

Sustainable Waste Management Practices

A guide for the Nova Scotia
Industrial, Commercial and Institutional (ICI) sector



Sustainable Waste Management Practices

Prepared by the Dalhousie University Office of Sustainability

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Campus-wide waste audit – October 2011.

1.0 Why a waste management guide for the ICI sector?

The Nova Scotia Industrial, Commercial, and Institutional (ICI) Sector disposes of millions of kilograms (KGs) of solid waste annually. In 2008, non-residential sources were responsible for approximately 58% (206,171 tonnes) of total waste disposed in Nova Scotia (Statistics Canada, 2010). As the residential sector has been more successful at diverting a greater percentage of solid waste, this percentage (58%) is likely to rise.

Increasing waste diversion from disposal sites has a number of economic, environmental, health, and leadership benefits.

Economic: Save money and time.

- Decreasing the amount of materials purchased can save capital, operating, and disposal costs.
- Keeping material streams clean will increase the viability of re-use and recycling options.
- Avoid fines, tickets, and disposal tipping fees by properly recycling and composting material.
- Aid taxpayers to save money by extending the life of engineered disposal facilities.

Environment and Health: Reduce Impacts.

- Using all of a product, like both sides of a piece of paper, helps to conserve natural resources.
- Using a waste as a resource extends the life of the product.
- Managing waste according to government regulations and best management practices helps to ensure health and safety standards.

Leadership: It is a Nova Scotia tradition.

- In 1996, Nova Scotia developed a solid waste-resource management strategy that set a target of 50% waste diversion from landfill. This target has been met and Nova Scotia is recognized as a global leader in waste diversion efforts.
- Nova Scotia passed the Environmental Goals and Sustainability and Prosperity Act in 2007. In the Act there is a goal “to reduce Nova Scotia’s solid waste disposal rate to no more than 300 kg/person per year by 2015”. This is a 38% reduction from 2006 levels. All sectors have to work towards meeting this goal.

This waste management guide has been developed to help ICI organizations create sustainable waste management plans to decrease waste volumes and increase diversion. Specific tools such as Waste Audit Procedures and a Waste Audit Calculator are provided as Appendices.

How is the Guide written?

To create the guide, information was collected from peer-reviewed journals, grey literature, reputable online sources, consultations with waste management experts, and applied research conducted at Dalhousie University.

Examples of key concepts and management practices are illustrated throughout the guide by using Dalhousie University as a case study. The University is presented as a suitable case study because it deals with a wide-range of waste materials and faces waste management issues similar to a small community and many ICI organizations. Key questions are also highlighted at the end of each section. These questions can help to stimulate discussion about waste management planning in an ICI organization.

2.0 Integrated waste management

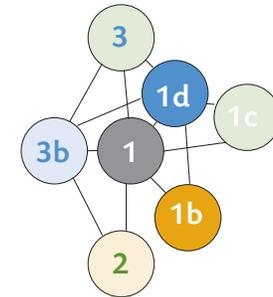
The concept of integrated waste management (IWM) highlights that waste management systems are comprised of interconnected functions. Just as there is no individual waste management method which is suitable for processing all waste, there is no perfect IWM system. Individual IWM systems will vary across regions and organizations; however, there are some key features which characterize IWM (McDougall et al., 2001):

- assessing the overall environmental burdens and economic costs of the system;
- using a range of collection and treatment methods which focus on producing less waste and effectively managing waste which is still produced;
- handling all materials in the solid waste stream rather than focusing solely on specific materials or sources of materials (Hazardous materials should be dealt with within the system, but in a separate stream);

- reducing the environmental impact such as emissions to air, land and water;
- being economically affordable by driving costs down and adopting a market-oriented approach with waste products that have end uses and can generate income; and
- increasing social acceptability by incorporating public participation techniques and ensuring individuals understand their role in the waste management system.

Waste management systems depend on the successful interaction and integration of a diverse range of activities, processes, equipment, and people. Many times when changes are made, they are added to an existing waste management system in a “bolt-on” approach (McDougall et al., 2001). This approach will often create additional costs resulting in greater environmental burdens and inefficiencies even if the materials are being processed in a more environmentally-friendly manner (Figure 1). Using an IWM a new system can be formed which considers all of the elements of the system and the interrelations between them.

Figure 1: Bolt-On Approach



Original system is created, then is added to, then new practices brought in, or bolted on, but they don't necessarily add efficiency.



Waste management has to be considered in the wider context of society, the environment, and the economy. Sustainability is a concept that focuses on meeting the needs of the present without compromising the ability of future generations to meet their own. The concept focuses on all aspects of human existence, placing equal importance on environmental, social and economic factors. IWM directly incorporates this concept. Waste management strategies with minimization and diversion efforts can save significant amounts of resources and energy. Given the global nature of waste management processing, social and health standards need be incorporated along with environmental and economic targets.

A common misconception is that improved waste management has to come at a direct economic trade-off. However, this is not always the case. Integrating sustainability objectives directly into waste management

“Bolting On” Bins at Dalhousie

Over the years, new materials streams have been incorporated into recycling programs at Dalhousie University. Hundreds of new recycling and composting bins have been added, but are we “over binned”? As part of developing the Dalhousie waste management plan, a comprehensive audit was taken of all bins inside and outside buildings (over a 100 buildings and houses). Bin types were recorded, photographed, and counted. Bins were identified on floor maps. During this process, each bin was appropriately labelled with stickers on the front and the top, making for consistent branding for users.

Findings: We had many more garbage bins than other recycling containers throughout the campus (Figure 2). As an example, the Killiam library had hundreds of single bins in common spaces. With the interest of the Library Sustainability Team and the support of Facilities Management, many single bins were replaced with strategically placed four-bin stations. Student auditors assessed diversion rates before and after. Diversion rates are up! But more education is needed as there is still contamination.

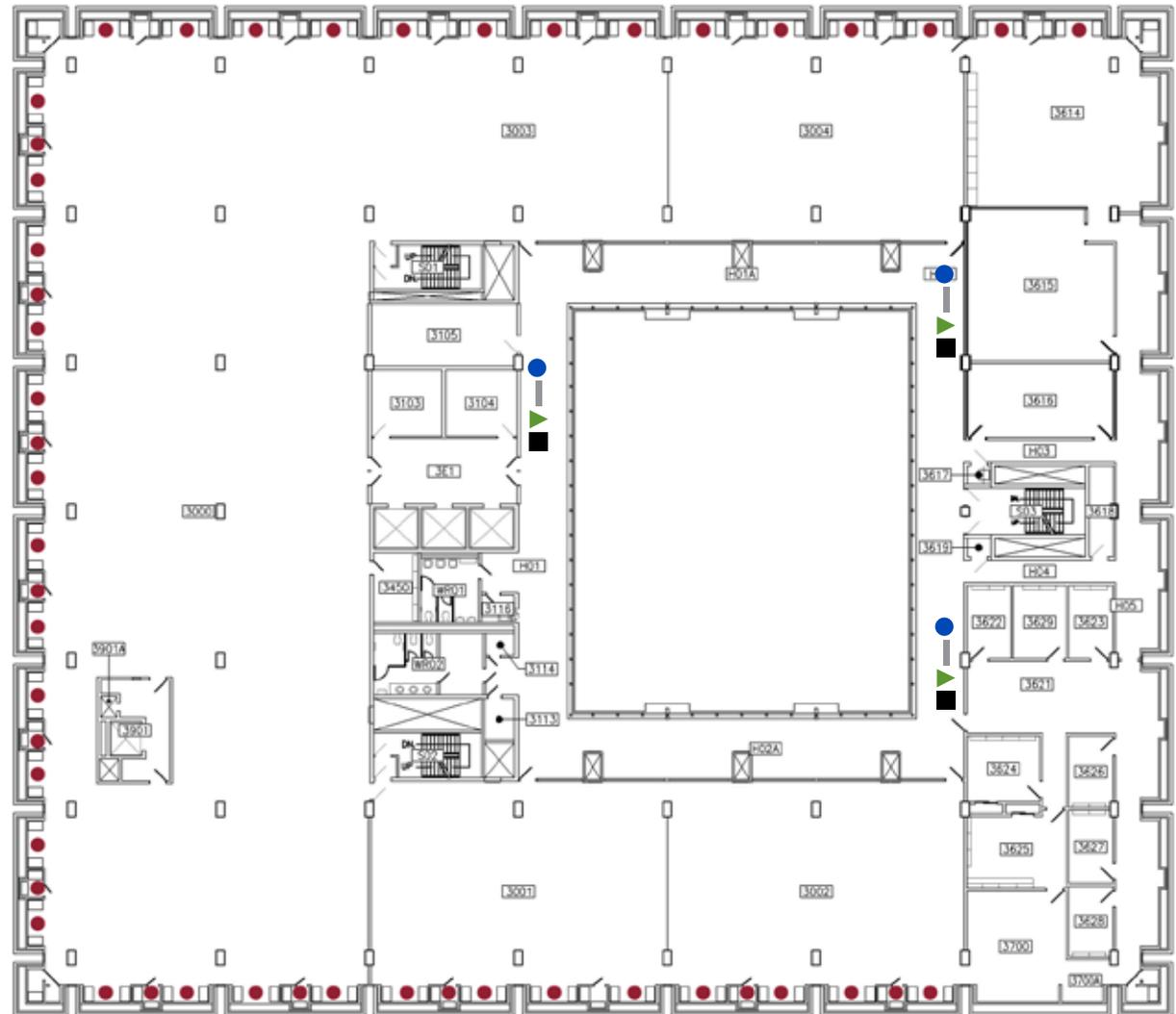
Key Points: Reduction of single use waste bins saves resources (such as bags) and time and increases diversion rates. Education: Consistent labelling, bin type and colour, and the shape of bin openings helps increase recognition and correct sorting behaviour. Ongoing education is needed of patrons and staff. Eye-level signage above bins is another recommended strategy.

systems can prevent the waste of valuable materials. Assessing a variety of options and taking into account all of the different components of the system allows for the development of an integrated strategy.

Figure 2: Higher ratio of waste containers to recycling containers.

Key Questions to ask your organization:

- Is your waste management system integrated or are pieces “bolted on”?
- Do you have a higher percentage of waste bins to other recycling and compost bins?
- Are your bins consistently labelled with correct information?
- Do bins have standard colours and shaped openings to help with sorting?



● Waste Bins ● — ▲ ■ Separation Bins: Recyclables, Paper, Organics, Garbage

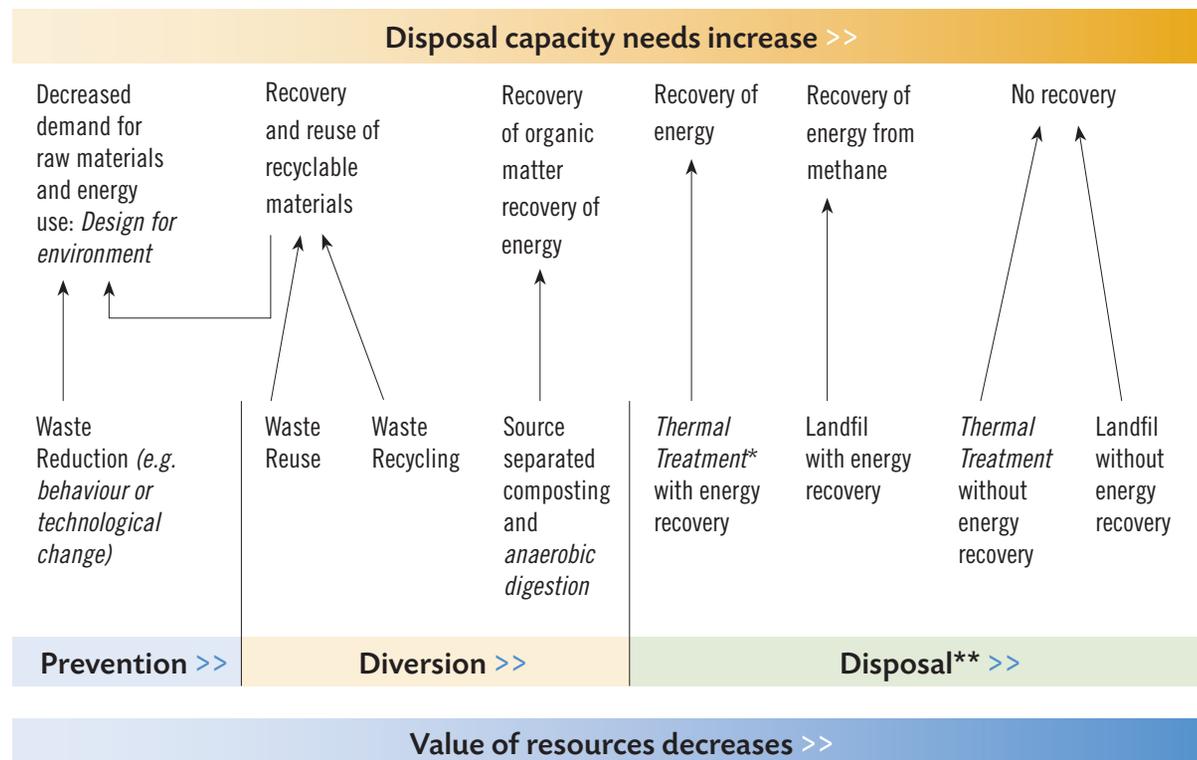
3.0 Guiding concepts

There are a variety of waste management guiding philosophies (Table 1). These key concepts help to frame the overall guiding priorities for a waste management system. There are similarities and overlap between these different concepts, and each has their strengths and weaknesses. The suitability of any given concept must be assessed and determined by the organization. Some are more inspirational in form while others are process focussed. The function and culture of the organization will help determine the appropriate waste management framework for an ICI organization.

Table 1: Summary of waste management concepts

The Three and Four Rs.	The three R's are commonly used terms in waste management; they stand for "reduce, reuse, and recycle". As waste generation rates have risen, processing costs increased, and available landfill space decreased, the three Rs have become a central tenet in sustainable waste management efforts. Other R's have been added to the three R's including concepts such as Rebuy and Rethink which focusing on upstream purchasing and Recover (related to energy recovery) (Figure 3). The three or four R concept is to be implemented in a hierarchical fashion.
Zero waste	A philosophical approach to waste management which emphasizes waste prevention through planning, design, and restructuring production and distribution systems rather than simply managing waste. Zero waste is an ideal end goal that is strived for as opposed to a hard target to be reached.
Cradle-to-cradle (close loop systems)	A strategy that focuses on improving the recyclability and reusability of materials so that waste products can become the raw materials used to make new products rather than being disposed of.
Eco-efficiency	An approach that focuses on achieving more with less. Eco-efficiency is a broad discipline which can be used in conjunction with a variety of other established strategies to reduce the consumption of resources, minimize pollution, and improve environmental performance.
Industrial ecology	An approach that focuses on improving the economic and environmental performance of industrial firms through re-designing, integrating and adapting technology and processes.

Figure 3: Waste management hierarchy (CIELP, 2008)



Dalhousie goes with the Four R's

The Four R's: Rethink, Reduce, Reuse, and Recycle are hierarchical principles that will guide the Dalhousie University Waste Management Plan (Figure 4.) In an institutional setting, products are most often used rather than created. A wide-range of products are consumed. Hundreds of people are involved in procurement and sorting materials. Each year there is a large turn-over of students. Large volumes of a variety of material streams are processed. The Four R's provide the framework and flexibility for the University conditions.

In an industrial setting, focus may be on product creation. The opportunity for waste efficiency and reuse is more streamline and perhaps easier to control with less individual actors. Therefore guiding concepts that evolved from the industrial sector such as cradle-to-cradle and zero-waste maybe more fitting.

Key Questions to Ask Your Organization:

- Does your organization primarily make products, consume them, or both?
- Is there a clear waste management vision and guiding principles?



Figure 4: The Four R's: Rethink, Reduce, Reuse, Recycle (ReUse Long Island)

4.0 External and internal factors

There are many factors, both external and internal, which may impact the waste management plan of an ICI organization (Figure 5). In Nova Scotia, waste management law and policy have significant implications for the ICI sector.

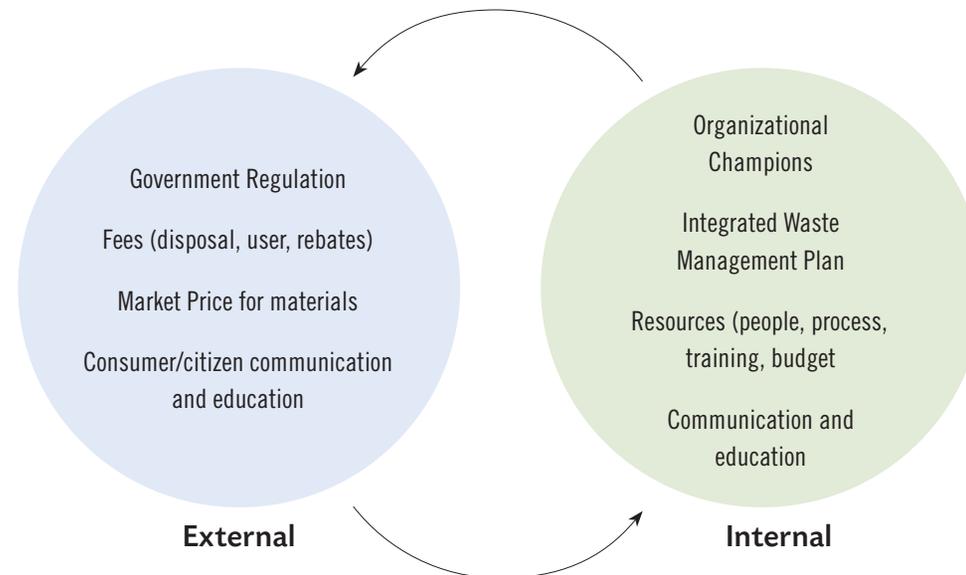
Waste management law and policy

Federal government involvement in waste legislation is primarily related to the regulation and management of certain types of hazardous substances, pollutants, and wastes through transportation and pollution regulations. In addition, the Canadian Council of the Ministers of the Environment (CCME), a minister-led intergovernmental forum, provides resources for environmentally sound waste management.

Key legislative acts and regulations include:

- The Transportation of Dangerous Goods Act and Regulations which regulates the transportation of hazardous waste over air, sea, rail and road; and
- The Canadian Environmental Protection Act (CEPA) which establishes regulations for the management and control of

Figure 5. External and Internal waste management planning considerations



certain toxic and hazardous waste. Examples of a regulation under CEPA include the Interprovincial Movement of Hazardous Waste Regulations and proposed Export and Import of Hazardous Waste and Hazardous Recyclables Regulations.

In Nova Scotia, key legislative acts and regulations include:

- The Solid Waste-Resource Management

Regulations (SWRMR, 1996), enabled under the Nova Scotia Environment Act (1994-95). It establishes measures in law to improve waste management in the province. These regulations are the basis for banning the disposal of certain items from disposal sites (Figure 6), prohibiting the open burning of waste, and establishing seven regional waste management areas in the province. The (SWRMR) also established the Resource

Recovery Fund and the Resource Recovery Fund Board (RRFB) which is responsible for overseeing the Fund. The RRFB is charged with developing: municipal or regional diversion programs; a deposit/refund system for beverage containers; industry stewardship programs; programs and materials to raise awareness for waste reduction, reuse, recycling and composting; and value-added manufacturing in the Province (NSEL, n d; SWRMS, 1996). In 2007, the SWRMR were amended to include restrictions on the disposal of other types of waste, most notably electronics. The amendments resulted in the creation of an electronics stewardship program called the Atlantic Canada Electronics Stewardship (ACES) Program which is led by the electronics industry to reduce, divert and recycle electronic waste.

- The Activities Designations Regulations (defines a waste and hazardous waste handling facility) and the Dangerous Goods Management Regulations (highlights what is hazardous and how materials should be handled and stored) also fall under the Nova Scotia Environment Act.

Figure 6: Materials Banned from Nova Scotia Disposal sites: www.gov.ns.ca/nse/waste/banned.asp

- Desktop, laptop, and notebook computers, including CPUs, Keyboards, mice, cables and other components
- Computer monitors
- Computer printers, including printers that have scanning or fax capabilities or both
- Televisions
- Redeemed beverage containers
- Corrugated cardboard
- Newsprint
- Used tires
- Automotive lead-acid batteries
- Leaf and yard waste
- Post-consumer paint products
- Ethylene glycol (automotive antifreeze)
- Steel/tin food containers
- Glass food containers
- #2 HDPE non-hazardous containers (ice cream containers, plastic jugs, detergent bottles, etc.)
- Low density polyethylene bags and packaging
- Compostable organic material (food waste, yard waste, soiled and non-recyclable paper)

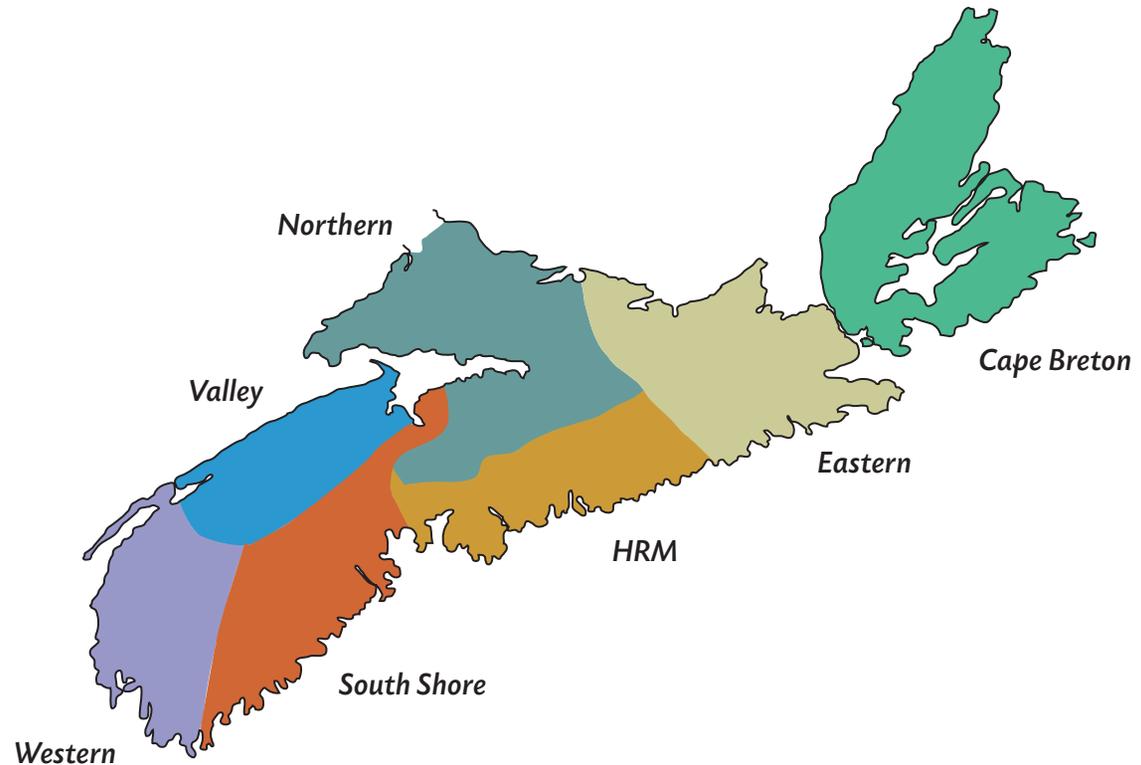


Glass and tin and beverage containers – some of the many items banned from disposal sites

- The Environmental Goals and Sustainable Prosperity Act (EGSPA, 2007) does not contain provisions which allow the government to enforce or regulate waste management. It does commit the government to achieving a variety of environmental objectives by the year 2020 including the 300kg/person/year disposal rate also outlined in the Environment Act (Nova Scotia Government, 2010).

There are seven solid waste resource management regions in Nova Scotia (Figure 7). Classification and disposal/recycling of materials can differ somewhat between regions (and even between some municipalities within one region). For local waste management options, institutions can visit www.reduceyourwaste.ca. Municipalities often have enacted solid waste bylaws that relate to material sorting and disposal. It is therefore important that ICI organizations ensure they are in compliance with any government (federal, provincial and municipal) regulation to ensure compliance is achieved.

Figure 7: Nova Scotia's waste management regions (Source: RRFB.com)



Key Questions to Ask Your Organization:

- Is your organization in compliance with federal, provincial, and municipal waste related acts and regulations?
- Have external and internal waste planning drivers been identified?

Figure 8: Dalhousie University: waste management drivers.

Comparing Internal and External Waste Factors at Dalhousie

Dalhousie University developed a quadrant analysis that compares external and internal drivers against opportunities and risks as part of the University waste management plan (Figure 8).

	Opportunities	Risks
Internal	<ul style="list-style-type: none"> • Long involvement in operating waste management programs • Waste management research and programs through the Office of Sustainability; Facilities Management; and Environment, Health, and Safety Office • Many waste issues are in our direct sphere of influence to change • A number of interested groups and individuals on campus • Staff dedicated to hazardous and solid waste-resource management 	<ul style="list-style-type: none"> • “Bolting” on programs – system is not as efficient as it could be. Example – too many garbage bins per square foot • Clear roles and procedures for handling all waste management streams including universal waste • Open access to bins – illegal dumping • Extra costs and environmental impacts as material is not used efficiently – upstream and downstream • Compliance with multiple levels of regulations • Decentralized procurement and constant influx of people engaged in the system
External	<ul style="list-style-type: none"> • Partnership opportunities with Master students, Eco-efficiency Centre, RRFB, HRM solid waste resources, Dept. of Environment • Supportive policy and legislative context such as EGSPA goal of 300 kg per person per year and bans • Increase market opportunities for material streams • Sustainability concepts are becoming more embedded in product manufacturing 	<ul style="list-style-type: none"> • No markets for particular streams • Multi-mixed materials with pollutants – hard to reuse and recycle and extra costs for disposal • Volatile market prices for recycling material • Ecological degradation (air quality, water quality, habitats) • Short-lived, disposable, and over-packaged products • Producers and users are not paying for waste management fees

5.0 Understanding material streams

The ICI sector produces a broad range of potential waste streams, including municipal and industrial solid wastes, clinical wastes, and hazardous wastes. Through the work at the Dalhousie, a specific Materials Categorization Guide was developed (Appendix A). It is challenging to consistently define waste streams according to collection regimes because of the differences across jurisdictions, therefore, this guide groups materials according to physical properties. The guide categorizes materials into nine streams. Each major category has sub-categories. It is important to have a constant set of categories and sub-categories for waste auditing, tracking, and planning. The nine streams include: fibre, organic, plastic, metal, glass, construction and demolition (C&D), hazardous, universal, and composite/ miscellaneous.

Key questions to ask your organization:

- Do you know what material streams are being handled and where they are coming from?

Material Stream Categories

1. *Fibre: Paper and Cardboard*
2. *Organic: Food, Yard, Farm*
3. *Glass: Containers and Composite Glass*
4. *Metal: Containers, Cans, Products*
5. *Plastic: Container, Product, Film*
6. *Construction and Demolition*
7. *Hazardous: Nine Classes*
8. *Universal: Products with some toxins*
9. *Composite & Miscellaneous Waste*

For a more detailed description of the nine materials streams view Appendix A: Materials Categorization Guide



Saint Mary's and Dalhousie Dump and Run

6.0 Goals, objectives, indicators

Defining and establishing clear goals is a first step in creating a waste management strategy. Goals which are in line with the interests and core principles of the organization should be identified (USEPA, 1995). It can be helpful to gather input from the local community at this stage. Once goals have been defined, baseline data is needed to establish suitable objectives, indicators and targets. Baseline data is obtained by conducting waste characterization studies and, with this data, suitable system components can be identified. This information provides insight as to where efforts will need to be focused to gain the most benefit (USEPA, 1995).

Waste characterization studies and waste audits are critical to the process of designing and implementing a waste management plan and to gain insight as to where diversion efforts should be focused (Armijo de Vega et al, 2008; Smyth et al., 2010). The results of waste characterization studies and waste audits can play a central role in educational campaigns that are used to foster support for waste diversion initiatives. The results of ongoing studies are also useful for evaluating progress towards achieving goals and

objectives of a waste management plan, and also in helping to review previously established targets (CCME, 1996). More information is provided on establishing a baseline and auditing techniques in the Measurement and Monitoring section of the Guide.

Seven ICI sector waste management plans were analyzed to elicit the most common goals, objectives, and indicators. (Environmental Defense - McDonald's Waste Reduction Task Force, 1991; University of Victoria, 2004; Halifax Regional School Board, 2009; Nova Scotia Environment, 2009; Metro Vancouver, 2010; University of the Sunshine Coast, 2010; Polycello, 2011)

Goals/Objectives

- Minimize waste generation;
- Maximize reuse, composting, recycling and material recovery;
- Develop waste management practices in cooperation with the community;
- Adjust procurement policies so they are reflective of commitment to waste management principles;
- Develop educational programs;
- Ensure waste management practices are safe and effective;

- Minimize costs; and
- Become a regional leader in waste management.

Indicators

- Reduce the quantity of waste generated per capita;
- Eliminate unneeded materials;
- Achieve ISO 14001;
- Substitute reusable items for disposable items in shipping, handling, storage and operations;
- Increase the waste diversion rate;
- Work with regional organisations to minimise duplication of resources and facilities;
- Develop regional alliances to maximise purchasing power and encourage waste avoidance specifications for products;
- Involve the community through increasing awareness, meeting specific information needs, and fostering a sense of community commitment; and
- Ensure compliance with regulations.

Clear and concise targets are established once baseline data is obtained.

Figure 9. Dalhousie Waste Management: draft goals, objectives, indicators, and targets

Strategic Focus for Waste Management at Dalhousie

Clear goals, objectives, indicators, and targets to drive waste management effort have been drafted for the University (Figure 9).

Goals	Objectives	Indicators	Targets
Decrease natural resource use (energy, water, products) and outputs (waste, toxins and air emissions)	Minimize waste generation through administrative processes and purchasing	Centralized commodity purchasing with a sustainability focus	Baseline year 2008 – 2009
Become a leader in waste management	Maximize reuse, recycling, composting and material recovery	Efficient business processes such as reducing single use office equipment, and increasing electronic process management	Divert solid, liquid and hazardous waste from disposal sites (tonnes) 55% – Phase 1 (2009 – 2012)
Have a safe and healthy workplace	Ensure waste management is safe and effective	Right sizing principle is used everywhere from portion size to product purchasing	65% – Phase 2 (2013 – 2016)
Decrease costs	Increase knowledge of waste management initiatives	Materials are processed for effective reuse, composting and recycling	75% – Phase 3 (201 – 2020) Reduce quantity of each material stream by 5% per capita by 2015
		Students and employees are knowledgeable of the waste management efforts and can sort material appropriately.	Contamination rates are reduced in the garbage stream 10-20% by 2015

7.0 Actions

There are several types of strategies which can be implemented to carry out waste management plans. Strategies can typically be classified as command and control approaches, economic incentives and stimulation of innovation in the market place, and information and educational efforts (CEF Consultants, 1994). At an ICI organization a number of strategies can be utilized to take action (Figure 10).



Figure 10. Waste Management Strategies

Policies/Plans	<ul style="list-style-type: none"> • Ensure all contracts have appropriate waste management diversion and tracking clauses. • Institute policies that reduce the use of material stream such as double-sided paper policy, reduced use of phone books, etc. • Institute a user-pay-system with groups within your ICI organization. • Provide financial incentives and/or recognition programs for reducing waste. • Develop an integrated waste management plan and involve key stakeholders.
Education & Communication	<ul style="list-style-type: none"> • Provide information on waste management program and sorting in orientation sessions and information. • Conduct staff training for key groups including custodians, grounds, health and safety, trades, and sustainability staff. • Implement ongoing campaigns, workshops, and other educational efforts to engage users. • Create a waste management committee. • Communicate progress and efforts to clients and employees.
Procurement	<ul style="list-style-type: none"> • Create Design Guidelines, Request for Proposals (RFPs), and tender specifications with waste management criteria and requirements. • Identify options for cooperative product purchasing, including price and discounts for bulk purchases. • Purchase items that can be easily re-used and recycled.
Measurement	<ul style="list-style-type: none"> • Conduct material category studies to understand flows and amounts of inputs and outputs. • Identify targets and track progress. • Evaluate procedures in the creation of key ICI “products” to create suggestions for reductions. ICI products can vary depending on the core business of the group. It could range from delivering a medical procedure or lab to producing a meal or report.

Dalhousie key actions for the next five years

Policies/ Plans	<ul style="list-style-type: none"> • Finalize and publicise waste management plan. • Create paper and green Information Technology (IT) policy that focuses on paper reduction actions. • Conduct a business case on the cost/benefits of changing collection, sorting and processing procedures to reduce costs of pick ups and increase diversion. This could include developing different partners. • Explore user pay for ancillary services. • Require all new offices to receive blue-bin with a mini-waste bin attached instead of a waste bin. • Insert waste management diversion clauses and criteria in contracts, RFPs, guidelines, and tenders. Recent examples include outlining regulations in RFPs, requirements for tonnage receipts, and waste management plans.
Education & Communication	<ul style="list-style-type: none"> • Continue to conduct employee and student orientation education activities during Frosh week and Waste Reduction Week. • Produce and promote Dal Waste Sorting Guide for all Faculties and Departments. • Add a waste management challenge as part of the Dalhousie Eco-Olympics. • Promote sustainability guide for special events which includes a waste minimization section. • Pilot test new posters for above four-bin stations.
Procurement	<ul style="list-style-type: none"> • Focus on standing offers for key commodities to control purchasing and sustainability features such as waste minimization.
Measurement & Monitoring	<ul style="list-style-type: none"> • Perform yearly waste audits. • Finalize baseline tonnage figures for all material streams. • Conduct an input analysis of all material streams to compare to output tonnage to identify inefficiencies. • Conduct further research on C&D and lab waste.
Processing	<ul style="list-style-type: none"> • Sort material for added-value re-use and recycling (ex. building on the success of programs such as acetone recycling and chemical exchange program). Ideas including purchasing balers for cardboard and paper to sell material for a price instead of paying for it to be picked up. • Remove/reduce single waste bins on campus in areas such as classrooms, kitchens, offices, and hallways. Add more four bin-stations were needed.

8.0 Operational logistics

Materials stream flows through an ICI organization from procurement to delivery, handling (use and collection), storage, transportation, and processing. It is important to examine each step to see how it can be made the most effective and efficient in meeting waste management goals.

Consider the example of paper in an ICI organization. Paper is ordered, delivered, used, collected, stored, and transported all at ICI organizations. Every time a piece of paper is handled there is a cost. Is the piece of paper needed in the first place? If so, were both sides used? How long was it used for? Is it going in the right recycling bin? How is it collected and transported to a central site? Is this efficient and cost-effective? Is it baled? Is it re-sold as a commodity? Each one of these process steps will require collection and storage of material, required equipment, educational efforts, signage, human resources, transportation, materials processing, and material use (UC Davis, n d;

CCME, 1996). Even companies with a long history of adequate waste management plans may see drastic improvements in economic and environmental performance by analyzing the components of their system and making changes.

The economic and environmental performance of the entire system can be impacted by the way that materials are collected and sorted and how the different stakeholders in the system interact. The sustainability of the system will depend heavily upon the successful planning of operations and integration of activities among different stakeholders.

Equipment

There are generally two types of equipment which will be required by an organization to manage waste: collection equipment which is used for collecting the generated waste materials; and processing equipment for reducing the volume of materials and for storage (CCME, 1996). Handling and

processing equipment for waste-resource material (paper, organics, recyclables and generic waste) is fairly standard. (Table 2); however, specialized equipment is required for certain materials such as hazardous or universal waste. The size and type of collection equipment most suitable for any task will depend on a variety of factors such as: goals and objectives, facility size, waste volume and weights, storage space available, characteristics of the waste being handled, and costs (CCME, 1996).

Table 2: Commonly used collection equipment (Adopted from CCME, 1996)

Type	Volume Capacity	Approximate Costs *	Advantages	Disadvantages	Examples from Dalhousie University (2010-2011)
Collection Containers	Various sizes and volumes	\$10-15	Can be deployed in various locations, ranging from individual workstations to hallways and other small areas Can be used to encourage proper sorting	Stores small amounts of waste Garbage receptacles which encourage improper sorting	
Public Sorting Units & Multiple Bin Stations	0.35 yd ³ x (2 or more)	Indoor: \$300-3000 Outdoor: \$900-1500	Durable, aesthetically pleasing, encourages proper sorting	Larger size can prohibit range of suitable locations	
Waste Bins Large waste bags often made from tough plastic/canvas/burlap are also used to move materials around for small distances.	~ 0.5 yd ³	\$90-140	On wheels so they can be transported to central location Lid helps prevent contamination Holds larger volumes of waste	May require thorough cleaning when used for materials such as organics – can come in a variety of colours depending on the stream being collected	

*Cost estimates obtained for ordering individual units. Customized features, shipping, and bulk ordering can drastically change equipment costs.

Table 2: Commonly used collection equipment (Adopted from CCME, 1996) – Continued from previous page

<p>Carts & Tilt Trucks</p>	<p>~ 0.5 - 2 yd³</p>	<p>5/8 yd³: \$475-600 (regular) \$600-700 (heavy duty) 2 yd³: \$950-1150 (regular) \$1400-1600 (heavy duty)</p>	<p>On wheels allowing for easy transportation within or between buildings May hold large volumes of waste Good for collecting waste from smaller collection containers and bins</p>	<p>Not suitable for long term waste storage Can be difficult to remove heavy items from the bottom</p>	
<p>Loading Bins</p>	<p>~ 2 - 4 yd³</p>	<p>(Typically rented from a waste service provider) Range from \$60-200 per week for the bins and \$15-30 per pick up.</p>	<p>Holds larger quantities of waste May have wheels to allow for movement Can be fitted with locks and lids for outdoor use and controlled access</p>	<p>They require servicing by trucks and require large amounts of space May be too large for certain waste streams Illegal dumping can be problematic if bins are not equipped with proper lids and locks</p>	
<p>Roll Off Bins Large waste bags often made from tough plastic/canvas/burlap are also used to move materials around for small distances.</p>	<p>Up to 40 yd³</p>	<p>(Typically rented from a waste service provider) Range from \$100-150 per pick up</p>	<p>Holds large quantities of waste Suitable for short-term projects with large volumes of waste</p>	<p>Must be kept outdoors Requires servicing by specialized vehicles Not suitable for all waste types Illegal dumping can be problematic</p>	

*Cost estimates obtained for ordering individual units. Customized features, shipping, and bulk ordering can drastically change equipment costs.

Processing equipment can be helpful for storing large volumes of materials and preparing them for shipment (Table 3). Since firms in the ICI sector are not eligible for regular municipal waste pickup many can benefit from using processing equipment to significantly reduce the volume of waste requiring less frequent waste pickups and to process recyclable materials so that more material can be transported per



shipment. Processing recyclable materials can also increase their marketability. Balers are used to create dense blocks of waste called bales. These bales may be sold to local area businesses to displace the use of raw materials in manufacturing processes. Compactors and densifiers can be used to compress materials such as cans into denser forms, while crushers can be used to break materials such as glass into significantly smaller pieces. These types of machines can be useful for reducing storage space requirements for certain materials and may be useful in reducing transportation costs by increasing the amount of material per shipment (CCME, 1996)

Within many organization, waste is generally handled in one of two ways: through contracted custodial collection, or through self-haul collection by employees. Each system has advantages and disadvantages. Custodial staff can offer reliable service and can ensure waste management is carried out properly. Challenges can arise such as with multipurpose buildings which contract one custodial service to manage waste for all firms within the building. In most instances

it is the property owner who contracts a custodial or cleaning company to manage waste for the entire building. In this case, organizations wishing to make changes to their waste management practices can be constrained by the fact that the organization is not the property owner and cannot make significant changes to the waste management plan for the building, particularly those which may require major modifications.

With self-haul collection systems, employees are responsible for collecting and handling waste as part of their regular duties. This can present challenges since a greater number of people will be involved with managing waste which will need to be reflected in educational efforts, and may impact monitoring and compliance.

Table 3: Commonly used processing equipment (Adopted from CCME, 1996; UC Davis, n.d.)

Type	Function	Example
Vertical Baler	Vertical balers offer the benefit of occupying a small footprint of floor space and they produce bales which may be moved around on pallets. These types of balers also offer the benefit of being able to process materials as they accumulate.	
Horizontal Baler	Horizontal balers require much more floor space to operate, and are designed to handle much larger capacities than horizontal balers. They produce much larger bales, called mill bales, which can sell for a higher price on the market and can make them more economical in the long-term if enough area is available for operation. The cost of these balers has fallen dramatically; from approximately \$250,000 U.S in 1993 to ~\$30,000 today (UC Davis, n.d.).	
Self Contained Compactor	Roll off bins can also be combined with compactors. This provides an opportunity for decreased service frequency by offering greater capacity than loading bins, while allowing for a reduction in the volume of waste being transported. It is estimated that compactors can condense refuse by an average of three to one (UC Davis, n.d.).	

Image sources: nexgenbalers.com; clydesdalerecyclingmachinery.co.uk; marathonequipment.com

Crusher	<p>Crushers are used to crush glass into cullet, helping to maximize storage space. When crushers are used, materials must be kept separate if they are going to be sent to recyclers. Recycling companies will typically ask that the crushed glass contain only one cullet type (CCME, 1996).</p>	
Densifier	<p>Densifiers are used to compact aluminum or steel cans into small dense units. When using a densifier to compact recyclable wastes, it is common for recycling companies to demand that the feedstock consist of similar materials. For example, steel cans are not typically accepted with aluminum cans (CCME, 1996).</p>	

Image sources: cpmfg.com; jddenterprise.com

Waste service providers

Many firms hire an external waste service provider. Waste service companies offer a wide range of services, equipment and options to suit the needs of their customers, but often times deciding what is suitable, can be a difficult task. Waste service companies own their own equipment and vehicles that are needed to handle waste and many also have representatives who can visit organizations to help them determine what equipment and services they require.

Most often, waste service providers will provide service on a contractual basis. It can be useful to conduct a waste characterization study before approaching external waste service providers to ensure that contract provisions will allow for implementation of the waste management strategy in a cost effective manner (CCME, 1996). There are many different factors which can be negotiated in a contract including the frequency of collection, the equipment being used, the fees, volumes collected, and rates for different streams. More detailed knowledge in these areas can save money from avoiding renting needless capacity and waste pickup charges. Organizations that

have knowledge of typical waste volumes and composition will have a greater idea of what types of equipment and services they require which can help ensure that an effective contract for both the waste service provider and the organization is formed (UC Davis, n.d.). Getting consultations and estimates from a variety of different waste service companies can also help ensure that an organization receives a good level of service at a fair price.

When forming a contract with a waste service provider, whether for the first time or as a renewal, there are some important provisions which may be included that can help to ensure the integrity, effectiveness, and sustainability of the waste management plan. There are many examples of clauses described in the (UC Davis, n.d) manual which firms may include in their contract:

- Termination for cause - can allow the organization to take actions for cancelling a contract if a problem is recurring;
- Non-performance or failure to perform - can stipulate sanctions for unexcused missed pick-ups, non-reported blocked

bins and inadequate maintenance of bins and equipment. Sanctions can take form as verbal warnings, or financial penalties;

- Normal working hours - can outline which days and hours the vendor can provide service. Any special holidays or events (such as move in and move out week) should be included in this section;
- Communication – can be required in some contracts. For larger firms with frequent pick-ups, it is possible to have the company provide the firm or organization with a two-way radio so that contact may be maintained with the service trucks on the property;
- A requirement for dedicated vehicles – can be stated in the contract, meaning that the truck arrives at the property empty or with a calculated net weight of the truck so an accurate weigh bills and waste quantities can be calculated;
- Types of collections should be specified. If the term “waste” is used in a contract, it can apply to all waste streams. Specifically state which container types, waste streams and frequency of collection are being included in the contract;

- The types and numbers of containers being used should be explicitly stated in the contract as well as a requirement to keep them clean, painted, and labelled properly. A maximum waiting period for when maintenance should be carried out after issuing a formal request should be specified;
- Collection sites should be left clean. It is possible to specify what is to be done with excess material left next to the bins;
- Invoicing and reporting can require weight tickets and monthly reports be provided to the organization. Point of service reports can include average weights of waste collected from individual locations over extended periods of time. It may also be worth specifying exactly what information should be included in the reports

Making operations efficient: A few examples.

Example 1: A department store does significantly more business over the holiday season. During this period they require 2 x 2yd³ loading bins to manage their waste. If they stipulate in their contract that they

need 2 loading bins, they may have them all year round with one of them sitting empty for most of the year. In situations like this, it may be advantageous to order an additional bin for the peak season.

Example 2: Many firms install sorting bins and increase waste diversion within their organization but do not account for the fact that improved waste sorting decreases the amount of garbage produced. As a result of implementing sorting bins, many firms no longer require as many loading bins to manage their waste since their volume of garbage has been significantly reduced. Organizations may be wasting money renting loading bins they do not need or by having pickups scheduled too frequently. (It may be possible to have waste picked up twice per week instead of 3 times for instance).

Example 3: As sales and business increase for a firm, they may be tempted to simply add on an additional loading bin to deal with the added volume. It may be advantageous to simply switch to one larger bin to save space and reduce the number of lift fees that will be incurred.

Example 4: Many firms simply call up a waste service provider and contract them to provide waste pickup services. With knowledge of the volumes and composition of waste the firm produces, it is possible to order the right size and quantity of containers. In addition processing equipment such as a self-contained compactor which can be used to compact material for less frequent pickup.

Education

Any waste management plan will fail if the stakeholders and users are not on board. Whether it is customers that must sort waste into proper bins, or employees that must properly separate and process waste, participation and public perception are essential to the success of any waste management plan.

When attempting to get people on board with a new waste management plan, particularly those which involve a change in behaviour, education plays an important role.

Strategies can be designed to target problematic areas such as a section of a building where a food or drink vendor

operates where waste bins typically have higher contamination rates. Organizations that serve populations that are more transient can have additional educational challenges. Holding awareness campaigns at set times and during orientation sessions, providing sorting charts or access to proper sorting bins, and running competitions which provide incentives for properly sorting or minimizing waste can be delivered on an ongoing basis. Certain materials may also prove to be problematic; particularly those which have names or traits which make it appear to be suitable for multiple waste streams. A list of common waste stream contaminants found in Halifax Regional Municipality (HRM) is listed in (Table 4).

Signage and labelling are critical to waste management systems. Signage helps inform the public about proper waste sorting and identifying problematic materials. They can also be used to help spread knowledge about the impacts of sustainable and unsustainable waste management which can encourage participation in recycling programs. Pamphlets, fact sheets and other informational sources such as websites can also be used to help educate people in this regard.

Table 4: Waste materials which are commonly mis-sorted according to HRM guidelines

Waste Item	Commonly Found In	Belongs In
Coffee Cups	Paper Recycling, Organics	Garbage
Bottle Caps & Straws	Recyclables	Garbage
Clean tin foil	Garbage	Recyclables
Clean plastic wrap	Garbage	Recyclables
Clean plastic bags	Garbage	Recyclables
Paper Egg Cartons	Organics	Paper Recycling
Paper Drink Trays	Organics	Paper Recycling
Napkins	Paper Recycling	Organics
Boxboard	Paper Recycling	Organics
Take-out pizza boxes	Organics	Corrugated Cardboard

In Nova Scotia, educational efforts are carried out locally by municipalities and across the province by the RRFB. The RRFB has created a signage system that relies on both colours and shapes to educate the public on sorting waste into proper waste streams (Figure 11).

RRFB provides funding in support Municipal Waste Educators. Educators can help businesses/organizations with

the development of waste management plans, and assist with the development of customized education materials. For more information, please visit www.rrfb.com

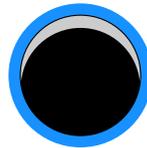
Municipalities are free to create their own by-laws regarding signage and labelling as “one size” may not fit all. ICI organizations may need to modify signage for specific streams. It is important to provide a standard look and feel for users to reduce confusion.

Dalhousie in HRM

In HRM by-law(S-600) states that signage of sufficient size and number is required to provide occupants (customers or employees) with clear instructions for proper sorting of waste into its proper waste streams (HRM, 1999). All organizations within HRM that sell goods to the general public which may result in the creation of waste are required to provide their customers with accessible options for properly sorting their waste into the distinct waste streams.

Figure 11: Colour coding, signage, and bin openings recommended by the RRFB (RRFB, n.d.)

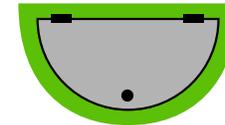
RECYCLABLES



PAPER



ORGANICS



GARBAGE

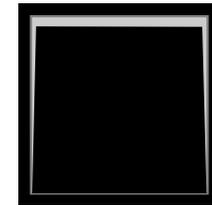


Figure 12: Typical costs associated with waste management (Cheremisinoff, 2003)

- Labor
- Energy
- Raw materials
- Pollution/waste fees
- Permits
- Equipment costs
- Site preparation
- Training
- Monitoring
- System modifications
- Transport & Disposal
- Operation
- Materials
- Repair

Budgeting

Many organizations strive to keep costs as low as possible by not spending more than absolutely necessary to get the job done, but this may not be an optimal choice even from a solely economic perspective. There are many different costs associated with waste management (Figure 12) and it is important to properly budget for them. Organizations may budget for the normal costs which arise as a result of compliance measures, but they may fail to properly budget for hidden and indirect costs, future and long-term costs and less tangible costs (Figure 13).

Figure 13: Additional costs associated with waste management (Cheremisinoff, 2003)

Hidden and indirect costs	Future and long-term liability costs	Less tangible costs
Monitoring costs	Medical claims from injured workers	Negative consumer response
Permitting & renewal fees	On-site remediation	Negative investor confidence
Environmental impact assessments	Off-site remediation	Long-term cleanup
Environmental transformation costs	Inflation	Lending institutions rescind or refuse favourable lines of credit
Legal fees	Litigation fees	Insurance premiums rise
Service agreements	More stringent compliance requirements	Become a target for inspections
Health and safety assessments	Property devaluation	
Replacement costs		
Reporting & recordkeeping		
Insurance premiums		
Inspections		

It is important to conduct full-cost accounting budgeting to identify capital, operating, and disposal/diversion costs. On first glance certain strategies may seem more costly however an examination of the true costs can reveal a different picture. Organizations such as the RRFB

and Efficiency NS offer resources and in some cases funding support to offset costs of innovative capital projects and energy efficiency products.

Who is involved and what roles might they play?

The success of a waste management plan relies upon the cooperation of several different stakeholder groups. The stakeholders involved with waste management of any given organization can be broadly defined as the people or organizations that are affected by, or have an interest in the activities being carried out or proposed. Stakeholder groups will vary across firms and geographical areas and so they need to be identified on a local context (Wasteportal, 2010). A significant challenge in forming an IWM plan lies in fostering agreement and cooperation between various stakeholder groups.

Once a plan is formed, the roles and responsibilities of these groups must be clearly outlined so expectations are clearly understood and individuals are accountable. Some of the major stakeholders typically involved in an ISWM plan are discussed below (Table 5).

Engaging Stakeholders to Develop a Dalhousie Waste Management Plan and Educational Efforts

Dalhousie University created a waste management committee to work on an integrated waste management plan. The committee includes staff from the Environment Health and Safety Office, Facilities Management (custodial, grounds, and trades), Office of Sustainability, Professors from Resource and Environment Studies, and students. The committee will create a final plan that will be presented to the President's Advisory Council on Sustainability and then to the Vice-President and President for Approval. Recent education efforts included waste management presentations at custodial meetings, bin exchange programs, creation of a Dal Waste Sorting Guide (Appendix B) and Dal Waste Activity at Frosh Week (Appendix C). The Universities (Saint Mary's and Dalhousie) also support programs such as the annual Dump and Run (an event where left over goods from residence and the community are sold at a large sale). Proceeds are given to charity.



Dal garbage bin to recycling bin exchange



Dump and Run

Table 5: Stakeholders typically involved with a waste management strategy – (1. UC Davis, n.d.; 2.Schübeler, Wehrle, & Christen, 1996)

<p>Solid-waste resource manager/ Recycling coordinator¹</p>	<p>The solid-waste resource manager is responsible for overseeing the management of waste for the organization. In most cases, this person will be the representative for the firm with respect to waste management activities. In larger organizations, an additional recycling coordinator may be required to oversee recycling programs and carry out educational programs. If both positions exist, they will need to coordinate efforts and work together to form long-term plans. It is a good idea to have someone responsible for waste management. Even for organizations which are too small to warrant hiring a full-time waste manager, someone should have the responsibility for upholding, reviewing and forming waste policies within the firm.</p>
<p>Vendors¹</p>	<p>Multi-use buildings which house several different businesses will need to coordinate efforts with these businesses. Problems with contamination, special pickup requirements, high and low traffic areas, and regular waste tonnage reports should be coordinated between the organizations.</p>
<p>Custodial staff¹</p>	<p>Custodians play an active role in waste management programs. They are often responsible for collecting waste from indoor collection bins and bringing them to centralized containers. Any changes to waste management collection practices should be coordinated with custodial management and the custodians. Custodians can also be an important source of information in developing the plan. They are often aware of problematic areas, successful changes, and special events which require special considerations and can be helpful when reorganizing collection locations and schedules.</p>
<p>Contracts officer¹</p>	<p>Most organizations require the services of an external waste service provider. It is important to keep this person informed of the specific requirements of the plan and ensure that the necessary provisions are included in the final agreement. The contracts officer can also address other issues by including provisions in renovation and construction projects and vendor agreements (eg. Companies providing vending machines must help with costs for disposal and recycling, provide bins, or switch plastic bottles for aluminum cans).</p>
<p>Architects, engineers, planners^{1,2}</p>	<p>Any new construction or renovation projects should make considerations for waste management. This includes ensuring that loading docks and central collection locations have sufficient space, and proper sorting stations have ample area to be deployed with adequate buffer zones.</p>

Administrators / Management¹	Any waste management plan which requires change will need to be supported by management and administration. Public encouragement and support for new policies and operating procedures are crucial.
High-volume generators¹	Certain areas within larger firms, particularly those with multiple vendors and businesses within a single complex, may be faced with high-volume generators. Identify these groups and work with them to help improve waste minimization and diversion.
Police/Security¹	Vandalism of containers, theft of valuable recyclables, and illegal dumping can all have negative economic impacts on a business, and on a successful waste management plan. Work with police and security to devise strategies for crime prevention, help determine ideal locations for bins and containers, and to help identify problematic areas. Private security should be informed that these issues are a concern for the organization and of what steps to take if problems occur.
Fire	Any changes to waste management must be in compliance with fire codes and regulations. If there are doubts or concerns as to whether new equipment will be in compliance, contact the relevant authorities.
Environmental / Occupational Health and Safety	A waste management plan should include a health and safety component which identifies officers which are responsible for training staff on collection procedures and outline what is to be done with hazardous materials that end up in the waste stream.
Municipal waste education officers	Municipal education officers can provide valuable feedback and advice when designing a waste management plan. They can share educational resources, help develop and education plan, and help determine what kind of services are required from waste service providers.
General Public & Service Users (including staff and volunteers)¹	For many firms, the general public will be required to participate with the waste management plan. Their role will be to practice proper source separation and reduction practices ² such as bringing a reusable coffee mug. Educational programs, signage and labelling should be designed to help the public understand their role within the firms waste management plan.

9.0 Measurement and monitoring

Monitoring is an essential component to the continued success and growth of the plan. Monitoring also allows the expected impacts of the strategy to be measured against actual changes. This can identify potential revisions for the management plan. Evaluation and monitoring is typically conducted through use of waste characterization studies, bills, and weight tickets. Regular waste audits should be scheduled at least annually, but optimally at any time significant fluctuations in the waste stream are expected to occur. The results from monitoring will allow for the calculation of diversion rates, waste reduction, participation, and costs. The information obtained from regular audits can then be used to inform a revised waste management strategy (CCME, 1996).

Are Your Numbers Off?

Dalhousie University has conducted and number of building, campus-wide, and document audits over the last three years. Through this experience waste audit methodology and procedures have been refined and many valuable lessons have been learned. Here are a few.

Accuracy. It is easy to have inaccurate baseline numbers. Our first attempt at setting a baseline for waste was inaccurate because a) we didn't have all the material streams accounted for, b) we didn't know all the sources and c) our weight data for each stream was not reliable. To ensure a better baseline we defined materials consistently into nine streams (Appendix A: Materials Categorization

Sheet). We had a number of meetings with key stakeholders to confirm sources for each stream. For example, paper is collected from hallways but also was shredded through outside companies. Organics are collected from buildings and brought to the warehouse. We then found out the hauler also picked up organics at each kitchen which was a large portion of the organics stream. Waste service provider bills and weigh tickets were also examined. From this exercise we realized that there were not weights for each material streams. Further the discussion is being had with the hauler about supplying weights. We then embarked on a series of waste audits to help identify approximate weights. Further research is being conducted to see how more accurate weights can be tracked upstream (in the procurement process) and downstream (at the waste stream).

Key Questions to Ask Your Organization:

- Are materials baseline information and tracking systems “accurate”?
- Is the system efficient? Are goals being met?

Waste Audits. It is important to have a precise method. A number of waste audits have been conducted on campus in the last three years (Appendix D: Dalhousie Waste Auditing History). Measuring materials according to weight provide more reliable results than estimating volume or counting individual items. When conducting large audits, data integrity, accuracy and precision is an issue. New data entry sheets have been created with more specific instructions and procedures on how to run three different audit types (Appendix E: Waste Audit Procedures). A waste calculator for analyzing the data has been developed (Appendix F).

Assumptions. Don't make them blindly. Contamination rates for different streams varied by location. Usually paper (3-10%) and organics (5-10%) had lower contamination rates. Higher contamination rates would be found in recyclables (10%-20%) and garbage (40-60%). In some audits recyclables had lower contamination rates and organics higher. Why? It depends on a number of issues such as the size, location, and hours of food and beverage outlets and the type and placement of bins and labelling. At Dalhousie, much of the contamination is pre-sorted out of the streams except for the garbage bag. (This garbage stream is focus for future strategies). If you conduct an audit and try to extrapolate to a month or year, potential biases can occur. Examples include: day of the week, season, special events, kitchen schedules, and slow vs. peak periods of activity. It is important to conduct a number of audits to decrease confounding variables.



Waste sorting game to teach what goes into the different streams

10.0 Summary

An integrated waste management plan can help create a strategic focus. The NS ICI Waste Management Guide highlights key plan components to assist in the creation of ICI sector plans (Figure 14).

Figure 14: Waste Management Plan Outline

Develop guiding principles, goals and objectives	<ul style="list-style-type: none"> • Integrated waste management plans prioritize reducing the amount of waste generated and then focus on handling the inevitable waste that is produced; • Additional goals and objectives should be formed around values held by the organization and ideally in conjunction with prominent values held by the local community.
Research	<ul style="list-style-type: none"> • Conduct waste characterization studies to determine the quantities and types of waste that need to be managed; • Additional information that can be helpful includes contamination rates of waste streams and identification of problematic materials and areas.
Evaluate	<ul style="list-style-type: none"> • Analyze external and internal drivers. • Examine the tradeoffs between the range of suitable waste processing options which are possible given the available resources and personnel; • Take into account long-term risks, costs and benefits of each option.
Strategize	<ul style="list-style-type: none"> • Choose the waste treatment options which will best suit the needs of the organization; • Ensure that chosen options are in line with regulatory requirement as well as the goals and objectives guiding the plan; • Choose some quantitative (measureable) indicators that will allow progress to be monitored.
Educate	<ul style="list-style-type: none"> • Conduct training for staff that are required to carry out the strategy; • Design an educational campaign informing stakeholders of any changes that are made, the benefits of the changes, and solutions to the problematic areas.
Implement	<ul style="list-style-type: none"> • Ensure all of the logistical requirements are in place before implementing the strategy.
Monitor & Update	<ul style="list-style-type: none"> • Conduct regular monitoring to evaluate the effectiveness of the strategy and make changes as required; • Review and update the plan every few years to ensure the system remains in regulatory compliance and to make continual improvements.

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13.0 Summary of key questions

- Is your waste management system integrated or are pieces “bolted on”?
- Do you have a higher percentage of waste bins to other recycling and compost bins?
- Are your bins consistently labelled with correct information?
- Do bins have standard colours and shaped openings to help with sorting?
- Does your organization primarily make products, consume them, or both?
- Is there a clear waste management vision and guiding principles?
- Is your organization in compliance with federal, provincial, and municipal waste related acts and regulations?
- Have external and internal waste planning drivers been identified?
- Do you know what material streams are being handled and where they are coming from?
- Does your waste management plan have specific goals, indicators, targets, and strategies?
- Have system components been identified (flow of materials from procurement to delivery, handling (use and collection), storage, transportation, and processing)? Is this process effective and efficient?
- Have action plans been developed and communicated?
- Are detailed budgets outlined with all indirect and direct costs?
- Are educational and communication efforts targeted and evaluated (i.e. bin labelling; awareness events, stakeholder involvement in planning, ...)
- Have procedures and roles and responsibilities been clearly articulated?
- Are materials baseline information and tracking systems “accurate”?
- Is the system efficient? Are goals being met?

14.0 Appendices

Appendix A: Materials Categorization Sheet

Appendix B: Dalhousie's Waste Sorting Guide

Appendix C: Dalhousie's Waste Sorting Activity

Appendix D: Dalhousie Waste Audit History

Appendix E: Waste Audit Procedures

Appendix F: Waste Audit Calculator