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SOLID WASTE DIVERSION REQUIREMENTS AND OPPORTUNITIES FOR
INDUSTRIAL COMMERCIAL AND INSTITUTIONAL FACILITIES IN ONTARIO

by

Ruth A. McGuire B. Env. Studies

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfilment of
the requirements for the degree of

Master of Arts

Department of Geography

Carleton University

Ottawa, Ontario

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**SOLID WASTE DIVERSION REQUIREMENTS AND OPPORTUNITIES FOR
INDUSTRIAL COMMERCIAL AND INSTITUTIONAL FACILITIES IN ONTARIO**

submitted by Ruth A McGuire B Env Studies
in partial fulfilment of the requirements for
the degree of Master of Arts

Thesis Supervisor

Chair, Department of Geography

Carleton University
Ottawa, Ontario
September 18, 1996

ABSTRACT

Canadians generate approximately 20.3 million tonnes of solid waste annually. In Ontario, the volume of waste generated in the Industrial, Commercial, and Institutional (IC&I) sectors is almost half of the total with the Residential sector making up the other half. Traditionally, waste management practices have employed the collect-transport-dispose approach; however, this is no longer a viable option. Location of landfills and incinerators by urban planners is becoming more and more difficult.

The government of Ontario has established a target to decrease the amount of waste disposed of in landfill by at least 50% by the year 2000. One strategy toward reaching this goal is the *Ontario 3Rs Regulations*. The purpose of these regulations is to ensure that IC&I sectors, as well as municipalities, develop programs to reduce the flow of valuable resources going to landfill. Diversion efforts such as waste audits, source separation, and recycling programs by IC&I facilities can significantly reduce the volume of solid waste requiring disposal. In addition to the environmental benefits that can be realized from waste diversion, remuneration from recyclable materials and cost avoidance from landfilling less, can often outweigh the cost of solid waste haulage and disposal in an IC&I location.

Markets and end uses for recyclable materials are expanding rapidly and the recyclable list continues to grow as end uses expand. With increased diversion by municipalities through expanded blue box programs, coupled with Industrial, Commercial, and Institutional efforts through source separation and recycling programs, Ontario will benefit from a decreased requirement for landfill sites.

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1 INTRODUCTION

1.1 Background on the Solid Waste Problem

The management of solid waste increasingly imposes significant costs on society. Until recently, these costs have not been considered by many businesses when products are designed or by consumers when a purchasing decision is made. Location of landfills and incinerators by urban planners is becoming more and more difficult. The Not-In-My-Backyard (NIMBY) reaction is a powerful influence in constraining the options for siting a waste management facility within a municipality. When Industrial, Commercial, Institutional, and Residential volumes are combined, Canadians generate approximately 20.3 million tonnes of solid waste annually (approximately 712 kilograms per person per year). Until recently, waste management practices have been to burn or bury this material. Ontario, with the largest per cent of the Canadian population (38%), understandably generates the largest volume of waste compared with other provinces. The volume of waste generated in the Industrial, Commercial, and Institutional (IC&I) sectors is almost half of the total with the Residential sector making up the other half. Ontario reports that both of these major sectors are reducing their volumes of waste sent to landfill; however, the IC&I sectors are reducing their volumes at a faster rate.¹

The trend for waste management practices in Canada is to decrease the need for waste disposal by viewing these materials as a resource instead of a liability. During the past decade, many Canadian communities have found themselves in a 'waste crisis'.² Many existing waste management facilities are close to capacity and it is very difficult to site and get approval for new ones.³

¹ Gies, Glenda. 'The State of Garbage in Canada' *Biocycle Journal of Composting and Recycling*, February, 1996, p 46-52

² Maclaren, Virginia W. 'Waste Management: Moving Beyond the Crisis' *Resource and Environmental Management in Canada*. Oxford University Press, 1995, p 30

³ Maclaren, Virginia W. *op cit*, p 30

Public concern for the environment, increasing waste generation due to increased population, marketing and packaging incentives to purchase goods, and decreased space availability for landfills have changed the face of waste management in Canada.

Understanding where waste is generated, and the volume and composition of this waste material is essential in establishing a waste management program so as to divert as much waste as possible from landfill. This paper focusses on waste management practices in Ontario, with the main emphasis on how the *Ontario 3Rs Regulations*⁴ can assist IC&I facilities in benefitting from reduced volumes of solid waste generated that were previously sent to landfill.

1.2 Purpose and Objectives

This thesis demonstrates how to conduct a waste audit (required in the *Ontario 3Rs Regulations*) in IC&I establishments with the goal of identifying and quantifying the solid non-hazardous waste generated. The possibility for IC&I establishments to achieve fifty percent waste diversion by the year 2000 will be assessed, and the benefits of implementing a source separation and recycling program will be demonstrated, over the negative effects if a program is not initiated. The thesis will show that: revenue received from a successful program can offset, and in some cases, outweigh the cost of solid waste management for IC&I establishments; strong markets exist for many items that are currently found in the waste stream; and that potentially valuable resources can be lost if sent to landfill. The research has been guided by the following objectives:

- (1) To define the methodology required for an IC&I establishment to successfully conduct a waste audit and to demonstrate that a waste audit and preparation of a waste reduction workplan is essential for solid waste reduction.

⁴ Ontario Ministry of Environment and Energy, *Ontario 3Rs Regulations*, 102/94 and 103/94, March 3, 1994.

- (2) To determine the types of waste diversion efforts that will make a source separation program successful and assess the economic benefits of conducting a waste audit to determine if the benefits outweigh the cost of implementing the *3Rs Regulations* for Ontario businesses.
- (3) To assess whether or not strong end markets are currently available for recyclable materials found in a waste audit, and if so, what types of products are made from these materials.
- (4) To assess whether or not these new regulations will assist Ontario in reaching the 50 percent goal of solid, non-hazardous waste reduction by the year 2000.

1.3 Hypothesis and Thesis Outline

The hypothesis of this thesis is as follows: if an IC&I establishment conducts a waste audit which demonstrates that a potential for diversion exists, then the implementation of *Ontario 3Rs Regulation 102/94* and *103/94* will result in financial benefits to the IC&I, and diversion of this waste will reduce Ontario's landfill requirements.

This hypothesis is tested on data gathered from conducting three waste audits and from an analysis of solid waste information provided by the following: Regional Municipality of Ottawa-Carleton, Waste Recycling (Ottawa/Hull) Inc., Metro Waste Paper Recovery, Waste Management Hull/Ottawa Inc., Laidlaw Waste Systems Ltd., an Ottawa-based School Board, an Ottawa-based Property Management Company, and an Ottawa-based Telecommunications Facility. Literature from environmental journals and reports, the Ontario Ministry of Environment and Energy (MOEE), the Federal Government of Canada, the Recycling Council of Ontario, the Ontario Waste Management Association, and various manufacturers of recycled products is analyzed in order to contextualize the results of this study. Information gathered from conducting personal interviews with professionals in the private sector and ministry officials is also included.

The research framework provides background on the solid waste problem in Canada with a focus on waste diversion opportunities for the IC&I sector in Ontario as defined by the *Ontario 3Rs Regulations 102 and 103*. Chapter 2 outlines Canadian trends, Ontario's waste diversion initiatives focusing on the *Ontario 3Rs Regulations* that apply to the IC&I sectors, and opportunities within the Regional Municipality of Ottawa-Carleton. Chapter 3 outlines the methodology used to conduct three waste audits, summarizes the results, and discusses opportunities to increase solid waste diversion at these sites. The first waste audit in this chapter was conducted over five days at an Educational Institution, the second over three days at a Property Management Company, and the third over one day at a Telecommunications Facility.

Chapter 4 provides a critical analysis of the data and includes a financial benefit analysis of diverting waste from landfill for the three study locations. Chapter 5 describes the current markets for recyclable materials in Ontario including end products made from recoverable materials found in an IC&I waste stream. This chapter includes remuneration rates from a local recycling firm for these materials in 1994 and 1995. Tables and Figures are inserted throughout the thesis to provide a visual representation of information discussed. The Conclusion is followed by Appendices which include samples of MOEE waste audit forms, followed by a Glossary and a Bibliography.

As a result of the nature and confidentiality of waste audit information, the data provided is biased because it examines only one small portion of IC&I facilities. Because it is difficult to acquire waste audit data from IC&I establishments, the three facilities audited were done so as the opportunity to research these sites presented itself during the period of this study. A larger and broader sample size, and a six or twelve month follow up audit, would have, of course, allowed for a more detailed analysis of the 3Rs issue.

2 SOLID WASTE GENERATION AND DIVERSION

Traditionally, waste management practices have employed the collect-transport-dispose approach; however, this is no longer a viable option. Currently, waste management strategies in Canada emphasize techniques that focus on minimizing waste disposal requirements.

2.1 Canadian Trends

Waste generation per capita has been steadily rising in North America for many years.⁵ During the 1980s, Ontario's per capita waste generation is estimated to have increased by as much as 25%.⁶ Almost 90% of the increase in North America since 1960 has resulted from greater volumes of paper and plastic (discarded packaging) in the waste stream.⁷ During the late 1980s and early 1990s, our understanding of solid waste composition increased substantially, mainly resulting from numerous municipal government studies as part of their efforts to site new landfills and incinerators. Municipal residential solid waste in Ontario and other Canadian provinces is dominated by paper which comprises approximately 35%.⁸ Organics comprise approximately 32%, with the balance mainly composed of glass, metals, plastics, wood, and disposable diapers.⁹ Within each of the IC&I sectors, similar categories of waste are generated although individual volumes differ depending on physical size and employee numbers. Businesses of the same nature will generate solid waste categories of very similar types.

⁵ Maclaren, Virginia W. op. cit., p 33

⁶ Government of Canada, *The State of Canada's Environment*, Ottawa, 1991, p 25-1

⁷ Maclaren, Virginia W. op. cit., p 33.

⁸ Government of Canada, op. cit., p 25-1.

⁹ Maclaren, Virginia W. op. cit., p 33.

Decision-makers and individual consumers are becoming increasingly well informed about our environment and are gaining a better understanding of the relevant terminology. The July 1995 Angus Reid Group's annual *Canadians and the Environment* Poll determined that environmentally conscious adults comprise 35% of the adult population and approximately 2 in 5 Canadians are sensitive to environmental practices both in their own lives, and in the lives of others.¹⁰ When asked the question, "How concerned are you about the effect that the products you purchase have on the environment?", 54% responded Very Concerned, 38% were Somewhat Concerned, 4% Not Very Concerned, and 2% Not At All Concerned.¹¹ In response to the findings in the Angus Reid Group analysis, the president of the Canadian Polystyrene Recycling Association noted: "Just because it's not 'number one' in the polls, doesn't mean that consumers aren't influenced by environmental priorities when they make purchasing decisions".¹² The Ontario Ministry of Environment and Energy cites research conducted by Marjorie MacPherson, (Decima Research): "Not only has Canadians' commitment to the environment remained intact, but there is evidence that their understanding of environmental issues is growing. One example of this heightened understanding is in the area of solid waste management. Many Canadians are sceptical of companies making unsubstantiated environmental claims, and are wary of 'greenwashing'".¹³

Previously, the focus on waste management planning has been to develop efficient collection systems to transport these materials to suitable disposal and

¹⁰ Canadian Polystyrene Recycling Association, *July 1995 Angus Reid Poll*, Mississauga, Ontario, July 1995

¹¹ Canadian Polystyrene Recycling Association, *op. cit* , p 2

¹² Canadian Polystyrene Recycling Association, *Polystyrene Recycling & Consumer Opinion*, Mississauga, Ontario, July 1995.

¹³ Ontario Ministry of Environment and Energy, *New Business Opportunities for Recyclable Materials*, Queen's Printer for Ontario, 1994, p 3.

incineration sites. The focus has now shifted to implementing the 3Rs - *Reduce, Reuse, and Recycle*. A fourth R - *Recovery* has been suggested; however, *Recovery* has been interpreted to mean recovery of energy from incineration and with the perceived negative effects associated with incineration, recovery is no longer perceived to be as desirable as the other 3Rs.¹⁴

The 3Rs Strategy is based on a hierarchy of an 'Rs' ability to generate less waste, conserve more raw material resources, save more energy, and create fewer environmental impacts than a strategy lying below it in the hierarchy.¹⁵ At the top of the hierarchy is reduction, followed by reuse and recycling. The position of a 3Rs strategy within the hierarchy is determined by its ability to generate less waste and conserve more energy than a strategy lying below it.¹⁶

The provinces and territories in Canada are responsible for regulating and managing their own solid, non-hazardous waste.¹⁷ In 1994, approximately 90% of landfills in Canada were owned by municipalities; as a result, the management of solid waste and recycling programs usually takes place at the municipal level.¹⁸ Landfill tipping fees vary across Canada; however, according to a 1992 Federation of Canadian Municipalities survey, Ontario's were the highest. Currently, Canada houses approximately 2,322 landfill sites, 61 Incineration facilities and 175 Material Recovery Facilities (MRFs). Table 1 summarizes the number of Canadian landfills, incinerators, and MRFs, and the percent of material recycled for each province.

¹⁴ Winfield, Mark, *Looking Back and Looking Ahead: Municipal Solid Waste Management in Ontario from the 1983 Blueprint to 50% Diversion in 2000*, Canadian Institute for Environmental Law & Policy, Conference Report, February 1993, p 1

¹⁵ Maclaren, Virginia, W. op. cit., p 36.

¹⁶ Maclaren, Virginia, W. op. cit., p 36

¹⁷ Gies, Glenda. 'The State of Garbage in Canada'. *BioCycle Journal of Composting and Recycling* February, 1996, p 46-52

¹⁸ Environment Canada, *Bulletin: Landfill Tipping Fees*, August, 1994

The information provided in this table demonstrates that landfills continue to be the most common waste management option utilized by Canadian municipalities today; however, the number of Material Recovery Facilities is increasing across Canada. Environmental protection and pollution control industries - including reuse and recycling - represent one of the fastest growing industries in our economy.¹⁹ Relatively few studies have attempted to project the economic impact of reuse and recycling industries; however, from Canadian and United States data, recycling creates an average of 2 jobs in collection and processing and an average of 5 jobs in manufacturing for each 450 tonnes of material.²⁰

Typically, landfills are costly to site, manage, and maintain, and produce many environmental concerns such as leachate and heavy metals.²¹ In February 1992, the Ministry of the Environment estimated that 62 landfills in Ontario would close within one year, and another 65 would close by 1997.²² In addition to environmental and economic issues associated with the siting of a landfill, the major opposition is NIMBY. The difficulty of locating environmentally and politically acceptable landfill sites, coupled with financial incentives from solid waste diversion, will result in a decreased requirement for new ones. With increased diversion by municipalities through expanded blue box programs, coupled with Industrial, Commercial, and Institutional efforts through source separation and recycling programs, the decreased number of landfills will also require significantly less space.

¹⁹ Ontario Ministry of Environment and Energy, *New Business Opportunities for Recyclable Materials*, Queens Printer for Ontario, 1994, p 3.

²⁰ Ontario Ministry of Environment and Energy, op. cit., p 3.

²¹ Environment Canada, *Stress on Land*, Canadian Government Publishing Centre, 1983, p 47.

²² McRobert, David, *Restructuring the Economy - A Look at the Implications of the Shift to Recycled Materials*, in *Alternatives*, University of Waterloo, Vol. 19 No. 2, 1993.

Table 1. Summary of Canadian Landfills, Incinerators, Material Recovery Facilities (MRFs), and Percent of Solid Waste Recycled by Province*

Province	Number of Landfills	Number of Incinerators	Number of MRFs	Per cent Recycled
Alberta	359	1	5	n/a
British Columbia	252	1	20	25%
Manitoba	439	0	n/a	n/a
New Brunswick	83	0	2	10%
Newfoundland	188	52	6	18%
Northwest Territories	53	0	18	3%
Nova Scotia	36	1	2	15%
Ontario	165	3	64	28%
Prince Edward Island	3	1	2	20%
Quebec	n/a	2	30	n/a
Saskatchewan	724	0	25	5%
Yukon	20	0	1	n/a
Total	2,322	61	175	16% average

* Adapted from the *Biocycle Survey: The State of Garbage in Canada, February 1996* and information provided by the *Ontario Ministry of Environment and Energy, October, 1995*.

Notes:

1. None of Newfoundland's incinerators in the above table are waste to energy plants.
2. The Northwest Territories MRFs in the above table are low tech facilities with balers but not conveyor belt systems.

2.2 An Ontario Perspective

As a result of past reliance on landfilling waste, we are becoming increasingly aware of the environment's dwindling capacity. The government of Ontario has established a target to decrease the amount of waste disposed of in landfill by at least 50% by the year 2000.

2.2.1 Ontario's Waste Diversion Initiatives

On March 10, 1989, the then Ontario Minister of the Environment, Mr. Jim Bradley, announced an Ontario objective of 25% diversion of municipal solid waste from landfill and incineration by 1992 and a 50% diversion by the year 2000.²³ Mr. Bradley announced that both diversion percentages would be determined against the 1987 base year in which Ontario generated approximately 8.9 million tonnes of solid, non-hazardous waste.²⁴ These goals were reaffirmed on a number of occasions by the succeeding Minister of the Environment, Ruth Grier. In April of 1991, Ms. Grier announced a ban on the establishment of new municipal solid waste incineration or energy-from-waste projects in Ontario.²⁵ This ban allowed for the expansion of strong recycling markets and the establishment of new ones.

In October 1991, the Ontario Waste Reduction Office produced its first discussion paper, *Regulatory Initiatives to Achieve Ontario's Waste Reduction Targets*. It outlined regulatory initiatives that could be taken to ensure that the provincial targets for waste reduction were met.²⁶ Included in these initiatives were provisions for mandatory waste audits and source separation programs in the Industrial, Commercial and Institutional (IC&I) sectors. On October 24, 1991, the

²³ Winfield, Mark, op cit , p 4

²⁴ Ontario Ministry of Environment and Energy, Letter to Irene Fedun, Recycling Council of Ontario, *Re: Request for Waste Generation and Diversion Statistics*, October 10, 1995

²⁵ Winfield, Mark, op cit , p 5

²⁶ Waste Reduction Office, *Regulatory Measures to Achieve Ontario's Waste Reduction Targets*, Ontario Ministry of the Environment, Toronto, 1991

Ontario Ministry of the Environment introduced Bill 143, the *Waste Management Act*.²⁷ The first three parts of the bill addressed waste management issues in the Greater Toronto Area, and the fourth amended the *Environmental Protection Act* to allow the Province of Ontario to implement some of the initiatives proposed in the Waste Reduction Office's discussion paper.²⁸ The bill was enacted in April 1992, and the *Ontario 3Rs Regulations* were promulgated on March 3, 1994. The latest government has re-introduced incineration as a waste management option, however, in August, 1995, the *Recycling Council of Ontario* reported that the current Ministry of Environment and Energy Minister, Brenda Elliott, confirmed that the Harris government will not repeal *Ontario's 3Rs Regulations*.²⁹ This means that the regulations requiring curbside recycling and IC&I source separation, waste and packaging audits, and waste reduction workplans will continue.

Since the introduction of Ontario's solid waste diversion initiatives to require waste reduction, Ontarians have not only diverted waste from landfill sites, but have considerably decreased generation of solid waste in this province. In 1992, an estimated 7.5 million tonnes of solid waste was generated and in 1993 an estimated 7.14 million tonnes.³⁰ Relative to 1987 waste generation levels, the 1993 volume represents a decrease in municipal solid waste by 28 percent on a per capita basis. Residential and IC&I Sectors generated nearly equal tonnages in 1993: 3.60

²⁷ Winfield, Mark, *op cit*, 5

²⁸ Winfield, Mark, *op cit*, 6

²⁹ Recycling Council of Ontario, *WasteNOTES*, Ontario Waste Management Association, August 18, 1995

³⁰ Winfield, Mark, *op cit*, 6

million tonnes from the Residential and 3.54 million tonnes from IC&I sectors respectively.³¹

Although the volumes of solid waste include an estimate of an export of one million tonnes of this material from the province, the precise causes of the reduction in recorded waste generation are unclear.³² Therefore, it is difficult to ascertain the degree to which the reduction is due to the 3Rs efforts as opposed to other factors. For example, many municipalities which have observed reductions of 80-90% in the amount of IC&I sector waste arriving at their landfills, argue that the province is substantially underestimating the amount of waste export.³³ In addition, consideration must be given to the possibility that the recession is having a significant impact on the amount of waste being generated in the province. It has been estimated by Environment Canada that during the 1981-82 recession, waste disposal in Canada decreased by 20%.³⁴ Another factor influencing solid waste tonnages includes landfills receiving materials other than the municipal site. This private sector information may not all be included in a municipal solid waste summary. An example of this in the Regional Municipality of Ottawa-Carleton (RMOC) is that both the Lairdlaw and Heaunalt landfill sites accept solid and construction waste respectively and both sites have been in operation for more than fifteen years. In the RMOC, another possible factor is the transfer of solid waste into Quebec; however, this is no longer an acceptable practice for solid waste management for IC&I facilities throughout the region.

³¹ Ontario Ministry of Environment and Energy, Letter to Irene Fedun, Recycling Council of Ontario, *Re: Request for Waste Generation and Diversion Statistics*, October 10, 1995.

³² Waste Reduction Advisory Committee 'A Shared Model: A Stewardship Approach to Waste Management in Ontario' Ontario Ministry of the Environment, 1992, p. 3.

³³ Winfield, Mark, *op. cit.*, 7.

³⁴ Environment Canada, 'A Report on Canada's Progress Towards a National Set of Environmental Indicators' *State of the Environment Report* 1991, p. 67.

Previous to the *Ontario 3Rs Regulations*, the efforts of the Ontario government to promote the 3Rs activities had focused on encouraging voluntary action from industry, with some financial support from the province for programs such as the Blue Box. This approach brought some significant decreases in residential volumes and the *3Rs Regulations* are expected to further decrease the volumes from the IC&I sector.³⁵

Although the regulations were not promulgated until almost two years after their enactment, many IC&I facilities were aware of Bill 143 and began implementing source separation and recycling programs with the expectation that they would soon be mandatory.³⁶ Many IC&I facilities are motivated to continue with solid waste diversion programs mainly because the cost avoidance of not sending these materials to landfill outweighs not diverting these materials, however, other motivating factors should also be considered. Some of these include an improved corporate image and/or pressure from within an IC&I facility from employees to expand recycling programs to include all items diverted from the residential sector. Another influencing factor is the increase in private sector businesses to include recycling opportunities in their waste management services. Instead of just offering solid waste hauling and disposal services, many private solid waste management companies have opened their own Material Recovery Facilities to expand their service base.

Many municipalities and government facilities have promoted the *Ontario 3Rs Regulations* and made available to the IC&I sector, programs including seminars of 3Rs activities, promotional materials, waste audit and waste reduction action plan manuals and various workgroups. All of these factors have assisted in the success of solid waste diversion throughout Ontario.

³⁵ Winfield, Mark, *op cit*, 9

³⁶ Personal Conversation with Ms. Sherin Hasinantha, Ontario Ministry of Environment and Energy, September, 1994

Municipalities and IC&I establishments continue to expand their source separation and recycling programs, and as a result, Material Recovery Facilities (MRFs) are being established across Ontario. In 1995 it was estimated that 64 MRFs were operating in Ontario, dedicated to handling material from Municipal and IC&I facilities³⁷. Over the past 10 years, markets and end uses for these recyclable materials have expanded rapidly. Today, where facilities exist, the following types of materials are currently being recycled: a full fibre stream; container stream including steel, aluminum, glass, and plastic, aluminum foils, trays, and plastic films; polystyrene, textiles, toner cartridges, wood and drywall; paint and aerosol cans, and diapers and incontinence products. The recyclable list continues to grow as new markets surface and end uses expand.

Through the conversion of recoverable materials from solid waste into marketable products, the success of recycling depends not only on acquiring the materials for processing, but also in "closing the loop", the process of putting secondary products and materials back into productive use. Businesses and individual consumers are increasingly making a conscious effort to buy recycled content products.

As stated by John Wright, Senior Vice President, Angus Reid Group,

"It is clear from our research that while the environment may not be at the top of the 'hit parade' of issues requiring urgent action by governments today, the environment is a very personal, deeply resonating concern that strikes close to home in consumers' day to day activities. What does it mean? Clearly, a retailer's recycling policies alone are not going to help them build or maintain consumer traffic, be it a clothing retailer, a garden centre, or a fast food court or outlet. Outside of a modest segment of the population which rigorously governs their lifestyle by a strict code of environmental conduct and encourages others to do the same, most consumers will not become disenfranchised from a retailer who doesn't recycle - if they are satisfied with the value, selection, service, and quality they receive. But the poll strongly suggests that a retailer recycling program will positively impact consumer opinion. In the competitive retail arena, this could be the basis of a competitive edge. With consumers continuing to spend their dollars

³⁷ Gies, Glenda, *The State of Garbage in Canada*, Biocycle, February 1996, p. 46-52.

cautiously, any edge becomes consequential and should not be overlooked as retailers search for ways to improve their bottom line" ³⁸

Many progressive companies include some form of environmental awareness as part of the cost of doing business. for example, a survey conducted in Fortune 500 companies revealed that 924 of them plan to spend 3.6 billion dollars U.S. on recycled content products in 1992. ³⁹ This represents an eightfold increase over the 470 million dollars U.S. that the same corporations spent in 1989.

Although concern for the environment may not be the "most important problem" when employment and economy are considered, Statistics Canada reports that 95% of Canadians recycle at least paper when provided with recycling programs, and 45% of all Canadians intentionally purchase recycled content paper. ⁴⁰ An IC&I facility can provide the opportunity for employees to participate in a recycling program, while at the same time improving their bottom line in solid waste management.

In a 1993 address to the Canadian Institute for Environmental Law and Policy, the then Ontario Environment Minister, Ruth Grier stated that the politics and logistics of selecting disposal sites are becoming increasingly complex. ⁴¹

"All too often, people still look to "NIMBY - Not In My Backyard" as the solution, when, in fact, it is the root of the problem. The government's environmental policy is based on personal and social responsibility. We want to bring about a significant change in how we care for our environment and go about our business. Waste reduction is fundamental to this agenda. We have a firm goal—to reduce the wastes we send to landfill by at least 50 percent by the year 2000. That goal cannot be met by simplistic approaches. We must create a comprehensive waste

³⁸ Canadian Polystyrene Recycling Association, *July, 1995 Angus Reid Poll*, Mississauga, Ontario, July 1995

³⁹ Ontario Ministry of Environment and Energy, *New Business Opportunities for Recyclable Materials*, Queen's Printer for Ontario, 1994, p. 4

⁴⁰ Ontario Ministry of Environment and Energy, *op. cit.*, 3

⁴¹ Grier, Ruth, *Opening Address to the Canadian Institute for Environmental Law and Policy Municipal Solid Waste Management Conference*, January 23, 1993

management system. This system must integrate waste reduction as a priority in terms of financing, in planning, through infrastructure and market development and through public education that reinforces a sense of environmental responsibility. The NIMBY solution is not an acceptable alternative to waste reduction. I am confident about our future. We will reduce the wastes we generate, our industries and institutions will continue to reduce their wastes, become cleaner and greener and benefit financially from it, and our landfills will be better-sited, last longer because of reduced waste production, and have less of an impact on our environment. We are getting there. The results of our Waste Reduction Action Plan are paying off economically, environmentally, and socially."⁴²

As the costs for siting and constructing landfills continue to rise, pressure to find 3Rs alternatives will increase and new opportunities for 3Rs entrepreneurs will multiply. These opportunities should be viewed in a positive light: benefits from both environmental and economical investments can in fact be a reality.

With the increase in public awareness, through media coverage of human-induced disasters, such as the EXXON Valdez, and logging controversies, such as Temagami and Clayoquot Sound, people are becoming increasingly aware of wide-ranging, broad-scale environmental impacts. The option of producing new products from secondary materials, such as recyclables, is becoming increasingly popular. The public is also increasing its demand for corporate responsibility or "product stewardship". Product stewardship is based on taking responsibility for production of a product throughout its entire life cycle, or from "cradle to grave". Landfill site managers are increasing the types of materials that are banned, especially if recycling markets are available. At the Trail Road Site in Ottawa-Carleton these items include cardboard, wood, drywall, tires and construction and demolition products.

2.2.2 The Ontario 3Rs Regulations

Ontario's large businesses, industries, and municipalities were required to implement waste reduction programs under the environmental regulations that became law on March 3, 1994. The *Ontario 3Rs Regulations* comprise five waste

⁴² Grier, Ruth, op. cit.

reduction regulations which define the rules and requirements for reduction, reuse, and recycling throughout the province. The purpose of the 3Rs Regulations is to ensure that IC&I Sectors, as well as Municipalities, develop programs to reduce the flow of valuable resources going to landfill in Ontario. These regulations apply only to non-hazardous solid waste from residential and IC&I sources.

The five regulations made under the Environmental Protection Act, are as follows:

Ontario Regulation 101/94:	Recycling and Composting of Municipal Waste
Ontario Regulation 102/94:	Waste Audits and Waste Reduction Workplans
Ontario Regulation 103/94:	Industrial, Commercial, and Institutional Source Separation Programs
Ontario Regulation 104/94:	Packaging Audits and Packaging Reduction Workplans
Ontario Regulation 105/94:	Definitions (Amendments to Regulation 347)

The then Minister of Environment and Energy, Bud Wildman, announced that, "These regulations build on the success of Ontario's waste reduction efforts. The new requirements will divert as much as two (2) million tonnes of waste a year; that's the equivalent of 200,000 truckloads every year or forty (40) million garbage cans full of waste that won't be going to landfill. These regulations in their final form are both flexible and cost-effective. They affect the larger businesses and industries in the province, and offer municipalities options in the way they implement mandatory recycling programs".⁴³

The *Ontario 3Rs Regulations* require the following:

- (1) Residential recycling and backyard composting programs must be provided by all municipalities with a population of 5,000 or more (101/94).
- (2) Leaf and yard waste composting must be implemented by municipalities with a population of 5,000 or more if they have an existing leaf and yard waste collection program. Leaf and yard waste collection and composting are

⁴³ Wildman, C.J., Minister of Environment and Energy, News Release, *Re: New Regulations Will Help Ontario Achieve 50 per cent Waste Reduction*, April 29, 1993.

required in municipalities of 50,000 or more whether or not they currently have a leaf and yard waste collection program (101/94).

- (3) Waste audits and waste reduction workplans, updated annually, are required for major waste generators in designated IC&I Sectors as follows: large retail complexes, hospitals, schools, hotels and motels, restaurants, office buildings, construction and demolition projects and manufacturing establishments (102/94).
- (4) Source separation (recycling) programs are required for major waste generators in designated IC&I sectors as follows: large retail complexes, hospitals, schools, hotels and motels, restaurants, and office buildings, in municipalities of 5,000 or more in population; and large construction and demolition projects and manufacturing establishments, regardless of location (103/94).
- (5) Packaging audits and packaging reduction workplans, updated every two years, are required for major manufacturers, packagers, and importers of packaged food, beverage, paper, and chemical products (104/94).
- (6) Mandatory recycling programs for multi-unit residential buildings with six or more units that are located in municipalities of 5,000 or more in population (103/94).
- (7) Recycling facilities may be eligible for exemptions from Certificate of Approval requirements under the Environmental Protection Act, provided that certain standards are met in order to fast-track these recycling projects (101/94).

As a result of greater distances to recycling material markets, municipalities and designated establishments in Northern Ontario will have until July 1, 1996 to implement their Blue Box and IC&I recycling programs. Throughout the rest of Ontario, designated IC&I establishments must have a complete waste audit and

waste reduction workplan available within six months of promulgation ⁴⁴ The two regulations that apply directly to IC&I facilities are *Ontario 3Rs Regulation 102 and 103*. A detailed summary of these two regulations is provided in the following section.

2.2.2.1 *Regulation 102/94: Waste Audits and Waste Reduction Workplans for Industrial, Commercial and Institutional Sectors.*

Almost half of the non-hazardous solid waste stream generated in Ontario is generated by IC&I establishments. As a result, efforts to reduce this waste stream have great potential for diverting valuable materials away from disposal, and into productive use. The intent of the *3Rs Regulations* is to encourage IC&I establishments to examine the types of waste that they generate, the volumes of waste that they send to landfill, and to realize that much of this disposable material is recoverable. The idea of conducting an audit is intended to provide a representative sample, or at least an indication, of where the waste is generated, and which areas in an IC&I facility should be targeted for reduction. It is intended to provide a starting point from which waste reduction goals can be set.

Waste audits and waste reduction work plans can also lead to reduction of the residential waste stream; for example, potential changes in the manufacturing process, identified in a waste audit, can lead to design changes in a product ultimately purchased by consumers (102/94). A design change that incorporates the 3Rs hierarchy, by not only reducing materials used but also making the product more reusable or recyclable, will increase the potential for solid waste diversion (102/94).

A waste audit is intended to ensure that a comprehensive study of solid waste is reported. The focus is to address the amount, nature, and composition of waste generated in all functional areas of an establishment (102/94). The intent is to determine how the waste is produced and how it is managed (102/94).

⁴⁴ Ontario Ministry of Environment, Information, *Ontario's New 3Rs Regulations: Backgrounder*, Spring 1993, p 2

The information gathered from conducting a representative waste audit provides the basis for developing the waste reduction work plan. The work plan addresses 3Rs opportunities that can be implemented (102/94). *Regulation 102/94* also requires that waste audits from waste reduction work plans be up-dated at least once a year and reported on a form provided by the Ontario Ministry of Environment and Energy or in a similar format. The report of a waste audit and waste reduction work plan must be retained on file for at least five years. The waste reduction work plan must be posted in areas where employees can see it, and must be provided to an employee upon request. When requested by a Ministry Director, the most recent audit and the work plan must be submitted to the Ontario Ministry of Environment and Energy within seven days (102/94). Table 2 summarizes designated IC&I establishments which are affected by *Regulations 102 and 103/94*.

2.2.2.2 *Regulation 103/94: Source Separation of Recyclable Materials for Industrial, Commercial and Institutional Sectors.*

Ontario Regulation 103/94 requires identified IC&I establishments to implement source separation programs for recyclable waste materials. A source separation program is one that facilitates source separation of waste for reuse or recycling and must include provisions for the following:

- (1) Collection of source separated waste.
- (2) Handling of source separated waste.
- (3) Storage of source separated waste.
- (4) Ensuring source separated wastes are removed from the facility.
- (5) Information to users and potential users on the performance of the program.
- (6) Reasonable efforts to ensure full use is made of the program.
- (7) Reasonable efforts to ensure separated wastes are reused and/or recycled.

The intention of the *Ontario 3Rs Regulations* is not to place the responsibility of processing and marketing the source separated materials on an IC&I facility. Instead, they provide an opportunity for local businesses to provide this service. A number of commercial organizations have been established in the Regional

Table 2: IC&I Establishments Affected by the Ontario 3Rs Regulations 102/94 and 103/94.*

IC&I Establishment	Designated Requirements
Educational Institutions	350 persons enrolled at the location or campus at any time during the calendar year with no distinction between full- and part-time students. It includes both public and private, elementary, secondary and vocational schools; training academies; colleges and universities located in a municipality with a population of 5,000+.
Hospitals	General hospitals with teaching facilities for university and medical students; general hospitals with at least 100 beds; hospitals for chronic patients with at least 200 beds located in a municipality with a population of 5,000+.
Hotels or Motels	More than 75 units located in a municipality with a population of 5,000+.
Manufacturing Establishments	If employees at the site work in excess of 16,000 hours in any one calendar month.
Office Buildings	10,000 square metres or more of floor area used as offices, located in a municipality with a population of 5,000+.
Restaurants	Gross sales in excess of \$3,000,000 and located in a municipality with a population of 5,000+.
Retail Shopping Establishments and Complexes	Floor area at least 10,000 sq. metres located in a municipality with a population of 5,000+.
Construction and Demolition Projects	Total floor area of at least 2,000 sq. metres
Multi-unit Residential Buildings	With six or more units located in a municipality with a population of 5,000+.

* Adapted from Ontario 3Rs Regulation 102/94.

Municipality of Ottawa-Carleton who can process and market IC&I and municipal recyclables, such as Waste Recycling (Ottawa/Hull) Inc., Cascade, Laidlaw Waste Systems Ltd., and Fibre Resource Recovery. Table 3 outlines materials required to be source separated by designated IC&I establishments.

Materials that can be recycled quite often are of monetary value and should be viewed as a resource rather than a liability. In addition to the environmental benefits that can be realized from diverting waste from landfill, remuneration from recyclable materials can often cover the cost of solid waste haulage and disposal in an IC&I location, not to mention the benefits from demonstrating corporate responsibility and improving employee morale.

"Ontario's waste reduction initiatives are consistent with the government's 10-point plan to put Ontario back to work," said Mr. Wildman. "They are an investment in jobs and people and in structuring a more environmentally sustainable economy. We will meet our year-2000 target of 50 percent waste reduction in ways that benefit both our environment and economic recovery".⁴⁵

2.3 Opportunities Within the Regional Municipality of Ottawa-Carleton

In 1990, the Regional Municipality of Ottawa-Carleton (RMOC) landfilled over 673,000 tonnes of solid waste and diverted only 133,000 tonnes (approximately 20%).⁴⁶ Of this diverted material, over 99,000 tonnes came from the IC&I sector (approximately 74% of the total diverted). These diversion efforts by IC&I facilities can significantly reduce the volumes of solid waste ending up in landfill. In 1993 an estimated 201,000 tonnes of solid waste was landfilled at Trail Road and in 1994 disposal dropped again to 196,000 tonnes.⁴⁷

In addition to the *Ontario 3Rs Regulations*, other factors have also influenced the volumes of solid waste disposed of in Ontario landfills.

⁴⁵ Wildman, C J., op. cit

⁴⁶ Regional Municipality of Ottawa-Carleton, *Wastelines*, Spring, 1993, No. 5, p 6

⁴⁷ Regional Municipality of Ottawa-Carleton, *Recycling Report Card*, October, 1995.

Table 3: Source Separation Requirements for Affected IC&I Establishments *

IC&I Establishment	Mandatory Materials to be Source Separated
Educational Institutions	Corrugated cardboard, fine paper, newsprint, steel and aluminum food and beverage cans, clear and coloured glass for food and beverages.
Hospitals	Corrugated cardboard, fine paper, newsprint, steel and aluminum food and beverage cans, clear and coloured glass for food and beverages.
Hotels or Motels	Corrugated cardboard, fine paper, newsprint, steel and aluminum food and beverage cans, clear and coloured glass for food and beverages and food or beverage bottles made from PET (polyethylene terephthalate).
Manufacturing Establishments	Corrugated cardboard, fine paper, newsprint, aluminum, glass, HDPE (high density polyethylene) jugs, pails, crates, totes and drums; LLDPE (linear low density) and LDPE (low density polyethylene) film; polystyrene-expanded foam; polystyrene trays, reels, spools; steel; and untreated wood.
Office Buildings	Corrugated cardboard, fine paper, newsprint, steel and aluminum food and beverage cans, clear and coloured glass for food and beverages.
Restaurants	Corrugated cardboard, fine paper, newsprint, steel and aluminum food and beverage cans, clear and coloured glass for food and beverages and food or beverage bottles made from PET.
Retail Shopping Establishments and Complexes	Corrugated cardboard, fine paper, newsprint, steel and aluminum food and beverage cans, clear and coloured glass for food and beverages.
Construction and Demolition Projects	Brick and Portland cement concrete, corrugated cardboard; unpainted drywall; steel; and untreated wood
Multi-unit Residential Buildings	Newsprint, steel and aluminum food and beverage cans, clear and coloured glass for food and beverages and food or beverage bottles made from PET.

* Adapted from Ontario 3Rs Regulation 103/94

The *Recycling Council of Ontario* held an awards banquet in April 1996 where they honoured twenty IC&I facilities such as MRFs, schools, not-for-profit organizations, businesses, industries, and outstanding individuals across Ontario with "Waste Minimization Awards". One of these recipients was the Ottawa-based "Hospital Shared Services Total Waste Management and Recycling Program". Under this program, eleven hospitals are working together and sharing information in a joint effort to maximize solid waste diversion from landfill. When the program began in February, 1995, diversion percentages ranged from 0% (no diversion program yet in place) to 28%. By July, 1996, the average diversion increased to 37%, with the lowest at 20% and the highest at 57%!

The RMOC has negotiated a total solid waste management tender for all municipalities that fall under their jurisdiction in an effort to standardize types of materials that can be diverted from landfill. The contract includes collection of leaf and yard waste, non-hazardous solid waste, and recyclables. The program began for many municipalities on June 1, 1996, with the balance starting on July 1, 1996. In this contract, a wider range of materials is accepted in the Blue Box program and two different contractors have each been awarded 'zones' of the region in a effort to increase competition. All revenues from recyclable materials go back to the RMOC who also have the option of deciding where the materials are marketed. The recoverable materials are now very similar to those currently recycled from local IC&I facilities and include the following: all fibre-based products (OCC, newsprint, magazines, fine paper, and mixed paper); clear and coloured container glass; steel and aluminium food and beverage containers; paint and aerosol cans; aluminum foils and trays; gable top cartons and aseptic drinking boxes; PET, HDPE, LDPE, mixed wide-mouthed tub container plastics, and polystyrene.⁴⁸ As a result of this expanded Blue Box program, with all municipalities benefiting from increased diversion, the RMOC is expecting to further decrease volumes of solid

⁴⁸ Regional Municipality of Ottawa-Carleton, *Section A Tender - Regional Solid Waste Collection Contract CE-5244*, December 1995.

waste disposed at Trail Road and thereby extend the life of this site. From the data that has been collected from the expanded Blue Box program, the average diversion of solid waste from landfill by municipalities participating is over 60% compared to the lowest percentages resulting from a previously limited list of recyclable materials.⁴⁹

The following chapter outlines the methodology and extrapolation of observations when three waste audits were conducted at three separate locations over three different periods of time in the IC&I sector of the RMOC.

⁴⁹ *The Ottawa Citizen* 'Blue Box Changes Spark Recycling', Thursday, June 13, 1996

3 ESTIMATING SOLID WASTE DIVERSION FROM IC&I FACILITIES

3.1 Purpose

Solid waste audits were conducted for three locations in the Ottawa area. A five-day audit was conducted at an Educational Institution, a three-day audit was conducted at a Property Management Company, and a one-day audit at a Telecommunications Firm. The audits were intended to:

- (1) Determine the quantity and categories of waste generated;
- (2) Determine the success of current diversion rates achieved through programs already in place;
- (3) Provide a baseline or benchmark from which to measure the success of proposed diversion initiatives;
- (4) Calculate the potential diversion rate as required through the Ministry of Environment and Energy's *Ontario 3Rs Regulations*;
- (5) Estimate the feasibility of expanding existing recycling programs;
- (6) Evaluate the findings within the context of the Ministry of Environment and Energy's *Ontario 3Rs Regulations 102 and 103*, and the Province of Ontario's diversion objectives of 25% by the end of 1992, and 50% by the year 2000.
- (7) Document this information as required through the Ministry of Environment and Energy's *Ontario 3Rs Regulations*.

3.2 Methodology

Waste was collected in clear plastic bags by in-house staff at each location. Each bag was labelled according to functional area and floor number and stored for analysis. The five-day (Educational Institution) audit data was collected from Monday through Friday in October 1993, the three-day (Property Management Company) audit from Tuesday through Thursday in March 1995, and the one-day (Telecommunications Firm) audit was on a Wednesday in June 1995.

All waste generated during these audits was weighed by functional area, sorted, categorized by waste type, and recorded.

The plastic bag contents were emptied onto a plastic-covered floor and waste was sorted by category into 25-gallon buckets. The sorting categories included the following: newsprint, old corrugated cardboard (OCC), waxed OCC, fine paper, mixed paper, clear glass, coloured glass, various grades of plastics, aluminum cans, steel cans, organics, napkins, floor sweepings, and other (this category consisted of items that did not fall into the above categories such as broken items, small pieces of equipment, catering supplies, etc.). After the sorting was complete, each bucket was weighed separately and recorded, and any anomalies in the types of waste found were noted.

Current diversion weights for paper, old corrugated cardboard, newsprint, glass (clear and coloured food and beverage containers), and cans (aluminium and steel food and beverage containers) were determined in the five-day audit by weighing the material collected during the audit period and extrapolating it to an annual estimate; however, in the three- and one-day audits, true weights of recycled materials were provided by a local recycling firm (for the two facilities audited) over a twelve-month period. Waste categories were established prior to the audits and additional categories were added as a result of the actual waste composition found throughout the audits.

3.3 Waste Audit Results

From these audits, it was estimated that the Educational Institution and Property Management Facility were diverting approximately 37% of their solid waste from landfill while the Telecommunications Business was diverting approximately 78%. All three establishments have the potential to divert at least 85% if current source separation programs are improved, and if waste reduction is expanded through the implementation of composting of organics (mainly food waste), napkins, and paper towels. In the Educational Institution and Property Management Company, significant quantities of recyclables were found (destined for landfill) such as office and mixed paper, newsprint, polystyrene, aluminum and steel food and beverage cans, and container glass. In the Telecommunications Firm,

significant quantities of mixed paper and plastics were found in the waste stream. These volumes of recyclable materials found in the waste stream are an indication that some staff members and/or tenants are not fully participating in current recycling programs, which provides room to concentrate on these generation areas to improve recovery. Table 4 provides a summary of the estimated annual volumes of solid, non-hazardous waste generated and diverted at the three locations studied.

3.4 Solid Waste Composition and Success of Current Diversion Initiatives

In all three waste audits conducted, fibre-based products and organics are present in significant volumes. The following figures (Figures 1, 2, and 3) illustrate a comparison of solid waste composition generated at each location through the use of stacked bar graphs. Each graph represents the average daily waste volumes generated, based on all waste that was sorted and weighed in each audit and compares this to volumes of materials currently recycled. Volumes of currently recycled materials were determined from actual weights provided from a local recycling firm for the Property Management and Telecommunications audit and the recycled material from the Educational Institution was determined by weighing material diverted during one week in the Blue Box program. From the data, it is evident that in the education and property management facilities, substantial amounts of material is "leaking" out of the recycling program and into the waste stream. Even in the successful fibre recovery program at the telecommunications facility, some material continues to go to landfill.

3.5 Functional Areas of Waste Generation

Data from the three IC&I facilities studied were individually broken down into functional areas of waste generation reflecting the nature of activities done at each location. On-site housekeeping staff were consulted at each location to establish an accurate representation. A detailed breakdown of Functional Area versus Waste Category and Waste Weight for each of the three IC&I audit locations is provided in the following tables (Tables 5 through 10). From the data gathered, it

Table 4: Summary of Estimated Annual Solid Waste Generated, Diverted, and Landfilled for Three IC&I Establishments as Determined From Waste Audits

	EDUCATIONAL INSTITUTION	PROPERTY MANAGEMENT	TELECOM- MUNICATIONS
NO. OF EMPLOYEES	65	700	540
AUDIT LENGTH (DAYS)	5	3	1
TOTAL NON- HAZARDOUS SOLID WASTE GENERATED (ESTIMATED TONNES/YEAR)	19	230	165
TYPE OF MATERIAL AND ESTIMATED ANNUAL DIVERSION			
Office Mix	5 tonnes	45 tonnes	90 tonnes
OCC	550 kilograms	23 tonnes	14 tonnes
Printed News	500 kilograms	12 tonnes	8 tonnes
Clear and Coloured Glass	400 kilograms	3 tonnes	5 tonnes
Steel and Aluminium Cans	300 kilograms	1 tonnes	1 tonnes
Telephone Books	No program in place	1 tonnes	3 tonnes
Diverted Through Reduction and Reuse	No program in place	No program in place	8 tonnes
TOTAL WASTE DIVERTED (TONNES/YEAR)	7	85	129
TOTAL WASTE SENT TO LANDFILL (TONNES/YEAR)	12	145	36
PERCENTAGE OF WASTE DIVERTED	37%	37%	78%

Figure 1

Educational Institution Average Daily Waste Weights (Kg)

Figure 2

Property Management Average Daily Waste Weights (Kg)

Figure 3

Telecommunications Average Daily Waste Weights (Kg)

Table 5: Waste Audit Data Collected From an Educational Institution Over a Five Day Period

To Landfill Site											
OCT.18-22.1993 *											
Sorted Wt in Kg	News		OCC		Fine		Mixed		Ch Col		Total Weight Kg
	Print	Other	Paper	Plastic	Paper	Plastic	Paper	Plastic	Glass	Other	
Cafeteria	0	0	0	0	0	0	0	0	0	0	0
Print Shop	0	0	0	0	0	0	0	0	0	0	0
Custodial Area	0	0	0	0	0	0	0	0	0	0	0
Second Fl Offices	0	0	0	0	0	0	0	0	0	0	0
Third Fl Offices	0	0	0	0	0	0	0	0	0	0	0
Board Room	0	0	0	0	0	0	0	0	0	0	0
Workrooms	0	0	0	0	0	0	0	0	0	0	0
Photocopy Room	0	0	0	0	0	0	0	0	0	0	0
Mail Room	0	0	0	0	0	0	0	0	0	0	0
Chapel	0	0	0	0	0	0	0	0	0	0	0
Total Weekly Wt.	0	0	0	0	0	0	0	0	0	0	0

Table 6: Waste Audit Data Collected From an Educational Institution Over a Five Day Period

To Recycling (Blue Box Program)											
OCT.18-22.1993 *											
Sorted Wt in Kg	News		OCC		Fine		Mixed		Ch Col		Total Weight Kg
	Print	Other	Paper	Plastic	Paper	Plastic	Paper	Plastic	Glass	Other	
Cafeteria	4	0	0	0	0	0	0	0	0	0	0
Print Shop	1	0	0	0	0	0	0	0	0	0	0
Custodial Area	0	0	0	0	0	0	0	0	0	0	0
Second Fl Offices	3	0	0	0	0	0	0	0	0	0	0
Third Fl Offices	2	0	0	0	0	0	0	0	0	0	0
Board Room	0	0	0	0	0	0	0	0	0	0	0
Workrooms	0	0	0	0	0	0	0	0	0	0	0
Photocopy Room	0	0	0	0	0	0	0	0	0	0	0
Mail Room	0	0	0	0	0	0	0	0	0	0	0
Chapel	0	0	0	0	0	0	0	0	0	0	0
Total Weekly Wt.	10	0	0	0	0	0	0	0	0	0	0

Table 7: Waste Audit Data Collected From a Property Management Company On The First Day of a Three Day Period

MARCH 7, 1995	News Print	News OCC	OCC	Washed Paper	Fine Paper	Mixed Paper	Clear Glass	Colours Glass	PETE #1	PETE #2	HDPE #2	Polyst #6	Other Plastic	Poly Coat	Alumn Cans	Steel Cans	Organic Napkins	Metal	Floor Sweepings	Other	Total Weight Sorted	Total Weight Rooms	Total Weight Wash	Total Daily Weight	Total No. of Bags
Sorted Wt in Kg	2.08	0.41	0.98	0.76	0.67	0.3	0.02	0.17	0.02	0.02	0.02	0.02	0.02	0.02	0.12	3.76	62	176	0.05	3.89	26.07	19.19	33.1	36	
Food Crt Unlabeled																								4	
Food Crt Labeled																									
RB Cash Deposit																									
RB Cash Wet Bag																									
RB Cash Vault																									
Basement Room	0.49				16.31	1.01									0.05										
RB 1st Floor	0.57				172	0.23									0.04										
RB 2C Floor	0.78				2.44	4.56									0.1										
Suite 302					0.5	2.4									0.03										
Suite 330					127	3.91									0.12										
Floor 1	0.98					9.15	0.38								0.08										
Floor 2	1.78														0.23										
Floor 3	0.2					8.8		0.24	0.05						0.04										
Floor 4 Empty																									
Floor 5	0.99	0.14			0.8	3.47	0.47								0.05										
Floor 6	1.26				0.6	3.16	0.17								0.14										
Floor 7	2.75				1.23	5.64	0.46		0.07						0.08										
Floor 8	0.53				0.63	4.21	0.3								0.03										
Floor 9					2.25	1.23									0.08										
Floor 10	1.98	1.56			1.89	4.32	1.67	0.34	0.12						0.08										
Floor 11	2.76	0.24			2.43	6.09	1.2	0.56	0.04						0.18										
Floor 12	1.32				3.23	2.67	1.01								0.18										
Total Weight Kg	19.41	2.6	0.98	17.27	79.67	8.22	1.44	0.48	0.12	0.08	0.02	0.02	0.02	0.02	0.02	3.78	51.93	25.36	6.2	2.95	33.66	309.92	19.48	576.48	

Note: Data represents materials destined for landfill only

Table 8: Waste Audit Data Collected From a Property Management Company On The Second Day of a Three Day Period

MARCH 8, 1995	News Print	News OCC	OCC	Washed Paper	Fine Paper	Mixed Paper	Clear Glass	Colour Glass	PETE #1	PETE #2	HDPE #2	Polyst #6	Other Plastic	Poly. Coat	Alumn. Cans	Steel Cans	Organic Napkins	Metal	Floor Sweepings	Other	Total Weight Sorted	Total Weight Rooms	Total Weight Wash	Total Daily Weight	Total No. of Bags	
Sorted Wt in Kg		0.23	0.77																							
Food Crt Unlabeled	0.72			0.68											2.7	0.12	0.14	22.6	2.81			29.37			35	
Food Crt Labeled															3.2	0.18	0.22	4.3	2.71			13.21			13	
RB Cash Deposit				3.24										3.04												
RB Cash Wet Bag	0.39						0.43	0.25						1.2			2.03	0.46			1.97				2	
RB Cash Vault						1.03								2.76				0.15				5.21			1	
Basement Room	0.32			4.2										3.76	2.67							3.94			1	
RB 1st Floor					0.82	2.1										0.04		1.2				15.82			3	
RB 2C Floor	0.76	0.29		4.09	3.74	0.47														3.2		7.22			3	
Suite 302				1.97	3.12	0.23			0.02	0.08							3.91	1.08				12.22			1	
Suite 330				1.26	3.41	0.38	0.23										1.02	0.39				19.5			3	
Floor 1	0.67														0.09	1.26	0.04				1.01			1		
Floor 2	1.03				5.39	0.23			0.04						0.76	2.14	0.08	1.23	0.43			8.02			1	
Floor 3	0.29					0.27									0.46	1.8	0.06	3.02	3.83			9.76			1	
Floor 4 Empty				4.01	3.2	0.85			0.03						0.32	0.93	0.06	0.98	0.63			15.6			4	
Floor 5	0.58	0.3		2.46	3.21	2.1	0.47								0.94			0.31	0.2			11.98			1	
Floor 6				0.19	2.23	0.11			0.04						0.08	0.17		0.33				0			0	
Floor 7	2.09	1.23			4.98	0.2									0.23	0.08	0.18	1.34	0.46			11.66	0.77	12.43	3	
Floor 8	0.52			1.12	3.96				0.02						0.1			2.98	0.78			1.37	1.18		4	
Floor 9	1.22														0.83	1.57	0.08					1.89	0.97	18.91	6	
Floor 9				1.12	3.72	0.23									0.65	1.12	0.06	0.56	0.43			1.54	10.67	18.4	12.51	3
Floor 10	1.47	1.12		2.76	6.89	2.98	0.56								0.76	1.13		1.76	1.13			10.67	18.4	12.51	4	
Floor 11	1.89			2.99	5.78	0.38			0.02						1.76	3.87	0.04	2.87	1.98			0.16	27.31	3.86	31.17	5
Floor 12	0.32			1.98	4.24		0.23								1.12	1.43	0.06	2.23	1.98			0.23	18.71	18.3	20.34	5
Total Weight Kg	12.27	3.17	0.77	26.03	56.32	8.86	1.72	0.17	0.08	14.34	36.51	0.9	1.64	0.9	1.64	0.02	0.04	1.13	0.68			0.15	10.98	1.01	11.99	4
Total Weight	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	273.57	19.57	527.75	104	
Note: Data represents materials destined for landfill only.																										

Note: Data represents materials destined for landfill only

Table 10: Waste Audit Data Collected From a Telecommunications Facility Over a One Day Period

JUNE 21, 1995 *	News Print	OCF Print	Fine Paper	Mixed Paper	Clear Glass	PETE Glass	HDPE #2	Poly #8	Other Plastic	Poly-Carb	Alum. Cans	Steel Cans	Organic	Metal Swings	Floor Swings	Paper Towels	Other	Total Daily Weight Kg
Ground Floor	0	0.12	0.21	0.08	0	0	0.01	0.01	0.06	0	0.1	0.57	0.15	0.06	0	0.03	0	1.43
Reproduction	0.3	0	0.11	0.14	0	0	0.01	0.01	0.06	0	0	0	0.16	0	0	0.02	0.4	1.21
Restaurant	0	0	0	0.43	0	0	0.36	0.04	0.36	0.1	0.31	0	14.73	0	0	1.3	0.12	17.75
Second Floor	0.4	0.1	2.33	1.44	0	0	0.01	0.3	0.19	0	0.15	0	2.95	0.36	0	0.24	0.03	8.5
Third Floor	0.2	0.5	2.1	0.92	0	0	0.01	0.28	0.45	0.13	0.09	0	3.26	0.09	0	0.58	0.32	11.93
Fourth Floor	0.1	0.4	1.4	1.66	0.27	0	0.09	0.36	0.42	0.03	0.51	0	6.09	0.21	0	0.73	0.1	12.37
Fifth Floor	1.2	0.12	5.21	1.25	0.52	0	0.08	0.03	0.64	0.41	0.1	0.22	4.86	0.27	0	1.19	0.6	16.7
Fifth Fl. Lounge	0	0	0.02	0.67	0	0	0.01	0.11	0.01	0	0	0	0	0	0.25	0.05	0.31	1.43
Sixth Floor	0	0.06	0.5	0.36	0.12	0	0	0.03	0.18	0.23	0.01	0.06	1.48	0.07	0	0.34	0.21	5.34
Sixth Fl. Mailroom	0	0	0.01	0.02	0	0	0	0	0.13	0	0	0	0	0	0	0.01	0.8	0.97
Sixth Fl. Lounge	0	0	0.01	0	0	0	0	0.01	0.04	0.01	0	0	0.33	0	0	0.12	0	0.53
Seventh Floor	0.1	0.27	0.3	0.6	0.24	0	0.01	0.03	0.24	0.37	0.06	0.01	1.72	0.16	0	0.43	0	4.54
Eighth Floor	0.23	0.12	0.54	0.88	0	0	0.09	0.28	0.37	0.14	0.01	0	2.26	0.07	0	0.5	1.6	7.09
Ninth Floor	0.1	0.21	0.3	0.85	0	0	0.04	0.42	0.36	0.43	0.09	0.12	3.54	0.09	0	0.28	0.3	7.21
Tenth Floor	0.01	0.36	4.41	3.16	0	0	0.01	0.06	0.27	0.7	0.06	0.22	2.98	0.6	0	1.03	0	13.37
Tenth Fl. Lounge	0	0	0	0.06	0	0	0	0.01	0.04	0.01	0	0	0.15	0	0	0	0.22	0.49
Eleventh Floor	0	0	4.1	1.02	0	0	0.01	0.01	1.58	0.03	0.01	0.48	3.79	0.04	0	0.1	0.6	11.78
Washrooms	0.3	0	0	0.13	0	0	0.1	0.12	0.35	0.06	0.01	0	0.69	0	0	18	1.3	21.06
Total Weight	2.84	2.26	21.55	13.67	1.15	0	0.16	1.39	6.14	0.62	1.78	1.17	49.14	2.02	0.25	24.86	11.89	144.4

Note: Data represents materials destined for landfill only

* Adapted from data obtained in a Waste Audit performed by Laidlaw Waste Systems June 21, 1995

is evident that all three of the facilities generate a similar range of types of solid waste categories, but with significantly differing volumes of material generated at each site. The volume of material generated is directly related to the number of employees and type of activity at a facility. A larger number of employees will result in a higher volume of material generated.

3.6 Potential Waste Diversion

Current diversion efforts at all three study locations are a result of recycling and reduction efforts already in place. The following pie charts (Figures 4, 5 and 6) illustrate estimated current and potential diversion percentages for the three study locations if recycling and reduction are expanded. The potential diversion percentages are derived directly from the total audit weights presented in Figures 1, 2, and 3, and Tables 5 through 10. These pie charts indicate that all three IC&I facilities could realize a diversion percentage of 85% or greater of solid waste from landfill. The greatest potential exists for the Educational and Property Management facilities whose current diversion programs are not as successful and do not encompass as many types of recoverable materials as those programs implemented at the Telecommunications business.

3.7 How to Increase Waste Diversion to Comply with The Ontario 3Rs Regulations

All three of the IC&I study locations currently exceed the Ontario Ministry of Environment and Energy's waste reduction target of 25% by 1992; however, additional measures must be implemented to reach the provincial waste reduction target of 50% by the year 2000 for both the Educational Institution and Property Management Company. Based on the audits, all three sites have the potential to increase their diversion of solid waste from landfill if additional reduction measures are introduced.

There are many ways in which waste diversion can be implemented. In the IC&I sector, a major incentive to implement a 3Rs strategy is cost avoidance which

Figure 4

Educational Institution Estimated Current and Potential Diversion (%)

Figure 5

Property Management Estimated Current and Potential Diversion (%)

Figure 6

Telecommunications Estimated Current and Potential Diversion (%)

results from decreased solid waste hauling and landfilling requirements. In addition to this economic benefit, the implementation of a waste audit, source separation, and recycling program helps a facility meet the *Ontario 3Rs Regulations* requirements. The following suggestions for increased solid waste diversion will assist IC&I establishments in reaching the provincial waste diversion goal. Of these suggestions, the most popular 3Rs strategy in the IC&I sector is recycling, followed by reuse and then reduction.

3.7.1 **Reduce**

The strategy of waste reduction in the IC&I sector focuses on diversion of solid waste from landfill by decreasing the volume of waste by not producing it in the first place; however, less has been accomplished in this 3Rs strategy when compared with the other two Rs. It can be achieved by not purchasing "throw-away" items. For example, disposable packaging and wasted food organics are both waste items that could be reduced. The following section outlines some waste reduction strategies for increased solid waste diversion from landfill in the IC&I sector.

- (1) A large percentage of total generated waste in the three IC&I establishments studied is organic material that could be composted. However, commercial composting in Ottawa-Carleton is not yet available and until this time some other options for organic diversion include: sending food to organizations like *Second Harvest* to help needy people; advertising the availability of organics to staff who want to add to their composting piles at home; sending food to farmers for animal feed; or donating surplus food to animal shelters.
- (2) Disposable toner cartridges were found in two of the waste streams studied (educational and property management company). Staff and/or tenants should be encouraged to use rechargeable photocopier and printer toner cartridges (prices are very similar). Also, in an effort to reduce generation at source, staff should understand the operation of all office equipment so

that paper, etc. is not wasted through misuse or malfunction (all office equipment should be regularly serviced).

- (3) Paper towel waste generated in the washrooms of all three facilities could be composted along with the organic material.
- (4) Individuals could be encouraged to use reusable lunch containers and coffee cups. Re-usable coffee cups should be the first area of concentration for all three sites with the possibility of allowing food court and cafeteria vendors to provide cups at a discounted price and/or promoting discounts for customers who use reusable cups. Introduction of a polystyrene recycling program should be implemented at all three locations for recycling of the disposable coffee cups generated. This type of promotion should be aggressive and on going.
- (5) The property management facility had party and catering supplies in the waste stream. Caterers should be required to take all food packaging and party trays with them when they leave. Although not in itself leading to recycling, such action will encourage caterers to limit waste packaging. Otherwise, catering services should be ordered from companies who provide responsible waste management practices with minimum packaging. Tenants and/or staff should be provided with the opportunity to take unused party supplies home with them.
- (6) Borrowed or shared newspapers or journals/magazines should be encouraged and subscriptions should be periodically reviewed.
- (7) All text/chart revisions should be made on screen before printing a hard copy; and disks instead of hard copies should be circulated to management for revision. Letters and memos should be reduced to one page and responded to with comments on the back of the original. Many letters and memos could be replaced with face to face conversations and telephone calls.

- (8) Computer fax software should be used to send facsimiles without requiring hard copies. If hard copies are required, plain paper (recyclable) fax machines should be used (messages won't fade, therefore, photocopies are not required for filing). Electronic mail or bulletin boards can be used for memos and announcements. If photocopies are necessary, double sided copies and the reduction feature should be used.
- (9) Tenants and/or staff should remove their names from "Junk Mailing Lists". This can be done by returning the postage-paid envelope with a request to have names removed from the mailing list.
- (10) Reusable envelopes for inter-office and external mail (i.e. two-way envelopes for billing) can be encouraged.
- (11) Minimizing food packaging materials generated in the cafeteria and food court areas with emphasis on reducing single use packaging could be encouraged along with discouragement of the use of drinking straws and Stir Stix. Avoidance of over-packaged goods (i.e. single-serving condiment packages) and provision of soft drinks, milk, etc. from a fountain or their availability in recyclable containers should be required.
- (12) Ensuring that contract negotiations include, where possible, emphasis on waste return (such as wooden skids) as well as packaging reductions

3.7.2 Reuse

Waste reuse strategies are implemented when items are reused again rather than disposed of after one use. There are many examples of items and materials that can be reused and a number of businesses have resulted from the reuse industry such as "Re-Use It" outlets that purchase and resell various construction and building supplies and the Salvation Army that repairs and reuse items such as clothing, appliances, and furniture. Many reuse strategies are linked to recycling strategies such as provincial and national waste exchanges. The focus behind the exchange is that waste output from one industry may be of use to another instead of sending it to landfill. The following suggestions apply to many IC&I facilities.

- (1) The back of old drafts, letters, one-sided copies etc. can be used for rough notes, photocopying, producing drafts, and scrap paper.
- (2) Scrap paper can be cut into quarters and stapled/glued together for use as scratch pads.
- (3) Old file folders, envelopes, packaging materials, and shipping containers can be reused.
- (4) Reconditioned office equipment and supplies (i.e. laser and photocopier cartridges, typewriter ribbons, etc.) and reclaimed building products (i.e. dry wall, doors, etc.) can be purchased.
- (5) Reusable rather than disposable materials (i.e. washable coffee filters) can be purchased. Old cardboard boxes can be used as binder-bins for loose files and magazines or as "reusable scrap paper" trays.
- (6) Second hand office furniture can be purchased and old office equipment could be sold to employees/tenants, or donated to Reuse-it centres or charitable organizations.
- (7) A Reuse-it centre could be established in the IC&I facility where employees can pick-up unwanted binders, hole punches, stationery supplies, etc. for use at home. Special exchange days can be organized where employees/tenants bring in unwanted clothes, jewellery, books, etc. and swap.

3.7.3 *Recycle*

The recycling strategy of waste diversion involves physically altering a material in order to return it to its original function (aluminum cans recycled into new aluminum cans) or to a new function (styrofoam cup recycled into a compact disc case). Recycling has been practised for a very long time, for example, old cars have been recycled since their production.⁵⁰ Many industries such as the film plastic industry return scrap and offcuts from the manufacturing process back to the

⁵⁰ Government of Canada, op. cit., p 25-13.

melt hopper.⁵¹ The following suggestions could increase the volume of recyclable materials recovered from the IC&I sector.

- (1) Introduction of an expanded mixed-fibre recovery program in addition to a fine paper program.
- (2) Participation and ownership from employees and/or tenants should be encouraged including their suggestions on how to make the present recycling programs more successful.
- (3) Access to recycling "blue box" materials should be as convenient as possible. Special emphasis should be placed on recovering aluminium cans and glass juice containers throughout the facilities.
- (4) Information should be made available to staff and/or tenants on all new recycling initiatives such as vermicomposting, textile recycling, mixed fibre recycling, etc.
- (5) Ensure that recycling bins are large enough to handle the amount of material between pick-ups and that adequate self explanatory signage is provided.
- (6) Well-marked recycling bins should be placed beside the garbage cans for beverage cans, glass containers, newspapers, paper plates and cups, and plastic containers throughout food court and cafeteria areas. Increasing the accessibility of recycling bins will improve participation and recovery.

3.7.4 Procurement

Procurement policies are the main force influencing market development in the recycling industry and consumers are becoming increasingly aware of "environmentally-preferred" products. As IC&I sectors continue to expand procurement policies to include these items, manufacturers will improve the technology available to produce them. The following is a list of suggestions for procurement policies:

- (1) Tenants and/or staff should be encouraged to purchase post-consumer

⁵¹ Government of Canada, op. cit., p 25-14.

recycled content materials, refillable office supplies (i.e. pens, and permanent tape dispensers), and bulk orders. The purchase of individually wrapped office supplies (i.e. pens) should be avoided. The items should be purchased loose, in bulk boxes that can be reused and/or recycled.

- (2) The purchased of products and supplies that come in recycled packaging should be encouraged and tenants/staff should purchase products that have post-consumer content (i.e. office paper, envelopes, refined motor oil, retreaded tires, etc.) Products with the Environmental Choice Logo from Environment Canada should be preferred by purchasing agents.
- (3) Supplies destined to reduce consumption such as rechargeable batteries, carbonless forms, and canvas money bags should be preferred. High volumes of carbon forms and plastic money bags were found in the Property Management waste audit.
- (4) Products designed for easy maintenance and repair and those with packaging for which a recycling market exists should be preferred.
- (5) When dealing with suppliers, be sure to consider the following:
 - (a) Does the supplier have an environmental policy and waste reduction program?
 - (b) Has the supplier conducted a waste audit and packaging reduction audit?

3.7.5 *Promotion and Evaluation*

When an IC&I facility alters collection of resource materials from a work environment, it is very important to promote the program and evaluate its success on an ongoing basis. The following suggestions could improve diversion in the IC&I sector.

- (1) Waste reduction and recycling signs should be more plentiful. Signs are an effective method of increasing tenant and/or employee participation while reducing contamination.
- (2) The current waste management hauler should be required to provide display

information on where the recyclable materials are sent and what types of new products are made from them. Waste Recycling (Ottawa/Hull) Inc. provides this type of educational tool as part of their recycling service and it is very effective for increasing employee participation and decreasing contamination. Employees/tenants are more likely to source separate recyclable materials and remove organic contamination if they have had an opportunity to ask questions on how the materials are handled once they leave the IC&I facility. They are also less likely to mix the container stream (plastics, glass, and cans) together when they understand the handling process on the part of the recycling company. Another very useful tool for decreasing contamination levels is to allow the housekeeping staff to have a tour of the Material Recovery Facility (MRF) that processes the products. Once individuals realize that staff at the MRF physically handle, process and ship these materials to the recycling markets, IC&I staff are much more likely to take ownership of their recycling program and make it a success. Also, the understanding that remuneration for recyclable materials is affected by contamination levels, related to increased processing costs, often result in staff/tenants encouraging each other to decrease contamination levels and increase participation.

- (3) Audit findings must be posted in an accessible area to inform employees and/or tenants of the sources of waste generation and priorities for waste reduction. The waste audit must be updated annually and made available to evaluate the effectiveness of the waste reduction workplan.
- (4) Positive feedback and information about problem areas will help improve participation in existing programs.
- (5) More people could be involved by providing an open house for all tenants and/or staff to promote recycling success stories. Encourage functional areas to appoint a staff member as a recycling coordinator to review records of materials sent to landfill from their area of waste generation.

3.8 Summary of the Three IC&I Waste Audit Findings

The five-day waste audit conducted at an Educational Institution, with an estimated 37% diversion, and the three-day audit conducted at a Property Management Company, also with an estimated 37% diversion, revealed that although source separation programs for recyclable materials were in place, there continued to be a significant amount of recoverable materials "leaking out" and ending up as landfill from certain functional areas of waste generation. The Educational Institution lost all mixed fibre, one third of the fine paper, and over half of the container stream (steel, aluminum, glass, and plastic containers) to landfill in 1993. The Property Management Company lost all mixed fibre, one third of the newsprint, some fine paper and OCC, and over half of the container stream in 1995. The third audit, conducted on one day at a Telecommunications Facility with an estimated 78% diversion also revealed that some recyclable materials (small amounts of fine paper, mixed paper, newsprint, and containers) were being landfilled; however, their recovery programs are very successful. In all three audits, the recoverable materials "leaking" into landfill have strong end markets.

All three audits allowed for determination of the approximate volume of waste generated, the type of waste categories that were generated, and the functional areas where these materials were generated. From this information, a decision maker at an IC&I establishment such as a Material Manager, Property Manager, or Director of Purchasing can better target those areas in need of greater attention to improve current recovery. This information also provides a better understanding for IC&I of their waste management requirements and a benchmark from which to measure improvements in diversion efforts and potential bottom line savings.

The following section provides a critical analysis of the data collected in the three waste audits studied, and a financial benefit analysis of increasing diversion efforts at the three types of IC&I facilities.

4 CRITICAL ANALYSIS OF THE DATA

The purpose of conducting a waste audit for any IC&I establishment is to determine a benchmark against which increases and decreases in waste diversion can be measured. It should provide a baseline from which to measure success of diversion initiatives and to determine the effectiveness of current recycling efforts. It should assist in a company's ability to estimate the feasibility of expanding existing recycling programs and to begin new ones. And, a waste audit, as the basis for a waste reduction action plan, will meet the *3Rs Regulation* requirements. A waste audit reveals estimated volumes of recoverable materials and targets specific functional areas generating the highest volumes of these materials. Source separation programs that are expanded as a result of data revealed through a waste audit can prove to be cost effective for an IC&I establishment because diversion of these resources decreases the requirement for solid waste hauling and landfilling.

While conducting a waste audit, solid waste weights are measured to quantify categorized waste being created at a location during a specific period of time. Waste collected for inclusion must be labelled according to functional areas specific to that establishment, to determine how much and what specific kind of solid waste is being generated. Waste should be sorted, categorized, and weighed by waste type and recorded according to each functional area with any anomalies being noted. The time period chosen should be as representative as possible, eg. if a three-day audit is to be conducted, Tuesday through Thursday provides a better sample rather than including Monday or Friday or weekends; and, similarly, holidays and down-time periods should be excluded. All waste collected should be weighed and as much sorted by category as possible. The samples revealed that audit data is often repetitious with functional areas generating similar waste categories and volumes on a daily basis. This adds to the confidence in predicted estimates for annual solid waste generation.

A method of determining the reliability of estimated annual solid waste weights is to compare them to actual volumes of recyclables picked up, and actual solid waste weights disposed of at the landfill. The following section describes types of data collected for recyclable materials diverted and solid waste landfilled from an IC&I facility.

4.1 Data for Recyclable Material Diverted

For comparison of recyclable material weights, there are four methods of data collection. The first is generated by a recycling company which provides a pick-up and exchange service for full containers, whereby the full containers are removed, transported to a material recovery facility, weighed by category, and recorded. The second method generates data by the use of a side-loader truck which empties the full containers into a truck on site, leaves the same container once it is emptied, takes the material back to the material recovery facility, and generates the weight of material inside based on an estimated percentage of the container filled. With the third method, data is generated from a front-end container which also empties the container on site and uses an estimated average of recyclable material inside; and the fourth type is from using a compactor for collection of fibre-based materials which will provide a truthful weight because the compactor is weighed on accurate scales and a weigh scale ticket is provided.

The first type provides the truest and most reliable record of total recyclable materials. Monthly breakdowns for each type of recyclable material collected can be provided because they are weighed on government approved, "Legal for Trade" scales. The records provided reveal the date of pick up, weight of each category, and the total received per month.

The second type of recycling company service, utilizing side-loader trucks, cannot provide exact weights because accurate scales are not available on the trucks, and an overall estimate has to be established.

The third type of service, often common for old corrugated cardboard collection, relies on front-end weights which are even less reliable than the second

type mentioned above. Depending on the volume of the mixed-fibre program at an IC&I establishment, the fourth option for accurate recycling weights can be achieved through the use of a compactor for fibre material only. Although this provides a breakdown of the materials inside on a percentage of the total basis, the true weight of mixed fibre diverted from landfill is provided. Many IC&I businesses are beginning to employ this method of fibre-based material diversion from landfill. The determining factor is the volume of material generated at a facility (for example, the volume must warrant the expense and space used by a compactor).

4.2 Data for Solid Waste Sent to Landfill

For a comparison of solid waste weights, two types of data recording systems are available. The most reliable type of data collection is acquired from landfill receipts from the solid waste hauler. An example of this type of data is provided in Appendix A. These tickets record the time that the solid waste is disposed and the actual weight of the material inside. If IC&I establishments do not have compactors, their method of disposal is through front end containers (i.e. 2, 4, 6, 8, etc. cubic yard containers). Weights are recorded from these containers; however, they are not as accurate as landfill receipts. Scales used are mounted on the front fork of the waste hauler's truck, and the weight of the container is recorded once the bin reaches a certain angle (i.e., seventy-five degrees). Unfortunately, this type of scale is not "Legal for Trade" and if the truck bangs the container, or if it weather conditions are poor, the data is not recorded truly, and in some cases, not at all. Two examples of this type of recording system are provided in Appendix A. On average, approximately fifty to sixty percent of the recorded data is commonly true and can be utilized for comparing the waste audit information.⁵²

By comparing the types of solid waste weight recording methods, both for solid waste and recycling, it is quite evident that the most accurate method of determining the reliability of data collected by conducting a waste audit is if an IC&I

⁵² Personal conversation with General Manager of Waste Management, Hull/Ottawa, Inc., December 1995.

establishment has both landfill ticket receipts generated from a compactor only, and a recycling service that provides accurate breakdown weights. Unfortunately, in the great majority of cases, this is not the reality. Many IC&I businesses utilize a combination of compactors and front-end containers for solid waste, due to limited space requirements. Also, most IC&I facilities use front-end containers for OCC collection because internal bailing equipment for this material is not available. The following comparison demonstrates the difficulty of acquiring true and exact weights for solid waste and recycling for analysis in a waste audit:

- (1) Of two hundred educational institutions in the Ottawa-Carleton Region, both recyclable materials and solid waste are collected in front-end containers at all sites. To compound the potential error factor, all recyclable materials are collected in the same front-end container and dumped into a truck. The material from eight to ten schools is then dumped onto the floor at a material recovery facility, and volumes on a per school basis are extrapolated.
- (2) Of twelve hospitals in RMOC, eleven are using compactors for solid waste, while three are using front-end containers. Of these locations, one hospital has on site both a compactor and two different sized front-end containers for the collection of solid waste. Seven hospitals are collecting diapers and incontinence products in front-end containers for recycling. Ten hospitals are using front-end containers for collection of OCC for recycling, and eleven are using a recycling service that provides true and accurate breakdowns through a container exchange service. In addition to the container exchange service, two hospitals are using compactors for their mixed fibre recycling programs, while collecting cans, glass, and plastics in the exchangeable containers. Eleven of the area hospitals are utilizing a recycling service company that provides a true and accurate breakdown of materials recovered; however, one is not receiving this service and is provided with estimated averages only.

- (3) Of the two large office towers that are examined in this thesis, one uses both a compactor and front-end containers for solid waste, and the other uses front-end containers only. Both of these locations are using the recycling service that provides accurate breakdowns; however one bales the OCC that is generated and receives accurate weights along with the other recyclables, and the other is using a front-end container for OCC.

It is difficult to determine the truth of the data collected from a waste audit if, as mentioned above, actual weights for material collected previously cannot be determined. However, because an audit is intended only to provide a starting point from which to begin improving upon a current program, or to assist in the initial start-up of a source separation program, too much emphasis should not be placed on specific numbers as true measures. Therefore, although the audits conducted can be extrapolated to provide total solid waste volumes, they can only be viewed as estimates, and should be studied with this in mind.

The Educational Institution and Property Management Company audits were conducted at facilities which had already initiated source separation and recycling programs; however, they were in the primary stages of recycling. Both IC&I establishments had source separation programs in place prior to the implementation of the *Ontario 3Rs Regulations*. Both were diverting the basic materials that are required in the *Ontario 3Rs Regulations* but had not previously conducted a waste audit. Neither of the locations had strong education programs in place nor did they have adequate recycling containers and signage. Both of these waste audits revealed that source separation and recycling programs are beneficial for waste diversion; however, considerable potential for expanding waste diversion still remained.

The Educational Institution and the Property Management Company currently have diversion rates significantly greater than the MOEE present requirement of 25% reduction by the year 1992. However, greater effort is required if the target of 50% diversion by the year 2000 is to be realized.

The Telecommunications Facility audit, although it is representative of one day of waste only, reveals that a very successful source separation, recycling, and reduction strategy is in place at this site. It is evident from this audit, that having conducted previous audits, and following up on the past audit information by targeting new materials for recycling, this office tower has been very successful in exceeding the *3Rs Requirements*. As is evident from the data collected, this business is committed to making their reduction efforts a success and have dedicated resources for education and ongoing monitoring of their programs, which have definitely increased their diversion. A detailed description of waste diversion efforts in place at this location is provided in Appendix B. This office tower management is proactive in terms of diverting solid waste from landfill. It began its waste reduction initiatives in the fall of 1989, and conducted its first waste audit on April 30, 1992. Unfortunately, solid waste volumes were unavailable at that time for material sent to landfill and diverted material. However, a three-day audit conducted at the Telecommunications Facility revealed that 68% of the waste analyzed was recyclable. Although this audit conducted was very basic, it provided the initial framework to begin waste reduction efforts.⁵³ The Telecommunications Facility also had a waste audit conducted in April of 1994 that concluded with a 60% diversion rate and a 40% landfill rate.⁵⁴ The prediction resulting from this audit indicated a potential of 65% total diversion, leaving 35% to landfill. From the 1995 audit analyzed in this thesis, a prediction of potentially 86% could be diverted, leaving only 14% sent to landfill.⁵⁵ These differences are mainly a result of increases in recyclable material markets which have resulted from expanded technology available to recover these materials.

⁵³ Energy Pathways, Inc , *"Solid Waste Audit Final Report"*, April 30, 1992.

⁵⁴ Laidlaw Waste Systems Ltd., *"Wasteauditor Report"*, April 1994.

⁵⁵ Laidlaw Waste Systems Ltd , *"Wasteauditor Report"*, June 1995.

4.3 Bias and Error

The data provided from conducting the one-day audit and extrapolating it to arrive at annual estimates matches the front-end container weights provided in Appendix A with an error factor of less than 5%. For example, from Page 4 of the *Customer Pickup Report* the following can be summarised:

Total number of recorded lifts for one year (Jan-Dec. 1995) = 130 lifts

Total weight of recorded solid waste lifted (Jan-Dec. 1995) = 30,410 kg

Therefore, the average solid waste weight per cubic four yard container = 234 kg/lift.

It is evident from the *Customer Pickup Report* that some lift attempts were not recorded; however, with the current solid waste service at three lifts per week with an average of 234 kg/lift, disposal of solid waste in 1995 was 36,500 kg. The waste audit concluded an estimated annual solid waste volume of approximately 36,000 kg of solid waste disposed of in landfill with a resulting error factor of <5%. The truthfulness of front-end container waste weights is debatable, as is the reliability of extrapolating one-day of data over an entire year; however, the exact number is not the intention when conducting a waste audit. It is intended only to provide an understanding of what types of materials and what general volumes of these materials are present in a waste stream.

To further demonstrate the potential error factor of the one-day audit, the hauler estimated an average of 79 kg per cubic yard of solid waste came from this telecommunications facility.⁵⁶ Using this for comparison, a four-cubic yard container lifted three times per week would generate 316 kg/lift, resulting in 49,300 kg/yr, an error factor of 27%.

Annual estimates from waste haulers for solid waste were not available for either the three- or five-day audits; however, accurate recycling material volumes by category were available for the property management facility Recovery

⁵⁶ Personal conversation with Dispatch Manager, Laidlaw Waste Systems Ltd, January 1996.

percentage estimates were determined from the accurate information, and that found in the audit destined for landfill. Again, the actual numbers are not the main focus with this type of analysis but instead, the useful information that results is for targeting those programs that need immediate attention. In the five-day audit, all of the recyclable material was placed in the curbside Blue Box program, and, therefore, accurate weights were not possible to obtain. However, even without these weights, it was quite obvious which recycling programs were successful, and which functional areas of the facility were not fully participating. Labelling the bags by functional area is very important for analysis of where more education and signage needs to be placed, and which generation points are not being recovered. It is also preferable to use clear plastic bags for the collection of the waste to allow for an initial visual inspection of the bag, prior to emptying it out on the floor.

Data collected in the five-day audit was recorded using a balance scale that rounded the data to the nearest kilogram. Data recorded in the three- and one-day audits was more precise because a digital scale allowing for two decimal places was used. The key to successful programs, not only in source separation, recycling, and reduction efforts is through ongoing education. The provision of information is absolutely essential for programs to be successful.

IC&I establishments should know what they are recycling in order to be paid accordingly, and they should also be concerned and find out how much they are landfilling because they are paying for disposal on a per tonne basis—especially if front-end containers are being used.

Organic material represents a significant volume (over 20% of material destined for landfill) of solid waste that should be targeted for diversion; however, many IC&I establishments, especially those located in the downtown area, find onsite composting difficult, due to limited space. Therefore, until commercial composting becomes readily available, (expected in September, 1996) this material will not likely be diverted.

Although the three audits included in this study were conducted over different days of the week, number of days, and times of the year, the information gathered from this type of analysis is representative of the total volume of materials generated in that it provides a "snap shot" of functional area waste generation. The MOEE accepts all types of waste audit information, including just walking around an IC&I facility and examining the types of materials present in various waste and recycling containers to get an idea of success and problem areas. Often, the costs associated with an extensive waste audit are not necessary to provide a true assessment of the types and volumes of solid waste diverted and sent to landfill; however, the more data that is collected, the more reliable the extrapolated results will be.

Another factor that may influence the results of a waste audit are the types of individuals performing the audit. In some cases, a private waste hauler may provide only volumes of the types of waste that can be diverted instead of including reduction opportunities that could reduce the hauling requirement altogether, however, in all of the three audits examined in this study, reduction, reuse, and recycling opportunities are addressed.

The remuneration provided in the Markets Chapter of this study is quite high when compared to overall averages; however, all three of the facilities examined are continuing to expand their diversion programs. Some of these diverted materials are not generating any remuneration currently, but reduction and recycling efforts are still the main focus over landfilling for these and many other IC&I facilities. During the time of the school board audit, remuneration was not being received for material; however, the school board continued to expand diversion efforts to decrease solid waste disposal requirements.

4.4 Financial Benefit Analysis

The cost of waste removal and disposal is increasing, employees are environment conscious if not specifically cost conscious, and for an IC&I establishment in today's economy a key factor is the bottom line. In these difficult

economic times, businesses often look at reducing services from a top down approach as a means of meeting budget restraints. There may very well be an opportunity to benefit from a bottom up approach by reducing cost through responsible solid waste management. The following financial benefit analyses include information for all three study areas; however, the greatest benefits will be realized in the Property Management Company and Telecommunications Facility, respectively. It provides a breakdown of costs associated with landfilling the recyclable materials and the revenues generated through the recycling of these products. Managers at all three locations testified that although initially they were concerned about extra labour costs associated with implementing a recycling program, and the cost of keeping it going, the benefits are greater than they expected.

The data utilized in the Table 11 financial analysis was provided by the Educational Institution, the Property Management Company, and the Telecommunications Facility for costs associated with disposal of solid waste landfilled from their locations and the remuneration received for recyclable materials diverted. The Educational Institution and the Telecommunications Facility both utilize front-end containers for solid waste collection and removal. Therefore, the lift fee is combined with the disposal fee and they are billed on a flat rate basis. Also, although the Educational Institution was not remunerated for their recyclable materials (they were removed through the Blue Box program), they still benefitted from not sending this material to landfill. It is evident from Table 11 that cost avoidance can be realized from the implementation of source separation and recycling programs.

The Educational Institution (diversion rate of approximately 37%) could provide only a flat annual fee for solid waste disposal, and it is evident that with the introduction of a source separation program in 1993, the financial requirement for disposal decreased. The annual disposal fee was further reduced when the recycling program was expanded in 1994.

In 1995, the Telecommunications Facility (diversion rate of approximately 78%) was charged \$56.00 each time their four cubic foot front-end container was lifted for disposal. This location received three lifts per week, with an average of 316 kg of solid waste per lift. They diverted 32 tonnes of recyclable material from landfill in 1995 and received \$3,100 for this material. It was picked up free of charge; however, if the material was not diverted, it would have cost this facility \$5,600 to dispose of it through the solid waste hauler. Therefore, the remuneration for recyclable materials diverted was approximately \$100/tonne in contrast to a potential expense of \$175/tonne. This difference results in a cost avoidance of almost \$8,700 for 1995!

The Property Management Company (diversion rate of approximately 36%) pays \$100.00 for their forty yard solid waste compactor to be lifted, and in 1995, the landfill fee at the RMOC Trail Road Landfill site was \$62.00/tonne. Their compactor averaged 8.5 tonnes/lift and was lifted 17 times in 1995. The company paid almost \$10,700 for disposal of the solid waste collected in their compactor. They diverted 95 tonnes of recyclable material in 1995 and were remunerated \$8,500. Therefore, the Property Management Company avoided paying for 95 tonnes of material to be transported and disposed of in landfill (a cost avoidance of \$75/tonne) and was remunerated for the material recycled at \$90/tonne for a financial benefit of \$15,500 in 1995!

Remuneration rates and totals paid for the recyclable materials used in this financial analysis were provided by Waste Recycling (Ottawa/Hull) Inc. for the Telecommunication Facility and the Property Management Company.

With the remuneration received for materials and the contribution to the bottom line realized by not sending it to landfill, significant further contributions to the bottom line could be realized, especially for the property management and educational institution, if their projected diversion potentials are accomplished. The results from all three audits emphasize the need for ongoing education in order to maintain and expand successful recycling programs; however, the benefits that can

be realized outweigh the resources required to implement these educational efforts.⁵⁷ The remuneration received for clean material also emphasizes the importance of a successful education program. If recyclable material is contaminated and requires more handling at the material recovery facility, a significant decrease in remuneration received will result.

The focus for an IC&I facility when establishing a source separation program should be to divert as much fibre from the waste stream as possible. On average, 70% or greater of an IC&I waste stream consists of fibre-based products and thus represents the greatest potential for diversion. Focus on the container stream program should be to maximize diversion benefits from decreased landfill expenses, but the greatest remuneration will be realized by maximizing the quality of the fibre stream recovery. A transaction report (Table 12) has been adapted from information provided from a local recycling company. This data demonstrates the volume and types of materials diverted from an institutional facility during the month of October 1995.

Table 12 is representative of monthly diversion volumes of recyclable material when compared with eight consecutive months prior to October 1995. It is evident from this information that over fifteen tonnes, which represents 85% of the total material diverted during this month, is fibre based. The balance of material diverted represents the container stream and totals approximately two and a half tonnes. It is quite obvious from this transaction report that focusing on the fibre recycling program will result in the largest volume of recoverable material being diverted, while allowing for maximum remuneration. The following chapter further explains the remuneration and markets available for recyclable materials from an IC&I facility.

⁵⁷ Personal conversation with Regional Manager of the Property Management Facility
Examined, June 1995

Table 11: Recycling Program Cost Benefit Analyses

EDUCATIONAL INSTITUTION - SEPT. 1990 - AUG. 1994			
Solid Waste Disposal Cost	1990 (no recycling program in place) \$1200.00/year	1993 (initial recycling program implemented) \$962.88/year	1994 (recycling program expanded) \$827.88/year
TELECOMMUNICATIONS BUSINESS - JAN. 1995 TO DEC. 1995*			
Annual Solid Waste Costs 1995 (front-end 4 cu. yd. picked up 3 times weekly)	Annual Remuneration for Recyclable Material (picked up free of charge weekly)	Annual Saving in Recyclable Material Not Landfilled	Total Annual Savings (remuneration plus saving in material not landfilled)
156 Lifts per year @ \$56.00/lift = \$8,736.00	\$3,066.40	31.69 tonnes of material diverted equals 100 lifts @ \$56.00 (1 cubic 4 yard bin = 316 kg/lift) = \$5,600.00	\$3,066.40 + \$5,600.00 = \$8,666.40
PROPERTY MANAGEMENT FACILITY - JAN. 1995 TO DEC. 1995*			
Annual Solid Waste Costs 1995 40 cu. yd. Compactor (avg. 8.5 tonnes per lift picked up every 3 weeks)	Annual Remuneration for Recyclable Material (picked up free of charge weekly)	Annual Saving in Recyclable Material Not Landfilled (based on volume diverted that otherwise would have been picked up at the 40 cu.yd. Compactor pick-up rate)	Total Annual Savings (remuneration plus saving in material not landfilled)
17 lifts per yr. @ \$100/lift + \$62/tonne landfill fee = \$10,659.00	\$8,522.84	95.22 tonnes of material diverted equals 11 lifts @ \$100.00/lift + \$62 landfill fee per tonne = \$7,003.64	\$8,522.84 + \$7,003.64 = \$15,526.48

*Note: Above costs are based on 1995 RMOC landfill fees of \$62.00/tonne and remuneration is based on pricing provided by a local recycling firm displayed in Figure 7.

Table 12: Sample Transaction Report for Recyclables Received From an Institutional Facility

Date *	Description of Recyclable Material	Tonnes
October 1995	Office Paper	2.35
	Computer Paper	0.62
	Mixed Paper	2
	OCC	10.33
	PETE	0.18
	HDPE	0.77
	Polystyrene	0.01
	Tin Cans	0.41
	Aluminum Cans	0.02
	Clear Glass	1.13
	Coloured Glass	0.11
	Contamination	0.09
	Total	17.93

* Adapted from data obtained from Waste Recycling (Ottawa/Hull) Inc.

5 MARKETS

The advantage of conducting an IC&I waste audit is that it provides information on the types and approximate volumes of materials that are being generated. Once armed with this information, an IC&I facility can better gather information when looking for a recycling or solid waste hauler. It provides IC&I decision-makers with a better understanding of their solid waste handling requirements. A successful recycling program has the potential of offsetting the cost of solid waste management at an IC&I location. At the very least, the cost saving associated with not paying a landfill tipping fee will be realized. The type, volume, and quality of a recyclable material will greatly affect potential remuneration for an IC&I business. The following chapter discusses types of materials typically found in an IC&I waste audit that can be targeted for diversion; the end markets that accept these recyclables; some end products that are made from these materials; and some businesses that provide new products, made from the initial recoverable materials. This procedure, from source separation, collection and processing, shipment and sale to end use mills, and remanufacture of new products is termed "closing the loop". When this process is successfully accomplished, the remuneration for material that can be provided to an IC&I establishment creates even more incentive for them to divert as much as possible from landfill. Two streams of recyclable materials are considered below, the fibre stream (fibre based paper products) and the container stream (clear and coloured container glass, various plastics, steel and aluminum containers and "other" types of recyclables).

5.1 Paper Products

In many recycling programs, the recovery of all fibre-based products is achievable. The grades of paper include Hard White, Printers Mix, Computer Paper, and Office Paper, Mixed Paper, Newsprint, and Old Corrugated Cardboard. Price per tonne return, depends on the current market for a material, the volume of material generated, and the contamination level of the material recovered. Markets

for these materials fluctuate monthly, and even weekly, and a common source of market information can be acquired through the *Paperstock Report*. Many recycling firms base their remuneration on the market prices listed in these indexes. Table 13 provides a description of each product, based on the Scrap Specifications Circular, 1993 Guidelines for Paper Stock: Domestic Transactions.⁵⁸

Remuneration for the types of materials described in Table 13 was provided to IC&I businesses between January 1995 and January 1996 by a local recycling firm. The information presented in Figure 7 demonstrates a range factor of five for high grade hard white paper, and less than a range factor of one for low grade mix. The figure reveals that remuneration for most recyclable materials was flat throughout 1994 and increased significantly early in 1995; however, it is diminishing again toward the end of 1995. The President of Waste Recycling (Ottawa/Hull) Inc. provided the following explanation for these differences. Recycling is a cyclical industry, based on supply and demand, and is greatly affected by local economies. For example, when the economy is low, consumers are spending less, and the requirement from the mill for new boxes is also less (i.e. consumers are not purchasing as many televisions, computers, etc.). Therefore, the value of recyclable corrugated cardboard will also be less. Also, material markets are affected by offshore marketed materials which are often less expensive than North American materials. All remuneration paid by Waste Recycling (Ottawa/Hull) Inc., and many other recycling companies, is based on current market conditions and fluctuates accordingly.⁵⁹

As technological improvements continue to expand in the recycling industry, an increase in the types of recoverable materials also expands. For example, Metro Waste Paper Recovery Inc., a recycling firm based in Toronto, Ontario, and

⁵⁸ Scrap Specifications, Circular 1993, *Guidelines for Paper Stock: PS-93, Domestic Transactions*, PSI, A National Chapter of Institute of Scrap Recycling Industries, Inc.

⁵⁹ Personal conversation with Mr Peter J P McMahon, President, Waste Recycling (Ottawa/Hull) Inc, January, 1995

Paperboard Industries Corporation, an international mill industry, have initiated research and development in the implementation and usage of mixed paper in the manufacturing of new boxboard for the packaging industry

Over the past twelve months, over eight million dollars have been invested at Paperboard Industries Corporation to expand current technology to process lower grades of fibre. This technology will be utilized to handle fibre materials that contain various types of glue products which will expand the usage of mixed waste paper.⁶⁰

Once a recyclable fibre-based material is collected from an IC&I facility, it is sorted, baled, and shipped to a mill for processing, often within thirty-six hours. This turnaround time depends greatly on the market conditions and a material recovery facility's agreements with the mills. The processed material is then made into new products at the mill (in the example of paper). For plastics, the material is picked up, sorted and baled, sent to a processor, melted, strained, and formed into pellets which are sold to manufacturers of recycled plastic products. This turnaround time is often longer than two or three days because the volume of plastics generated at IC&I facilities is considerably less than fibre-based products and therefore, it takes a longer period of time for a material recovery facility to fill a tractor trailer for shipment.

5.2 Container Stream

In this category, the materials often recovered in an IC&I recycling program are: clear and coloured glass, steel and aluminum food and beverage containers, PET clear and coloured (#1 Plastic), HDPE natural and coloured (#2 Plastic), and POLYSTYRENE (#6 Plastic). This category of recyclable material is often included as part of a recycling program without remuneration. The advantage to an IC&I facility is the cost savings of diverting this material from landfill. Remuneration for glass and plastic is not common due to the cost of collection and transportation of

⁶⁰ Personal conversation with Mr. Albino Metauro, President, Metro Waste Paper Recovery Inc. (Toronto), November, 1995

Table 13. IC&I Paper Specifications

Type of Fibre-Based Material	Description
Hard White	Consists of shavings, end cuts, or sheets of all untreated white bond ledger or writing paper. Must be free of printing and groundwood.
Printers Mix	Consists of shavings, end cuts, or sheets of coated and uncoated white sulphite and sulphate printing paper, free of printing.
Computer Paper (CPO)	Paper that is typically used for computer printouts, free of groundwood.
Office Paper	Paper that is typically generated by offices, containing primarily white and lightly coloured groundwood free paper, free of unbleached fibre. May include a small percentage of groundwood computer printout and facsimile paper.
Old Corrugated Cardboard (OCC)	Corrugated containers generated from IC&I facilities having liners of test liner, jute, or kraft. Material has been sorted to be free of chip, off-shore corrugated, plastic, and wax.
Newsprint (News)	Consists of fresh, dry newspapers, not sunburned, free from paper other than news, containing not more than the normal percentage of rotogravure and coloured sections.
Mixed Paper	Consists of a mixture of various qualities of paper not limited as to type of packing or fibre content. Examples include, but are not limited to: boxboard, magazines, NCR paper, posters, greeting cards, calendars, Post-It Notes, manuals, file folders, flyers, glossy paper, egg cartons, telephone books, all envelopes (windowed, manilla, etc.), cores, and kraft paper bags.

Figure 7

IC&I REMUNERATION FOR FIBRE-BASED MATERIALS AFFECTED BY MARKET CONDITIONS IN 1994/95

this material. Glass is especially heavy, and plastic quite bulky, and the removal of both from a solid waste container will reduce the haulage requirements significantly. Remuneration can be received for aluminum cans; however, this is usually based on volume and the level of contamination. Tin and aluminum cans are often collected in the same recycling container because both types of cans are often generated in the same location, so commingling the two maximizes diversion while minimizing the number of required containers for an IC&I establishment to purchase. When this material is delivered to a material recovery facility, the 'tin' must be separated from the aluminum. Contamination levels at the end use mills are very strict for items such as aluminum, and even small levels can result in an entire tractor load being rejected. Therefore, the resources involved in separating these two containers by running them through a labour-intensive sorting belt and a magnetic separator, decrease the potential remuneration. Another factor affecting remuneration for aluminum is the volume required to make a tonne. For example, it takes approximately 50,000 aluminum pop cans to make one tonne of aluminum for sale to an end use mill. Remuneration for an IC&I facility for this material ranged between \$900/tonne and \$1200/tonne between January '95-'96. The following is a breakdown of the types of recoverable containers and 'other' materials commonly found in IC&I waste audits: many of the materials listed were found in conducting the three waste audits analyzed in this thesis.

5.3 Closing the Loop

The Recycling Council of Ontario receives approximately 20,000 inquiries annually for waste diversion and recycled content product information that will help close the 3Rs loop.⁶¹ All of the materials listed in Table 14 are fully recoverable and are increasingly being treated as a resource instead of a liability by decision

⁶¹ Recycling Council of Ontario, *3Rs Buyers Guide for Business*, February 1995, p 1

Table 14. IC&I Container Stream Specifications

Type of Container Stream	Description
Clear and Coloured Container Glass	Clear and coloured food, beverage, and container glass. Examples include juice, wine/liquor, solution and chemical, and medication bottles.
PET (polyethylene terephthalate)	All petroleum-based plastic housing the number 1 inside a mobius loop. Examples include clear, green, and brown pop bottles and clear health care instrument coverings
HDPE (high density polyethylene)	All petroleum-based plastic housing the number 2 inside a mobius loop. Examples of natural HDPE include saline solution and windshield wiper fluid bottles. Examples of coloured HDPE include milk and juice jugs
LDPE (low density polyethylene)	Petroleum-based plastic including plastic film and garbage bags.
Mixed Plastics (Wide- mouthed Tubs)	Petroleum-based wide-mouthed plastic containers, such as yogurt, ice cream, and margarine tubs.
POLYSTYRENE	All petroleum-based plastic housing the number 6 inside a mobius loop. Often termed styrofoam, it also includes many forms of container plastic. Some examples include hot and cold drink cups, plates and soup bowls, egg cartons, meat and produce trays, plastic beer cups and wine glasses, cutlery, Stir Stix, and individual creamer containers

Steel Food and Beverage Cans and Containers	All food and beverage cans and containers made from flat rolled steel having a metallic tin coating applied to its surface. Examples include food and beverage, aerosol, and paint cans, lids from jars, beer bottle caps, and ends from frozen juice containers.
Aluminum Food and Beverage Cans and Containers	All food and beverage cans and containers made of aluminum. Examples include soft drink cans, aluminum food preparation trays, and aluminum foil.
Textiles	All used textiles. Examples include: clothing, draperies, bedding, and blankets.
Wood Skids	All used wooden skids.
Photocopier and Laser Printer Toner Cartridges	All spent photocopier and laser printer toner cartridges.
Disposable diapers and/or incontinence products	All soiled disposable diapers and incontinence products, including institutional bed underpads.
Organics	Different types of food waste, leaf and yard waste.

makers in IC&I facilities. The term "closing the loop" means taking a recyclable commodity such as a glass bottle or aluminum can and recycling it with the end product being used again. Table 15 outlines end markets for the recoverable materials often found in an IC&I waste audit, and reviews end products that are made from these recyclables. The information provided in this table emphasizes that at least 85% of the solid waste found in the three IC&I waste audits can be successfully diverted from landfill and recycled into useful new products

Table 15: Recyclable Materials, End Markets and New Products

Type of Recyclable Material	Current Market	End Products
Fine Paper (including Hard White, Printer's Mix, Computer Paper and Office Paper)	Canadian Pulp & Paper Association, Quebec	Various tissue products and can be used as feed stock for recycled content fine paper, liner board for corrugated containers, paper liner for drywall, and moulded pulp products.
Old Corrugated Cardboard	Domtar, Quebec	Used in the manufacturing of container-board, linerboard, and paperboard for use in new containers.
Newsprint	QUNO Corporation, Quebec	The manufacturing of new newsprint and as an insulation material.
Mixed Paper	Cascades Paperboard, Quebec	Manufacturing of new boxboard and construction paper products. Magazines can be used in the de-inking process to make newsprint. Can also be used for animal bedding.
Clear and Coloured Container Glass	Consumers Glass, Ontario	New glass containers, sand traps and beach sand, reflective paint, sand blasting, glassphalt, supplement road sand in winter, aquarium gravel, pressed glass.
PET (Polyethylene terephthalate)	Wellman, Inc., South Carolina	Carpets, clothing, automotive parts.
HDPE (High density polyethylene)	Dupont, Ontario	Incorporated into new bottles with recycled content, such as shampoo and automobile oil containers. Can also be used as feedstock for garbage bags and plastic sheets.
LDPE (Low density polyethylene)	Polychem, Quebec	Reprocessing into new plastic film and plastic bags.
Polystyrene	Canadian Polystyrene Recycling Association, Ontario	Office accessories, such as "in-trays", magazine holders and rulers. Building insulation, packaging materials, compact disc cases, and horticultural potting trays.
Mixed Plastics (Wide-mouthed Tubs)	Resource Plastics, Ontario	Used in the production of plastic crates, boxes, cases, pallets and plastic lumber.
Steel food and beverage cans and containers	Dofasco, Ontario	Remanufactured into new steel containers, such as food, beverage, aerosol and paint cans.
Aluminum food and beverage cans and containers	Alcan, Ontario	New aluminum cans can be made from old ones in a truly closed loop. Other products such as aluminum foil and trays.

Textiles	Canadian Allied Textile Trades Association, Ontario	Feed stock in the manufacture of new garments, felt, cotton swabs, and rag bond paper, industrial wiping cloths and upholstery stuffing.
Wood Skids	Ontario Home Builders Association, Ontario	New wood products such as furniture, toys and backyard composters. Wood chips for landscaping, as a bulk agent for composting, as road bed, or as an absorbent for oil spills, and particle board.
Photocopier and laser printer toner cartridges	Nortech Laser Cartridge, Ontario	Can be recharged for reuse or parts can be used in the manufacture of new ones.
Disposable diaper and incontinence products	Knowaste, Inc., Ontario	Three resources are recovered through this recycling process: high quality wood pulp, mixed plastic and absorbent gel. Wood pulp can be used in the manufacturing of new diapers, underpads and fine paper; mixed plastics can be used as an oil-absorbent in booms for off-shore spills; and the absorbent gel is being tested as a soil enhancer.
Organics	Composting Council of Canada, Ontario	Food suitable for human consumption can be redistributed through social service organizations. If not fit for human consumption but suitable for animals it may be used as animal feed for cattle, sheep, goats, pigs, poultry and domestic pets. Can be used in composting for use in landscaping, agriculture or as landfill cover.

6 CONCLUSION

6.1 The Future is Rs

Traditionally, solid waste management practices have employed the collect-transport-dispose approach; however, this is no longer a viable option. Location of landfills and incinerators by urban planners is becoming more and more difficult. The Not-In-My-Backyard (NIMBY) reaction is a powerful influence in constraining the options for siting a waste management facility within a municipality. The cost, both economically and environmentally, of landfilling solid waste is continually increasing. Currently, waste management strategies in Canada emphasize techniques that focus on minimizing waste disposal requirements. Diversion efforts such as waste audits, source separation, and recycling programs by IC&I facilities can significantly reduce the volume of solid waste requiring disposal.

By conducting a waste audit, an IC&I establishment is better armed with information about the types of waste generated and the functional areas generating the waste material. An audit provides a benchmark against which increases in waste diversion can be measured, and reveals the valuable resources still not being recovered. If efforts are made to recover these materials in the form of improved and expanded source separation programs, cost avoidance can result from decreased hauling and landfill costs. In addition to savings in solid waste handling, potential also exists for remuneration to be received for many types of recyclable materials. In addition to improvements in bottom lines, IC&I businesses will improve their corporate image if responsible waste management practices are increased.

In 1994 the then Chair of the *Recycling Council of Ontario*, Glenda Gies, reported that a survey of IC&I establishments in Canada and the United States revealed that over 80% of Ontario companies had some type of *Ontario 3Rs* program in place compared with only 10-40% of the same types of facilities outside of Ontario.⁶² This commitment to recycling in the IC&I sector is comparable to

⁶² Recycling Council of Ontario, *1994 Annual Report*, 1994.

Ontario's residential 3Rs activities with programs accessible to over 3 million households.

Over the past 10 years, markets and end uses for recyclable materials have expanded rapidly and the recyclable list continues to grow as new markets surface and end uses expand. Technological advances have allowed for "closing the loop". Container glass is 100% recyclable, and the cullet is made into new products. Plastic is broken down into flake, then washed, melted and turned into pellets which in turn are made into new products. Steel food and beverage containers can be recycled over and over without any loss in the quality of new products. Aluminum food and beverage cans can be recycled into new ones in a truly closed loop. Textile fibres can be recovered and re-woven into new products. Wood skids can be recovered and made into new wood products. Photocopier and laser printer toner cartridges can be recharged for reuse. Even disposable diapers and incontinence products are totally recyclable!

Through the implementation of reduction, reuse, and recycling, in municipal and IC&I establishments, the province of Ontario has reached the 1992 target of 25% diversion of solid waste from landfill; however, we still have a way to go to reach the 50% target by the year 2000.⁶³ With implementation of waste audits and waste reduction workplans in the IC&I sector, expanded markets for these recyclable materials, and the expansion of curbside Blue Box programs, Ontario can, in fact, make this a reality. The Regional Municipality of Ottawa-Carleton Expanded Blue Box program is already realizing a substantial increase in the diversion percentage, and all IC&I facilities analyzed in this paper have the potential to divert at least 85%. As landfill fees continue to rise and locating them becomes increasingly more difficult, waste audits are a useful tool for targeting functional areas for increased diversion. There is clear evidence that the hypothesis of this thesis is true: bottom line economic benefits are attainable from successful source

⁶³ The Canadian Recycling Handbook and Directory, 1995 Edition, p 2

separation and recycling programs and as a result of diversion efforts, solid waste destined for landfill is in fact being reduced in Ontario.

6.2 Future Research

There is limited documentation and research available in the area of solid waste reduction, reuse, and recycling programs throughout IC&I and municipal facilities in Ontario. This paper provides an initial analysis of specific waste audit data; however, in an effort to decrease the bias and error, the following suggestions for further research should be examined.

A larger sample size should be researched and audited. This larger sample could include industrial and retail/shopping centre facilities as well as the institutional and office style samples analyzed in this paper. A follow up waste audit, six months and/or twelve months after the first audit recommendations are implemented would be beneficial to monitor the success and participation levels throughout the facility. Samples from other Ontario cities would be useful to compare landfill, hauling, and remuneration rates to try to determine if cost avoidance is the major motivation factor. Comparison of Ontario based audits with facility diversion efforts outside of Ontario would be helpful to try to determine if the *Ontario 3Rs Regulations* are in fact a key motivating factor for solid waste diversion from an IC&I facility.

In addition to the information gathered for this paper from interviews with private sector individuals, both onsite at each audited location, and with local hauling companies, additional interviews with Ministry staff members would be beneficial to broaden the understanding of the implementation of the *Ontario 3Rs Regulations* and the efforts currently underway to increase solid waste diversion from landfill in Ontario.

APPENDIX A

Comparison of Solid Waste Data Collected by Licensed Waste Haulers

LWS (OTTAWA) LTD
WEST CARLETON LANDFILL
CARP, ONTARIO

C R E D I T T I C K E T *

D A T E : 07/28/95
TICKET NO: 95073255

Page: 1
TIME In: 07:23
TIME Out: 07:36

VEHICLE NO: WM1RD410
ACCOUNT NO: 23055

NAME: WASTE MANAGEMENT INC.
NAME: WASTE MANAGEMENT INC.

Wst Type	Description	
200	MEDICAL WASTE INSIDE	7.95 /TN
Origin	County: CI INSIDE	R. M. D. C. 100.00%
Sur	Charge: 69T GS	
Gross:	26850	
Tare:	18900 ** COMPUTED TARE **	
Net:	7950	
Tonnes:	7.95	
** Note:	Veh Cap: 40 HOSPITAL	

WEIGHMASTER: LL

Signature:

* Sample Landfill Ticket - Solid Waste.

CUSTOMER PICKUP REPORT *

Page: 1

Account Number: 0072845000
Service Name:
Service Address:

Date Covered From: 03/01/95
To: 03/31/95

Report Date: 04/05/95
Time: 10:09:03

Pickup Date	Pickup Time	Bin Size	Waste Weight	Wght/Cu.Yd. Kg/Cu. Yd.	Rolling Average
Bin Type:					
03/13/95	14:40	6	610	103	103
03/20/95	15:30	6	6	108	106
OVER LOADED BIN					
03/20/95	08:24	6	B 45		106
03/20/95	08:26	6	710	118	110
03/21/95	07:55	6	560	93	106
03/21/95	07:57	6	130	22	89
03/22/95	08:07	6	350	58	84
03/22/95	08:09	6	340	57	80
03/24/95	08:12	6	630	105	83
03/24/95	08:13	6	380	63	81
03/27/95	08:24	6	580	97	83
03/27/95	08:25	6	480	80	82
03/27/95	16:02	6	530	88	83
03/28/95	08:09	6	220	37	79
03/28/95	08:10	6	580	97	80
03/30/95	07:58	6	500	83	81
03/30/95	07:59	6	460	77	80
03/31/95	08:09	6	480	80	80
03/31/95	08:11	6	330	55	79
Total number of bins: 19		Totals:		8530	79

* Sample Front End Weights - Solid Waste.

CUSTOMER PICKUP REPORT *

Page: 1

Account Number: 0000606001
Service Name:
Service Address: LAURIER

Date Covered from: 01/01/95
To: 02/09/96

Report Date: 02/09/96
Time: 13:03:59

Pickup Date	Pickup Time	Bin Size	Waste Weight	Wght/Cu.Yd. Kg/Cu. Yd.	Rolling Average
----------------	----------------	-------------	-----------------	---------------------------	--------------------

Bin Type:

03/24/95	09:22	C 4	210	53	53
02/02/96	09:44	C 4	10	3	28
Total number of bins: 2		Totals:	220		28

Bin Type: NME

01/06/95	10:06	C 4	B 100		0
01/11/95	13:16	C 4	530	133	133
01/23/95	10:09	C 4	350	88	110
01/27/95	09:42	C 4	170	43	88
03/01/95	09:06	C 4	M 70		88
03/03/95	10:02	C 4	M 70		88
03/22/95	08:13	C 4	300	75	84
03/24/95	09:19	C 4	390	98	87
03/29/95	13:09	C 4	260	65	83
03/31/95	13:40	C 4	260	65	81
04/03/95	06:43	C 4	50	13	72
04/05/95	09:31	C 4	350	88	74
04/07/95	09:54	C 4	360	90	76
04/10/95	07:47	C 4	160	40	72
04/12/95	08:49	C 4	210	53	71
04/14/95	09:36	C 4	320	80	71
04/17/95	07:36	C 4	EMPTY BIN		
04/19/95	08:29	C 4	230	58	70
04/21/95	13:00	C 4	B 260		70
04/26/95	08:35	C 4	290	73	71
04/28/95	09:29	C 4	260	65	70
05/03/95	09:00	C 4	230	58	69
05/05/95	11:09	C 4	300	75	70
05/08/95	07:47	C 4	280	70	70
05/10/95	08:45	C 4	290	73	70
05/12/95	09:03	C 4	290	73	70
05/15/95	07:41	C 4	170	43	69
05/17/95	08:52	C 4	330	83	69
05/19/95	09:11	C 4	250	63	69
05/22/95	07:53	C 4	250	63	69
05/24/95	10:08	C 4	EMPTY BIN		
05/26/95	09:46	C 4	BLOCKED BIN		
05/26/95	09:51	C 4	380	95	70
05/29/95	07:47	C 4	100	25	68

* Sample Front End Weights - Telecommunications Facility (4 pages).

CUSTOMER PICKUP REPORT

Page: 2

Account Number: 0003606001

Date Covered From: 01/01/95

Service Name:

To: 02/09/96

Service Address: LAURIER

Report Date: 02/09/96

Time: 13:04:00

Pickup Date	Pickup Time	Bin Size	Waste Weight	Wght/Cu.Yd. Kg/Cu. Yd.	Rolling Average
05/31/95	09:34	C 4	220	55	68
05/31/95	09:36	C 4	360	90	68
06/02/95	09:45	C 4	260	65	68
06/05/95	08:26	C 4	B 170		68
06/07/95	09:25	C 4	300	75	69
06/09/95	09:33	C 4	200	50	68
06/12/95	08:28	C 4	B 220		68
06/14/95	08:42	C 4	EMPTY BIN		
06/16/95	09:32	C 4	550	138	70
06/19/95	07:38	C 4	0	0	68
06/21/95	08:58	C 4	230	58	68
06/23/95	09:35	C 4	430	108	69
06/26/95	07:56	C 4	150	38	68
06/30/95	10:00	C 4	490	123	69
07/03/95	08:18	C 4	EMPTY BIN		
07/05/95	08:26	C 4	EMPTY BIN		
07/07/95	09:13	C 4	440	110	70
07/10/95	07:40	C 4	110	28	69
07/14/95	09:17	C 4	410	103	70
07/19/95	08:35	C 4	240	60	70
07/26/95	08:16	C 4	360	90	70
07/28/95	08:52	C 4	BLOCKED BIN		
08/04/95	09:24	C 4	480	120	72
08/04/95	09:26	C 4	250	63	71
08/09/95	08:46	C 4	EMPTY BIN		
08/11/95	09:18	C 4	320	80	72
08/16/95	08:51	C 4	EMPTY BIN		
08/18/95	09:45	C 4	500	125	73
08/21/95	07:58	C 4	220	55	72
08/23/95	08:48	C 4	EMPTY BIN		
08/25/95	09:59	C 4	510	128	73
08/28/95	07:43	C 4	120	30	73
08/30/95	09:23	C 4	EMPTY BIN		
09/01/95	11:36	C 4	650	163	74
09/01/95	11:40	C 4	B 2400		74
09/04/95	10:27	C 4	EMPTY BIN		
09/11/95	13:21	C 4	560	135	75
09/13/95	09:14	C 4	EMPTY BIN		
09/15/95	09:56	C 4	560	135	77
09/18/95	13:06	C 4	200	50	76

CUSTOMER PICKUP REPORT

Page: 3

Account Number: 0000406001

Date Covered From: 01/01/95

Service Name:

To: 02/09/96

Service Address: LAURIER

Report Date: 02/09/96

Time: 13:04:01

Pickup Date	Pickup Time	Bin Size	Waste Weight	Wght/Cu.Yd. Kg/Cu Yd.	Rolling Average
09/20/95	09:00	C 4	EMPTY BIN		
09/22/95	10:24	C 4	670	118	77
09/25/95	13:14	C 4	180	65	76
09/27/95	09:13	C 4	EMPTY BIN		
09/29/95	10:53	C 4	460	119	77
10/02/95	15:21	C 4	210	53	77
10/06/95	11:00	C 4	610	153	78
10/09/95	13:41	C 4	120	30	77
10/11/95	08:49	C 4	EMPTY BIN		
10/13/95	09:33	C 4	410	103	77
10/16/95	14:26	C 4	260	65	77
10/18/95	08:01	C 4	EMPTY BIN		
10/20/95	10:43	C 4	540	135	78
10/23/95	15:24	C 4	1400	350	82
10/27/95	11:59	C 4	510	128	83
10/27/95	12:06	C 4	160	40	82
10/30/95	14:31	C 4	B 0		82
11/01/95	09:07	C 4	EMPTY BIN		
11/03/95	11:07	C 4	680	120	93
11/06/95	15:34	C 4	290	73	83
11/08/95	11:03	C 4	EMPTY BIN		
11/10/95	12:59	C 4	B 240		83
11/13/95	15:14	C 4	100	25	82
11/15/95	08:25	C 4	120	30	81
11/17/95	11:25	C 4	280	70	81
11/22/95	09:22	C 4	340	85	81
11/24/95	10:23	C 4	330	83	81
11/27/95	15:19	C 4	150	38	81
11/27/95	15:20	C 4	280	70	80
11/29/95	09:58	C 4	180	45	80
12/01/95	11:02	C 4	310	78	80
12/04/95	15:59	C 4	180	45	80
12/06/95	10:08	C 4	280	70	79
12/08/95	11:17	C 4	300	75	79
12/11/95	15:56	C 4	180	45	79
12/13/95	10:02	C 4	270	68	79
12/18/95	15:36	C 4	590	148	80
12/18/95	15:37	C 4	240	60	79
			EXTRA LIFT		
12/20/95	09:50	C 4	310	78	79

CUSTOMER PICKUP REPORT

Page: 4

Account Number: 0000606001

Date Covered From: 01/01/95

Service Name:

To: 02/09/96

Service Address: LAURIER

Report Date: 02/09/96

Time: 13:06:02

Pickup Date	Pickup Time	Bin Size	Waste Weight	Wght/Cu.Yd. Kg/Cu. Yd.	Rolling Average
12/27/95	09:26	C 4	EMPTY BIN		
12/27/95	09:25	C 4	EMPTY BIN		
12/29/95	10:48	C 4	260	60	79
01/03/96	09:26	C 4	EMPTY BIN		
01/05/96	12:05	C 4	290	73	79
01/08/96	16:52	C 4	120	30	78
01/10/96	08:47	C 4	EMPTY BIN		
01/12/96	09:17	C 4	BLOCKED BIN		
01/15/96	15:15	C 4	0 220		78
01/17/96	09:17	C 4	480	120	79
01/19/96	11:33	C 4	290	73	79
01/26/96	11:44	C 4	560	140	80
01/29/96	15:41	C 4	320	80	80
01/31/96	09:09	C 4	250	63	79
02/02/96	09:42	C 4	310	78	79
02/05/96	15:26	C 4	80	20	79
02/09/96	09:42	C 4	490	123	79
Total number of bins: 130		Totals:	30410		79

APPENDIX B

Summary of the Telecommunications Facility Waste Diversion Initiatives

Summary of the Telecommunications Facility Waste Reduction Initiatives

- All employees are provided with deskside containers for collection of recyclable material
- The four lounges and all conference rooms have containers for recyclable materials.
- Every floor has a complete source separation Recycling Centre, plus mini-recycling centres on the opposite side of the floor. Professional signage is utilized to ensure that contamination is minimized.
- The main floor restaurant has recycling containers for the collection of recyclable materials including instructional signage
- Telephone books are collected annually for recycling
- Photocopier, fax, and laser toner cartridges are recovered for recycling
- Alkaline batteries are recovered for recycling
- All wood pallets are recycled by a local recycling firm
- In 1995, 123 reduced the number of telephone directory sets ordered from 640 in 1994, to 125 in 1995
- Photocopiers at have two sided capability. In the main "Reprographics" area, two sided photocopying is the standard, unless otherwise specified by the customer.
- Facility turns off the lights in the entire tower every weekend which minimizes the number of florescent tubes (and saves energy)
- Every department is directly charged back for photocopying, which provides incentive to minimize wasted copies
- All paper products purchased, contain recycled materials, including tissue products
- All contractors that perform work are required to take any waste generated off site for disposal and/or recycling
- All office staff have E-mail accounts

2 OF 2

PM-1 3 1/2" x 4" PHOTOGRAPHIC MICROCOPY TARGET
NBS 1010a ANSI/ISO #2 EQUIVALENT

PRECISIONSM RESOLUTION TARGETS

- Paper cups were removed from every water fountain in the facility which have signage above, reminding staff not to use paper or styrofoam cups
- Facility does not purchase any forms containing carbon paper. All forms are NCR, thereby ensuring recyclability, and minimizing waste
- Facility has a "Green Team" who are committed to reducing paper consumption. The team organized "No Print Days" and "No Print Weeks" in 1994 and 1995 whereby they launched a communications campaign to provide employees with tips on how to reduce and reuse paper throughout the year. These activities have been very successful and are expected to continue
- Facility has converted 24 commonly used forms to an on-line format, where they can be filled out and sent to the appropriate person electronically
- 325 pieces of computer equipment were donated for re-use to an outside company committed to recycling obsolete electronics.
- Employees are encouraged to take home and reuse wood shipment pallets
- All obsolete furniture, surplus equipment, old terminals, and other reusable material is either given away, or sold to employees. Every attempt is made to re-use items prior to disposal. A private auction redirected 194 pieces of office furniture from landfill.
- Old binders, staplers, paper clip holders, etc. from the stationary department are given to employees, schools, or local charities for re-use.
- The "Green Team" and other groups organize several annual drives where clothing, snowsuits, and toys are collected for reuse by charity organizations in the region.
- Paper back and magazine racks are located in the four lounges throughout the building. Employees are encouraged to bring in their old reading materials to promote reuse.
- Every effort is made to re-use all packaging materials prior to disposal
- The "Green Team" plans a yearly book sale to promote re-use. Employees bring in books for the sale, and the proceeds are donated to charity.

- The "Green Team" has implemented "The Catalyst" as a communication vehicle to acknowledge past present and future environmental events and to inform and educate about environmental topics
- Signage at each laser printer throughout the building asks the user, "Do you really need to print this report?"
- Facility initiated a toner cartridge recycling program, and in six months had recycled 349 cartridges
- Expanded the mixed paper recycling program to accommodate all types of paper products in the deskside containers
- Recently expanded the recycling program to include polystyrene
- Expanded the recycling program to include old corrugated cardboard.
- Introduced an alkaline battery recycling program to prevent these materials from going to landfill
- New Recycling Signage was mounted on used corrugated cardboard instead of new foamcore
- A collection systems was initiated for used diskettes which are reformatted and reused
- Facility developed Corporate Environmental Policies with support and commitment from the Board of Directors and Executives.
- The Environmental Committee set objectives under each of the policies for 1995 activities.
- Environmental Committee developed an "Environmental Training Package". In this package, they have detailed Corporate Environmental Policies, the 3R's, and the use of new Recycling Centres. This training package was presented to over 430 employees (85% of the staff members).
- Introduction of new Recycling Centres on every floor, detailed, professional signage to ensure that users are aware of what is and what is not recyclable, in order to minimize contamination.
- Conference recycling programs have been expanded to maximize diversion.

- In 1994 facility awarded two local university students with Environmental Scholarships at Ottawa University and Carleton University
- The "Green Team" has Environmental displays every quarter to promote and expand environmental initiatives (i.e. Home Composting, Energy Efficient Offices, Recyclable Materials and Markets)
- A "Green Column" is published monthly in "The Catalyst"
- Green Tips are printed monthly in the "Bi-Weekly Digest"
- Celebrated Environment Week by holding three special events (Introduction of a Diskette Recycling Program, Environmental Suggestion Contest, and No Print Day).
- Introduction of a "Green Bulletin Board" on Lotus Notes, as an additional communication mechanism
- An overview of Environmental Initiatives is provided to new employees as part of their orientation session
- Conducted a "Desk-to-Desk" Waste Audit, where "Green Team" members dressed up as Recycling Police and audited every employees waste bin and deskside recycling container. Audit results were published, and offending employees were given "tickets" as a reminder to participate in the recycling programs in place. Informal, desk-to-desk waste audits are also conducted by "Green Team" members after hours to remind employees to recycle efficiently, without contaminating the recycling program. The "Green Team" checks over 600 workstations during these mini-audits
- Establishment of a Green Line for employees for any concerns, questions, and suggestions for improving the current programs in place
- Investigation is currently underway for the remaining organic material to be composted on site.

APPENDIX C

Five, Three, and One Day Waste Audit and Waste Reduction Action Plan Forms
as Required by the *Ontario 3Rs Regulations*

Waste Audit Summary

Industrial, Commercial and Institutional Establishments

As required by Ontario Regulation 102/94

Name of Company SCHOOL BOARD CENTRAL ADMIN OFFICE			Name of Contact Person MARY RECYCLER		Telephone No 765-4321	
Site/Location EDUCATIONAL INSTITUTION, OTTAWA, ONTARIO					Current Year 1993	
Type of Establishment Educational Inst ☐ Hotel/Motel Restaurant ☒ Office Building Square Metres > 10,000 Hospital ☐ Manufacturing						
Material Category	Waste Generated (tonnes)		Reused Material (tonnes)		Recycled Material (tonnes)	
	Base Yr *	Current Yr	Base Yr	Current Yr	Base Yr *	Current Yr
Office Mix		7				5
Mixed Paper		4				0
OCC		0.5				0.5
Newsprint		0.5				0.5
Clear/Colour Glass		1				0.4
Alum/Steel Cans		1				0.3
Residual		5				0
TOTAL		19				7
Materials (bought/sold) that contain recycled content Paper Towels and Toilet Paper					Percentage of recycled content 100%	
Gross Summary (Weights in Tonnes)		Base Yr	Current Yr	Increase/Decrease (+/-)		%
Waste Generated			19			
Less Reused			0			
Less Recycled			7			37%
Equals Disposed			12			63%
I hereby certify that the information provided is complete and correct and the establishment complies with all the requirements of Regulation 102/94 Signature of authorized official _____ Title _____ Date _____						

* Note: Base Year Data was unavailable

Adapted from Ontario Ministry of Environment and Energy Waste Audit Summary As Required by Ontario Regulation 102/94

Waste Reduction Workplan Summary As required by Ontario Regulation 103/94

☒ Industrial, commercial and institutional establishments
waste reduction and demolition projects
For period:

Nov 1993 to Nov 1994

Name of Company EDUCATIONAL INSTITUTION		Name of Contact Person MARY RECYCLER		Telephone No 765-432*	
Project Site Location EDUCATIONAL ADMINISTRATION OFFICE OTTAWA ONTARIO				Total Waste Disposal Last Year 12 tonnes	
Material Category	Weight of Waste Material (tonnes)	Proposed Action to Divert Material	Projection		Start Date
			Reduction (tonnes)	Reuse (tonnes)	
Mixed Paper	4	Initiate recycling program		4	
Office Mix	7	Improve present recycling		7	
Polystyrene (Plastic #6)	< 0.5	Initiate recycling program		< 0.5	
Other Plastics	< 0.5	Initiate recycling program		< 0.5	
Clear & Coloured Glass	1	Improve present recycling		1	
Aluminium & Steel Cans	1	Improve present recycling		1	
I hereby certify that the information provided is complete and correct and the establishment complies with all the requirements of Regulation 103/94					
Signature of authorized official:			Title		Date

Adapted from Ontario Ministry of Environment and Energy Waste Reduction Workplan Summary As Required by Ontario Regulation 103/94

Waste Audit Summary

Industrial, Commercial and Institutional Establishments

As required by Ontario Regulation 102/94

Name of Company PROPERTY MANAGEMENT LIMITED		Name of Contact Person DAVE RECYCLER		Telephone No. 123 456 7		
Site/Location OFFICE TOWER ABC OTTAWA ONTARIO				Current Year 1995		
Type of Establishment ☐ Educational Inst ☐ Hotel/Motel ☐ Restaurant ☒ Office Building Square Metres 345 000 Office ☐ Hospital ☐ Manufacturing 40 000 Retail						
Material Category	Waste Generated (tonnes)		Reused Material (tonnes)		Recycled Material (tonnes)	
	Base Yr *	Current Yr	Base Yr	Current Yr	Base Yr *	Current Yr
Fine Paper		50				45
OCC		25				23
Newsprint		17				12
Clear/Colour Glass		7				3
Alum/Steel Cans		5				1
Telephone Books		1				1
Residual		125				0
TOTAL		230				85
Materials (bought/sold) that contain recycled content					Percentage of recycled content	
Paper Towels					100%	
Gross Summary (Weights in Tonnes)		Base Yr	Current Yr	Increase/Decrease (+/-)		%
Waste Generated			230			
Less Reused			0			
Less Recycled			85			36%
Equals Disposed			145			64%
I hereby certify that the information provided is complete and correct, and the establishment complies with all the requirements of Regulation 102/94						
Signature of authorized official			Title		Date	

* Note: Base Year Data was unavailable

Adapted from Ontario Ministry of Environment and Energy: Waste Audit Summary As Required by Ontario Regulation 102/94

Waste Reduction Workplan Summary As required by Ontario Regulation 103/94

☒ Industrial, commercial and institutional establishments
☐ Construction and demolition projects

For period

April 1995 to April 1996

Name of Company PROPERTY MANAGEMENT LIMITED		Name of Contact Person DAVE RECYCLER		Telephone No 123-4567			
Project Site Location OFFICE TOWER ABC OTTAWA ONTARIO		Total Waste Disposal Last Year 145 tonnes					
Material Category	Weight of Waste Material (tonnes)	Proposed Action to Divert Material	Projection		Start Date	End Date	Status
			Reduction (tonnes)	Reuse (tonnes)			
Mixed Paper	18	Initiate recycling program			17		
Fine Paper	6	Improve present recycling			5		
Plastics #1 #2 and #6	5	Initiate recycling program			5		
Polycoat	1	Initiate recycling program			1		
Newsprint	5	Improve present recycling			5		
Clear & Coloured Glass	4	Improve present recycling			4		
Aluminium & Steel Cans	4	Improve present recycling			4		
Metal	0.5	Investigate reusable program	0.5				
<p>I hereby certify that the information provided is complete and correct and the establishment complies with all the requirements of Regulation 103/94</p> <p>Signature of authorized official _____ Title _____ Date _____</p> <p>Adapted from Ontario Ministry of Environment and Energy Waste Reduction Workplan Summary As Required by Ontario Regulation 103/94</p>							

Waste Audit Summary

Industrial, Commercial and Institutional Establishments
As required by Ontario Regulation 102/94

Name of Company TELECOMMUNICATIONS FACILITY		Name of Contact Person JAKE RECYCLER		Telephone No 987 6543		
Site/Location OFFICE TOWER 123, OTTAWA ONTARIO				Current Year 1995		
Type of Establishment ☐ Educational Inst ☐ Hotel/Motel ☐ Restaurant ☒ Office Building Square Metres > 10 000 ☐ Hospital ☐ Manufacturing						
Material Category	Waste Generated (tonnes)		Reused Material (tonnes)		Recycled Material (tonnes)	
	Base Yr	Current Yr	Base Yr	Current Yr	Base Yr	Current Yr
Office Mix	90	100			78	93
OCC	6	14			0	14
Newsprint	14	11			11	8
Clear/Colour Glass	6	5			5	5
Alum/Steel Cans	0	1			0.5	1
Plastics	3	2			0	0
Residual	43	24			0	0
TOTAL	162	157			95	121
Materials (bought/sold) that contain recycled content Paper Towels, Toilet Paper and Office Stationery					Percentage of recycled content 50 100%	
Gross Summary (Weights in Tonnes)		Base Yr	Current Yr	Increase/Decrease (+ / -)		%
Waste Generated		165	165			100%
Less Reduced		3	8	+		5 %
Less Recycled		95	121	+		73%
Equals Disposed		67	36			22%
I hereby certify that the information provided is complete and correct and the establishment complies with all the requirements of Regulation 102/94						
Signature of authorized official		Title		Date		

Adapted from Ontario Ministry of Environment and Energy Waste Audit Summary As Required by Ontario Regulation 102/94

Molded Pulp Products	Include egg cartons, nursery pots, dishes and other forms of packaging.
Newsprint	All newspapers and inserts.
OCC Waxed OCC	Old corrugated cardboard and "Asian" corrugated cardboard. Waxy old corrugated cardboard.
Other Waste	The last 10% of the waste audit consisted of a pair of women's high-heeled shoes, computer floppy disks, AA batteries, cassette tapes and popcorn bags.
Paper Fine Paper	White ledger, photocopy paper, index cards, fax paper, post-it notes, coloured, envelopes, letterhead, file folders, carbonless paper.
Glossy Paper	Magazines, catalogues, brochures, pamphlets.
Kraft Paper	Brown paper such as lunch bags.
Plastics PET #1	Polyethylene Terephthalate, commonly used for soft drink bottles, to package some food products such as cooking oil, packaging for some cosmetics, etc.
HDPE #2	High Density Polyethylene commonly used to make containers for several types of food products, such as milk and juice, also used to hold liquid detergents, etc.
Polyvinyl Chloride #3	Commonly used to package some cooking oils, mineral water, shampoos, cosmetics and personal care products.
LDPE #4	Low density polyethylene commonly used for plastic film products such as shopping bags, milk pouches and food wrap.
Polypropylene #5	Commonly used for household storage containers and for some food packaging.
Polystyrene #6	Commonly used for food service or industrial packaging, including foamed products such as coffee cups, food trays, packing peanuts.

APPENDIX D

Milestones in Solid Waste Management Policy in Ontario

Summary of the Milestones in Solid Waste Management Policy in Ontario

Date	Milestone
1970	Waste Management Act
July 1971	Waste Management Act became Part V of the Environmental Protection Act
1976	Regulations were introduced by the Ontario government under the Environmental Protection Act requiring that 75% of all soft-drink containers be refillable
June, 1980	The exemption granted in 1976 to municipal undertakings, including municipal solid waste management projects, from the requirements of the 1975 Environmental Assessment Act (Federal) was removed. As a result, municipalities were required to demonstrate alternative waste management options instead of simply applying to open another landfill site under the Environmental Protection Act.
1981	The first curbside recycling program using the Blue Box was initiated in Kitchener, Ontario
June 13, 1983	Minister of the Environment Keith Norton released a <i>Blueprint for Waste Management in Ontario</i> . This <i>Blueprint</i> stated that the "four Rs" (reduce, reuse, recycling, and recover) were to be part of solid waste management planning in the province.
1985	Appointment of the <i>Recycling Advisory Committee</i>
December, 1985	Soft drink container regulations were relaxed, permitting the use of aluminum cans and reducing the requirements to provide refillable containers provided that recycling requirements were met.
Spring, 1986	Ontario Multi-Material Recycling Incorporated (OMRI) was established by the soft-drink industry as a vehicle to provide funding (20 million dollars) to the curbside recycling of soft-drink containers. Capital costs for new Blue Box programs were to be split evenly between OMRI, the Ministry of the Environment, and the participating municipality
1986-present	Blue Box programs established in hundreds of Ontario communities.
March, 1987	Minister of the Environment, Mr. Bradley announced the application of the Environmental Assessment Act to all public and private sector incineration and energy-from-waste projects.

March 10, 1987	Mr. Bradley announced an Ontario policy objective of 25% diversion of municipal solid waste from landfill or incineration by 1992 and 50% diversion by the year 2000
March 14, 1987	Creation of the Solid Waste Interim Steering Committee (SWISC) by the province to find interim landfill sites for municipalities in the Greater Toronto Area (GTA)
July, 1987	The Comprehensive Funding Program for Waste Management was introduced. The program included financial assistance to municipalities for waste management master plan development and for landfill operations, improvement and closure
September, 1990	Liberal government was defeated by the New Democratic Party. The previous governments' commitment to the 1992 25% and year 2000 50% waste diversion goals were reaffirmed, although greater emphasis was to be placed on waste reduction over waste recycling
November 21, 1990	Minister of the Environment Ruth Grier announced the creation of the Interim Waste Authority to "search for and select a waste disposal site" for the GTA municipalities
February, 1991	A Waste Reduction Office was created within the Ministry of the Environment to oversee municipal solid waste 3Rs efforts. A Waste Reduction Action Plan was also introduced
April, 1991	Minister of the Environment Ruth Grier announce a ban on the establishment of new municipal solid waste incineration or energy-from-waste projects in Ontario
October, 1991	The Waste Reduction Office produced its first discussion paper <i>Regulatory Initiatives to Achieve Ontario's Waste Reduction Targets</i>
October 24, 1991	Minister of the Environment introduced Bill 143, the <i>Waste Management Act</i> . The first three parts of the bill addressed waste management issues in the GTA and the fourth part amended the Environmental Protection Act to enable the province to implement some of the regulatory proposals made in the Waste Reduction Office's discussion paper
April, 1992	Enactment of Bill 143
March 3, 1994	Promulgation of the <i>Ontario 3Rs Regulations</i>
August, 1995	Minister of Environment and Energy Brenda Elliot announced that the Harris government will not repeal the <i>Ontario 3Rs Regulations</i>

GLOSSARY

Boxboard	All single layer cardboard such as: pencil, pen, and other office supply boxes; cigarette boxes; Kleenex boxes.
Cans	Aluminium pop and juice cans. Steel food and beverage cans.
Carbon Inserts	Carbon forms found in large quantities in the bank waste.
Compostibles	Organics such as leftover food stuffs, coffee grounds, tea bags. Used serviettes and paper towels.
Construction	Construction products including insulation board, roofing board,
Paper Products	siding flooring, and ceiling tiles.
Cores	Paper towel and toilet paper cores.
Cullet	Chunks of ground glass of varying sizes.
Fibre Coffee Cups	Fast food paper cups.
Food Packaging	Single serving packaging such as "Lunchables", potato chip bags, waxed wrappers, muffin wrappers, and non-recyclable food wrapping.
Glass	Clear container glass such as juice bottles. Coloured glass containers such as wine and flavoured water bottles.
Glassphalt	Processed glass used as an aggregate substitute for stone or sand in the surface layer of roads
Industrial Cores	Mail tubes for items such as maps and blueprints.
Metal	Photocopier and printer toner cartridges, halogen lamp, screws.
Mobius Loop	The three-arrow enclosed triangle used to identify recyclable materials.

Molded Pulp Products	Include egg cartons, nursery pots, dishes and other forms of packaging.
Newsprint	All newspapers and inserts.
OCC	Old corrugated cardboard and "Asian" corrugated cardboard.
Waxed OCC	Waxy old corrugated cardboard.
Other Waste	The last 10% of the waste audit consisted of a pair of women's high-heeled shoes, computer floppy disks, AA batteries, cassette tapes and popcorn bags.
Paper	
Fine Paper	White ledger, photocopy paper, index cards, fax paper, post-it notes, coloured, envelopes, letterhead, file folders, carbonless paper.
Glossy Paper	Magazines, catalogues, brochures, pamphlets.
Kraft Paper	Brown paper such as lunch bags.
Plastics	
PET #1	Polyethylene Terephthalate, commonly used for soft drink bottles, to package some food products such as cooking oil, packaging for some cosmetics, etc.
HDPE #2	High Density Polyethylene commonly used to make containers for several types of food products, such as milk and juice, also used to hold liquid detergents, etc.
Polyvinyl Chloride #3	Commonly used to package some cooking oils, mineral water, shampoos, cosmetics and personal care products.
LDPE #4	Low density polyethylene commonly used for plastic film products such as shopping bags, milk pouches and food wrap.
Polypropylene #5	Commonly used for household storage containers and for some food packaging.
Polystyrene #6	Commonly used for food service or industrial packaging, including foamed products such as coffee cups, food trays, packing peanuts.

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