chantier et voir à ce que la contamination des matières dans les différents conteneurs soit réduite au strict minimum. Il devait aussi fournir à la Ville un rapport indiquant les destinations et les quantités des matériaux recyclés, réutilisés ou enfouis, bons de livraisons et de pesées à l'appui. Sans compter qu'il lui fallait voir à minimiser la pollution sur le site et les désagréments pour le voisinage ».		etude/la-deconstruction-du-11401-pie-ix-le-bilan. Retrieved 2 février, 2017
Gestion des CRD, déconstruction sélective	« *Dans de nombreux cas, le recours à des techniques de déconstruction sélective des bâtiments peut accroître considérablement la quantité de matières résiduelles récupérées, et leur qualité pour le recyclage et la valorisation. La Ville de Montréal a réalisé un projet pilote de déconstruction sélective d'un immeuble commercial. Un taux de récupération de 86% a été atteint, tout en diminuant les coûts de gestion par comparaison avec un projet de démolition traditionnel. En effet, un tri plus judicieux permet aux entrepreneurs d'obtenir un meilleur prix de revente pour les matières résiduelles* »	Québec	Extrait tiré de Boisvert, M., Bosniak, D., & Dallaire, P.-O. (2014). *Fiche d'information : Gestion des résidus du secteur de la construction, de la rénovation et de la démolition (CRD)*. Ministère du développement durable, environnement et lutte contre les changements climatiques, http://www.mddelcc.gouv.qc.ca/matieres/FicheInformationCRD.pdf
	« *La Ville de Vancouver favorise la valorisation des résidus de CRD au moment de la démolition des résidences unifamiliales en proposant deux types de permis : le permis de démolition et le permis de déconstruction. Afin d'encourager la délivrance des permis de déconstruction, ceux-ci sont délivrés plus rapidement que les permis de démolition et permettent d'obtenir un tarif réduit au site d'enfouissement (50 % pour les 15 premières tonnes)* »	Vancouver	Extrait tiré de Boisvert, M., Bosniak, D., & Dallaire, P.-O. (2014). *Fiche d'information : Gestion des résidus du secteur de la construction, de la rénovation et de la démolition (CRD)*. Ministère du développement durable, environnement et lutte contre les changements climatiques, http://www.mddelcc.gouv.qc.ca/matieres/FicheInformationCRD.pdf page 12 http://vancouver.ca/home-property-development/demolition-permit.aspx
	Ce document présente brièvement le déroulement d'un projet « *Les travaux se sont déroulés sur 6 mois (de mai à novembre 2003) et se sont articulés autour de 3 phases essentielles :* *1- la dépose[8] des matériaux de second œuvre, dans un premier temps à l'intérieur des logements, puis dans les parties communes,*	France	ADEME. (2004). *Déconstruction sélective de 140 logements à La Grand'Combe (30) Quartier "Trescol"*. ADEME, http://dechetsbtplr.free.fr/dossiers%20techniques/documents/d%E9constructiontrescol.pdf.

[8] Dépose : nf. (technologie) fait de déposer sur le sol un objet pour le nettoyer, le réparer, spécialement dans le cas d'un moteur (http://dictionnaire.reverso.net/francais-definition/d%C3%A9pose)

	2- *le traitement des toitures avec, selon les cas, dépose des éléments de couverture en amiante-ciment ou arrachement du complexe bitumineux, puis dépose des éléments de charpente bois,* 3- *l'abattage de la structure à la pelle mécanique, équipée de cisaille lorsque nécessaire* ».		
Déconstruction sélective.	Ce document présente une démarche de déconstruction sélective. On y retrouve : • Étapes de déconstruction sélective : • Audit des bâtiments ; • Décontamination et gestion des matériaux ayant besoin de préoccupations particulières; • Démantèlement des matériaux de second œuvre ; • Démantèlement de la structure.	France	http://marches.amiens-amenagement.fr/XTender/documents/2092/dce/demarche_projet.pdf
Démantèlement, réglementation	Cette conférence présente un survol de la réglementation et le contenu d'un plan de démantèlement.	Québec	Association des consultants et laboratoires experts. (2012). Mieux comprendre la procédure à suivre lors du démantèlement d'une propriété, *Forum 2012 Géoenvironnement*. Québec: http://www.acle.qc.ca/wp-content/uploads/2013/11/Presentation_AM_ACLE_Forum2012_equipe3_final.pdf

TOOL 4.3: ECOCENTRE CDR MANAGEMENT

Under an integrated approach to waste management, it becomes essential for a community to have a central inventory management location for recyclables CDR residue and other materials described herein. The location should ideally not be in the NL, since its purpose is to sort and optimally reuse RM so as to divert as much material as possible from the NL.

The eco/resource center should be located near the community to encourage the use of its services. Moreover, the distance between the ecocentre and the community should be less than the distance between the community and the NL so that the population instinctively moves towards the ecocentre rather than the NL. In short, the ecocentre must be easier to be used by residents of the community.

The concept suggested here can be described as an evolutionary ecocentre since it can start at a very modest size and grow to meet needs. The following are offered as examples[9]:

1. A small building designed specifically for secure HHW storage
2. "Tempo" shelters for processing and storing recyclables prior to shipment
3. Containers repurposed to store bundled recyclables and CDR residues that are made available to interested residents
4. A building sufficient in size for locating a mechanical composter and/or energy recovery equipment and/or a repair shop or recovered ELV parts, used furniture and clothing, etc.

This subject could thus have been brought up in the recyclables toolbox. However, HHW, CDR, ELV, used tire and bulky item management seemed to us to require a level of regulation and organization that presupposes infrastructure and increasingly elaborate logistics. It is thus essential for an operator to ask when and how the ecocentre could evolve to meet the needs of the population.

Once delivered to the ecocentre, CDR residues must be separated from reusables and recyclables, which can be stored while awaiting reuse or shipment to a recycler in Southern Québec. Ecocentres can also be resource centres and support the growth of materials and other objects reuse.

- Ecocentre: *A public place set up to receive selective collection waste, bulky, toxic or hazardous household waste, building or restoration materials, organic waste, whose aim is to encourage re-use and recycling.* Adapted from the Government of Québec definition.
- Resource centre: *A social economy environmental enterprise for the recovery, reuse and resale of household surplus donated by local residents. By supporting waste reclamation, resource centres implement sustainable development.* Definition adapted from the http://www.ressourcerielsc.org/ website.

[9] In parallel with this study, the Chaire en éco-conseil helped put together a project presenting the evolutionary ecocentre concept for the KRG and Kuujjuaq in the Écogestion de chantier call for reduction at source proposals program. Unfortunately, the project was not selected as a finalist in 2016.

4.3.1 How to organize CDR management in the ecocentre

How

Training construction site workers and ecocentre employees is the first stage of CDR residue sorting. Containers no more than 4 feet in height must be installed at construction sites to enable workers to perform preliminary sorting and minimally separate residue intended for the NL from residue going to the ecocentre. Minimal pile sorting management may be considered for small construction and individual sites.

In the ecocentre, the first stage consists in separating materials received for recovery, re-use or storage.

On-site reuse and recycling:

- Doors and windows → available for re-use
- Wood → available for re-use and chipping
- Coated fabric → available for re-use or shipping to the South
- Other materials not used during construction → reuse
- Paint cans (non-empty) → reuse
- Other metal → residues for recycling

Preparation

Materials are prepared on the basis of their destination:

- Composting: untreated wood is shredded and incorporated into the composting process
- Reuse: lumber, frames, windows, etc. are sorted, selected, repaired, inventoried and stored for easy identification and reuse
- Recycling: only metals are sorted, inventoried and packaged for shipment to recyclers in Southern Québec

Reusable materials

Reusable materials received at the ecocentre must be inventoried, with the list made available to potential users then stored, optimally protected from bad weather. A website listing available reusable materials is an asset.

Benefits of Reuse

Reuse of residual materials has unquestionable economic benefits because it avoids bringing in construction materials and shipping waste for recycling in Southern Québec, as well as sea freight costs, which can be significant. Moreover, the short open water season (6 months) makes delivery of new materials impossible at certain times of the year. The re-use of materials provides a low-cost solution for construction needs.

Ecocentres used for reuse create jobs for sorting, preparing and selling repurposed materials. Ecocentres can also become meeting places for craftsmen and other community members, where used products and/or raw materials are traded. This can generate a sense of social responsibility in the community and values of sanitation, recovery, security and reuse that have no impact on the natural environment.

Ecocentres also reduce the environmental impact of waste processing (shipping, recycling, incineration and loss of territory to the NL). Air emissions during waste burning are of great environmental concern to communities. This type of facility

	enables the responsible management of waste, recyclables and hazardous matter. **Recyclables** CDR, bulky item and similar recyclables intended for shipment to recyclers in Southern Québec are primarily metals (aluminum cans, sheets and steel). Metals and ELVs should be compacted and baled. (Tools 3.4 A, B and C).
Infrastructure requirements	Varies by recovered materials. **At the ecocentre** 1. Reception desk 2. Warehouse for furniture, household appliances, CDR residues and other reusable materials 3. Waste and recyclables containers 4. Corral, container or shelter for reusable materials 5. Secured container for HHW 6. Signage and safety equipment 7. Front loader 8. Industrial compactor **On the construction site** 1. Containers for sorting **For shipping to Southern Québec** Metal baler
Training needs	Construction site employee training and awareness on sorting and its benefits Sensitize workers on the need to sort and recover as much material as possible and process it appropriately Train ecocentre employees on sorting and equipment operation Health and safety training
Applicable regulations and standards	Local by-laws on RM disposal intended for operators
Potential job creation	One or two ecocentre employees
Preliminary cost analysis	**Infrastructure** Construction site reception container or trailer ≈$20,000+ shipping and set-up costs Container modified for HHW ≈ $10,000 Container modified for construction site sorting ≈ $5,000 per container 4 X 8X20 feet Storage containers if the ecocentre has no available warehouse space Dome warehouse ≈ $100,000

	Front-end loader Forklift truck **Recurring expenses** Employment–20–35 hours per week, June to November. Electricity and diesel fuel.
Potential partners	Fédération des Coopératives du Nouveau-Québec
Potential sources of funding	Recyc-Québec Federal government

4.3.2 Sample ecocentre CDR management consultants and suppliers

Suppliers and consultants	Skills and equipment	Location	Contact information
Conteneurs experts	Sea freight containers Modified sea freight containers Site trailers	Vaudreuil-Dorion, Québec	1201 Montée Labossière Vaudreuil-Dorion, QC, J7V 8P2 1-888-482-9674 www.conteneursexperts.com
Contern	Sea freight containers Modified sea freight containers Site trailers	Sainte-Catherine, Québec	705 1st avenue, Sainte-Catherine, Québec J5C 1C5 david@conterm.ca
MegaDome	Industrial domes	St-Thomas, Québec	1044 rue Principal, St-Thomas, Québec 1-888-427-6647 http://structuremegadome.com/secteur/industriel.html
Toiles Ste-Monique	Industrial domes	Sainte-Monique, Québec	Toiles Ste-Monique 101 Route du Quai, Sainte-Monique, Qc, G0W 2T0 Tel : 418-347-5224 et 1-800-547-5224 info@toilesstemonique.com http://www.toilesetauvents.com

4.3.3 Relevant literature on managing CDR residue in the ecocentre

Mots clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Planification, aspects technico-économiques	Ce guide décrit sommairement les étapes pour mettre en place un projet de ressourcerie.	Corse, France	ADEME. (2014). Guide pratique pour l'implantation de recycleries/ressourceries en Corse. ADEME, http://www.corse.ademe.fr/sites/default/files/files/Mediatheque/guide-ressourceries.pdf.
Éco-centre, réglementation	« *Les caractéristiques des écocentres […] incluent la dimension et le circuit, les bâtiments, les infrastructures pour l'entreposage des matières en vrac, les consignes de sécurité et, enfin, la signalisation et les équipements de*		Roy, A. (2015). *Implantation d'un service d'écocentre régional pour répondre aux besoins de la MRC de la Vallée-du-Richelieu.* Université de Sherbrooke, Université de Sherbrooke.

	sécurité », page 51		
3RV, démantèlement, stratégie	Ce document est une vieille version en révision, il propose tout de même des stratégies de gestion des matériaux de CRD. « *La « réduction » est l'action visant à diminuer la quantité de résidus à éliminer, notamment par l'application de techniques de traitement sur les divers matériaux rencontrés. Il peut s'agir, par exemple, de procéder à la scarification de la surface d'un béton contaminé avant de gérer l'ensemble du béton (voir le tableau 5).* *Le « réemploi » est l'utilisation répétée d'un produit sans modification de son apparence ou de ses propriétés (par exemple, le réemploi de poutres de métal provenant d'une usine démantelée pour la construction d'un autre bâtiment).* *Le « recyclage » est l'utilisation, dans un procédé industriel, d'une matière résiduelle ou d'un matériau de démantèlement en remplacement d'une matière première vierge. Un exemple serait l'utilisation de débris de métal comme matière première dans une fonderie.* *Finalement, la « valorisation » est la mise en valeur d'une matière résiduelle ou d'un matériau de démantèlement à d'autres fins que son réemploi ou son recyclage. On pense, par exemple, à la valorisation du béton concassé comme matériau granulaire pour la construction de routes.* » Voir le tableau 6 « Modes de gestion des diverses classes de matériaux de démantèlement » à la page 55.	Québec	Ministère du développement durable de l'environnement et de la lutte contre les changements climatiques (MDDELCC). (2002). *Guide de bonnes pratiques pour la gestion des matériaux de démantèlement, Québec*. ministère du Développement durable, de l'Environnement et des Parcs, Direction des politiques du secteur industriel, Secteur des lieux contaminés: Gouvernement du Québec.

TOOL 4.4: MANAGEMENT OF END-OF-LIFE VEHICLES AND REUSABLE SPARE PARTS

Several recent guides on end-of-life vehicle management exist, one pertaining to Nunavut, which is a comparable area to locations in this study.

See: Heinrichs, D. (2011). *End-of-Life Vehicle Hazardous Materials Recovery Program Manual*: Department of Environment, Government of Nunavut. http://docplayer.fr/7641250-End-of-life-vehicle-hazardous-materials-recovery-program-manual.html

"*The purpose of this report is to discuss the findings of the End-of-Life Vehicle Pilot Program in Iqaluit, NU and to provide recommendations on how to improve similar future programs. The report is divided into the following sections:*

- *End-of-Life Vehicle Program Executive Summary*
- *Introduction*
- *Background –ELVs in Nunavut and some of the limited efforts to date*
- *Assessment – observations and assessment of vehicle recovery activities in Iqaluit, NU from 2008 to 2010*
- *Rationale for recovering hazardous materials from ELVs.*
- *Prequalification – rationale and use of special prequalification applications*
- *Landfill Waste Diversion – brief discussion of the opportunities for landfill life extension through ELV recycling in Nunavut.*
- *Legislation – overview of various legislative tools with a focus on those with the potential for wider use in Canada*
- *Conclusions and Recommendations based on the results of the Iqaluit Pilot Project* (adapted from excerpted from Heinrichs, D. (2011).

The following paragraphs summarize studies that were consulted.

End-of-life vehicle management starts with the removal of hazardous matter before the hulk is stored, crushed and sent for recovery:

- Battery
- Refrigerants
- Gasoline or diesel fuel
- Antifreeze
- Brake fluid
- Engine oil
- Transmission fluid
- Power-steering hydraulic fluid
- Differential fluid (if any)
- Windshield washer liquid
- Mercury switches (ABS, convenience lighting)
- Lead (battery connectors, wheel rollers, etc.)
- Airbags
- Electronic components, etc.

With this in mind, the community should have the following infrastructure and equipment:

1- A secure building with a concrete floor, a wastewater tank and an oil/water separator
2- An impermeable external surface, for outside work
3- A fluid recovery area with surfaces that can sustain oil damage
4- Forklifts or other machinery for moving vehicles
5- Areas for vehicle intake, dismantling and storage
6- A gasoline removal pump with a filter
7- A hydraulic, electric or manual lift to facilitate the removal of fluids
8- Containers to store oil, antifreeze, windshield washer fluid, etc.;
9- A device for removing cooling fluids
10- Vats for draining and recovering liquids
11- A spill kit

The following employee training must be planned:[10]

- Health/security: personal protection, hazardous matter
- Appropriate collection, handling, storage and disposal of hazardous matter
- Procedures for spill prevention and control
- Certification for vehicle coolant removal and storage

Once all hazardous matter has been removed, vehicles can be stored temporarily before dismantling and removal of potentially reusable parts takes place.

The reuse of tires, batteries and vehicle parts is also an important environmental consideration. Tires and lead removed from vehicles can often be re-used for their original purposes.

In addition, auto parts such as alternators, windshields and headlights can fail or break. An alternative to purchasing new parts, reuse is a more affordable solution for consumers and has the additional benefit of curtailing needless manufacturing. Consequently, the re-use of parts from end-of-life vehicles can be of benefit to the environment […].

Automobile dismantlers and recyclers should seek to reuse tires, batteries and parts in good condition within the framework of the Green Recycled Parts Program. Adapted from Summerhill, (2012). The Canadian Auto Recyclers' Environmental Code (CAREC). http://carec.ca/carec-en-homepage.htm.

Automotive Recyclers of Canada (ARC) is an association of Canadian automotive recyclers whose purpose is to channel information and respond to concerns in order to help standardize the process of recycling end-of-life vehicles. The Association also provides a Web platform for easily locating auto parts (http://autorecyclers.ca/find-green-recycled-parts/).

The internet provides isolated communities with opportunities for selling vehicle parts to buyers in other areas. End-of-life vehicles in these areas are generally old but undamaged by rust, making their reusable parts marketable.

In cases where no parts from a given vehicle can be reused, shipment to Southern Québec follows[11] using these procedures:

1- Locate a recovery enterprise in Southern Québec and contract with it.
2- Compact vehicles to reduce hulk volume to a minimum for containerization
3- Containerize the vehicle hulks

[10]The following publication provides skills profiles: *Démonteur ou démonteuse de véhicules routiers: profil de compétences, Comité sectoriel de main-d'œuvre des services automobiles*, csmo-auto.com, December 2012. Available at: http://www.csmo-auto.com/documents/Profil_competences-demonteur-Final-HQ.pdf

[11]In Nunavik, communities could optimally share portable equipment that can travel from village to village. In the Basse-Côte-Nord and Schefferville areas, it is preferable to hire a contractor that has its own equipment.

(Source: Heinrichs, D. (2011). End-of-Life Vehicle Hazardous Materials Recovery Program Manual: Department of Environment, Government of Nunavut); (provided by Arctic Sealift)

Photo 3: Vehicle crusher; container filled with scrap metal and end-of-life vehicles

4.4.1 Relevant literature on end-of-life vehicle and auto part reuse and recycling

Mots clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
Pièces automobiles, exigences légales, réutilisation et revente, aires de traitement	Ce document constitue un résumé des exigences légales existantes en matière de déchets dangereux provenant de véhicules en fin de vie utile. *« La réutilisation de pneus, de batteries et de pièces de véhicules est également une considération environnementale importante. Les pneus et les accumulateurs au plomb provenant des véhicules peuvent être réutilisés à leur fin originale, ce qui constitue aussi une considération environnementale importante.* *De plus, des pièces comme les alternateurs, les pare-brise et les phares peuvent faire défaut ou se briser. Plutôt que de fabriquer de nouvelles pièces, la réutilisation de pièces est plus économique pour le consommateur et permet de différer cette fabrication. Par conséquent, la réutilisation des pièces provenant de véhicules en fin de vie utile peut être bénéfique pour l'environnement. »*	Québec	Summerhil. (2012). *Le Code environnemental des recycleurs automobiles du Canada*. http://cerac.ca/cerac_jan2012.pdf.
	« *The purpose of this report is to discuss the findings of the End-of-Life Vehicle Program piloted in Iqaluit, NU and to provide recommendations on how to improve similar future programs. The report is divided into the following sections:* • *Executive Summary – summary of the End-of-Life vehicle program.* • *Introduction – report introduction.* • *Background – background to the issue of ELVs in Nunavut and some of the limited efforts to date.* • *Assessment – observations and assessment of the vehicle recovery activities undertaken in Iqaluit, NU from 2008 through 2010.* • *Manual Development – rationale and basis for the hazardous materials recovery from ELVs.* • *Request for Pre-Qualifications – rationale and use for the special provisions request for pre-qualifications.* • *Landfill Waste Diversion – brief discussion of the opportunities for landfill life extension through ELV recycling in Nunavut.* • *Legislation – overview of different legislative tools with focus towards those that may have greater Canadian application.* • *Conclusions and Recommendations – conclusions and recommendations developed based on the results of the pilot project undertaken in Iqaluit, NU.* »	Iqualuit	Heinrichs, D. (2011). *End-of-Life Vehicle Hazardous Materials Recovery Program Manual*: Department of Environment, Government of Nunavut.
Exigences	À noter : un certificat d'autorisation en vertu de l'article 22 de la LQE est requis pour	Québec	Chrétien, R.-C., Dessureault, M., &

environnementales, démantèlement, recyclage.	toute activité concernant l'entreposage, le pressage et/ou le recyclage des VHU. « *Ce guide vise à encadrer la gestion des véhicules hors d'usage (VHU) lors des activités d'entreposage, de démantèlement, de pressage et de déchiquetage. Ce document a pour objectif principal de fournir un outil permettant de gérer adéquatement les matières dangereuses (MD) de même que les autres matières résiduelles (MR) qui se retrouvent dans les VHU, en évitant la contamination des eaux de surface et des eaux souterraines, des sols et de l'air. Les exigences environnementales concernant le bruit produit par les activités de ce secteur sont aussi précisées. Le guide permet également de s'assurer que chaque étape de l'activité de recyclage des VHU s'effectue dans le respect de la Loi sur la qualité de l'environnement (LQE) et des règlements qui s'y rattachent.* »		Martel, R. (2015). Guide de bonnes pratiques pour la gestion des véhicules hors d'usage. Gouvernement du Québec, http://www.mddelcc.gouv.qc.ca/matieres/mat_res/vehicules/guide-bonnes-pratiques-VHU.pdf.

TOOL 4.5: HOUSEHOLD HAZARDOUS WASTE MANAGEMENT

Given the dangers related to poor HHW disposal or incineration, HHW management is probably the most advanced of all types of RM.

If a community wishes to establish a sorting centre with growth potential, a specialHHW site that meets all security requirements (see documents below) must be planned.

Similarly, it is very important to comply with multiple technical requirements when shipping HHW. Each type of material is unique and requires that the latest available documentation be consulted.

Here are but a few of the many existing publications on this subject:

- The Government of Nunavut has made a number of guides to appropriate HHW management available to its communities. These guides are also applicable to the Québec's isolated Northern communities. See http://www.gov.nu.ca/environment/information/documents/195/184
- The MDDELCC offers data sheets on the **Regulation respecting hazardous materials**.
- You can also contact the KRG in Kuujjuaq, whose HHW management is well-established. http://www.krg.ca/fr/krg-departments/renewable-resources/environment

4.5.1 Relevant literature on HHW management

Mots clés	Exemple d'informations ou citations importantes	Localisations	Sources et liens
RDD	Fiche d'information sur la gestion des dépôts de résidus domestiques dangereux dans les éco-centres	Québec	Gouvernement du Québec. (2017). Info matières dangereuses résiduelles : Dépôt de résidus domestiques dangereux dans les écocentres. http://www.mddelcc.gouv.qc.ca/matieres/dangereux/fiches/depot-residus-ecocentre.pdf
Matériel informatique et électronique	Fiche d'information sur la gestion du matériel informatique et électronique.	Québec	Gouvernement du Québec. (2017). Info matières dangereuses résiduelles : matériel informatique et électroniques http://www.mddelcc.gouv.qc.ca/matieres/dangereux/fiches/materiel-informatique-electronique.pdf

Burning and incineration	*« This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with the burning and incineration of solid waste. This Guideline does not replace the need for the owner or person in charge, management or control of a solid waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of solid waste».*	Nunavut	Gouvernement du Nunavut. (2012). Guideline for the Burning and Incineration of Solid Waste. http://www.gov.nu.ca/environment/documents/guideline-burning-and-incineration-solid-waste-2012
Waste Mercury	« This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with common mercury-containing products and waste mercury. This Guideline does not replace the need for the owner or person in charge, management or control of the product or waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of mercury ».	Nunavut	Gouvernement du Nunavut. (2010). Guideline for Mercury-Containing Products and Waste Mercury. Departement of Environnement http://www.gov.nu.ca/environment/documents/mercury-containing-products-waste-mercury-2010
Contingency Planning	« *The Spill Contingency Planning and Reporting Regulations for Nunavut include the requirement for a contingency plan to be prepared and filed for facilities where petroleum, chemicals and other contaminants are stored* ».	Nunavut	Gouvernement du Nunavut. (non défini). Contingency planning and spill reporting in Nunavut. Departement of Environnement (http://www.gov.nu.ca/environment/documents/contingency-planning-and-spill-reporting-nunavut.
Waste Lead and Lead Paint	« *The Environmental Guideline for Waste Lead and Lead Paint (the Guideline) provides information on the characteristics and possible effects of waste lead and lead paint on the environment and human health and guidance on its proper containment and removal, storage, transportation and disposal* ».	Nunavut	Gouvernement du Nunavut. (2014). Waste Lead and Lead Paint. Departement of Environnement http://www.gov.nu.ca/environment/documents/waste-lead-and-lead-paint-2014
Contaminated sites	« This Guideline is not an official statement of the law and is provided for guidance only. It is intended to provide general guidance on assessment and remediation of contaminated sites and assist in their management. This Guideline does not replace the need for the land owner, site operator or person in charge, management or control of the contaminated site to comply with all applicable legislation and consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of contaminated sites ».	Nunavut	Gouvernement du Nunavut. (2014). Guideline for the Management of Contaminated Sites. Departement of Environnement http://www.gov.nu.ca/environment/documents/environmental-guideline-management-contaminated-sites

Waste fuel	*« This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with used oil and waste fuel. This Guideline does not replace the need for the owner or person in charge, management or control of the waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of used oil and waste fuel ».*	Nunavut	Gouvernement du Nunavut. (2011). Guideline for *oil and waste fuel* Departement of Environnement
Waste batteries	*« This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with waste batteries. This Guideline does not replace the need for the owner or person in charge, management or control of the waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of waste batteries* »	Nunavut	Gouvernement du Nunavut. (2011). Guideline for Waste Batteries Departement of Environnement http://www.gov.nu.ca/environment/documents/waste-batteries-2011
Waste Solvent	« This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with waste solvent. This Guideline does not replace the need for the owner or person in charge, management or control of the waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of waste solvent »	Nunavut	Gouvernement du Nunavut. (2011). Guideline for Waste solvent. Departement of Environnement http://www.gov.nu.ca/environment/documents/waste-solvent-2011
Waste paint	*« This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with waste paint. This Guideline does not replace the need for the owner or person in charge, management or control of the waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of waste paint ».*	Nunavut	Gouvernement du Nunavut. (2010). Guideline for Waste Paint Departement of Environnement http://www.gov.nu.ca/environment/documents/waste-paint-2010
Waste asbestos	*« This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with waste asbestos. This Guideline does not replace the need for the owner or person in charge, management or control of the waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of waste asbestos ».*	Nunavut	Gouvernement du Nunavut. (2011). Guideline for Waste asbestos. Departement of Environnement http://www.gov.nu.ca/environment/documents/waste-asbestos-2011

Waste antifreeze	*« This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with waste antifreeze. This Guideline does not replace the need for the owner or person in charge, management or control of the waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of waste antifreeze ».*	Nunavut	Gouvernement du Nunavut. (2011). Guideline for Waste Antifreeze. Departement of Environnement http://www.gov.nu.ca/environment/documents/waste-antifreeze-2011
Ozone depleting substances	« This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with ozone depleting substances. This Guideline does not replace the need for the owner or person in charge, management or control of ozone depleting substances to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of these substances ».	Nunavut	Gouvernement du Nunavut. (2011). Guideline for Ozone Depleting Substances. Departement of Environnement http://www.gov.nu.ca/environment/documents/ozone-depleting-substances-2011
Hazardous waste	« This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks and hazards associated with hazardous waste and to assist in its proper management. This Guideline does not replace the need for the owner or person in charge, management or control of a hazardous waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of hazardous waste ».	Nunavut	Gouvernement du Nunavut. (2010). Guideline for General Management of Hazardous Waste. Departement of Environnement http://www.gov.nu.ca/environment/documents/general-management-hazardous-wastes-2010
Matériaux composites	Fiche d'information sur la gestion des matériaux composites.	Québec	Gouvernement du Québec. (2017). Info matières dangereuses résiduelles : Les matériaux composites. http://www.mddelcc.gouv.qc.ca/matieres/dangereux/fiches/matiere_composite.pdf