GPI Atlantic

Genuine Progress Index for Atlantic Canada / Indice de progrès véritable - Atlantique

**MEASURING SUSTAINABLE DEVELOPMENT**

**APPLICATION OF THE GENUINE PROGRESS INDEX TO NOVA SCOTIA**

# THE NOVA SCOTIA GPI
# SOLID WASTE-RESOURCE ACCOUNTS

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# EXECUTIVE SUMMARY

In 1989, Canada's provincial Ministers of the Environment set a target to halve the amount of solid waste being sent to landfills and incinerators by the year 2000.[1] That same year, Nova Scotia sent 641,375 tonnes of waste – 726 kg per person – to landfills and incinerators. The challenge for Nova Scotia, therefore, using 1989 as a base year, was to create a system that would divert half that waste – 320,687 tonnes,[2] or 363 kg per person – from landfills each year.[3] Nova Scotia did succeed in diverting 50% of its waste from landfills for one six-month period in the year 2000 and has since achieved 46% diversion in each year.

The 50% diversion achievement (now at 46%) is the result of a comprehensive Solid Waste-Resource Management Strategy[4] that was developed through government action, citizen involvement, and industry support. The strategy was designed to ensure that the people of Nova Scotia "receive the maximum environmental and economic benefits while minimizing the potential increases in the cost of managing solid waste."[5] Municipalities have contributed significantly to the capital and operating costs associated with collecting and managing recyclables, organic materials and waste in Nova Scotia. In addition to municipal systems, the Resource Recovery Fund Board (RRFB), a non-profit organization, operates the bottle deposit, tire, and paint recycling systems in the province. The RRFB funnels portions of profits from the recycling programs back to municipalities through diversion credits, based on the rate of diversion for each solid waste-resource management region. The RRFB also funds approved programs, and invests in value-added manufacturing related to the recycling industry.

The new waste-resource management system – which involves recycling, composting and improved landfills – began in 1996. It came with a heavy price tag. Actual implementation of the

[1] SENES Consultants Limited, August 1995. *Study of The National Solid Waste Inventory 1994,* prepared for the Canadian Council of Ministers of the Environment (CCME) Solid Waste Management Task Group. The Nova Scotia Department of Environment and Labour (NSDEL) uses the official definition of solid waste as defined by the CCME. Solid waste refers to "any material, product, or by-product for which the generator has no further use and which is discarded for management at waste disposal facilities." This definition excludes wastes that are associated with primary resource extraction or harvesting, conventional air pollutants and liquid effluents that may be discharged from processing or manufacturing sites and soil as a result of contaminated sites clean-up programs." See Table 5 for a full list of what this definition includes and excludes.

[2] NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 1997 to March 31, 2001).* Note: The original estimate of waste disposed for 1989 was lower than noted here, hence the original projected diversion per capita was also lower. The rate has since been adjusted to the figures presented here as more information became available about the amount of waste actually disposed in 1989. The 1989 population used by NSDEL was 883,435. To calculate diversion rates, the 1989 amount of solid waste disposed in landfills is adjusted to the current population base, based on the per capita rate of disposal in 1989. Thus, the 1989 amount used to calculate diversion rates for 2001 is 688,317.

[3] NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 2000 to March 31, 2001).*

[4] As the 1995 Solid Waste-Resource Management Strategy is the official name of the program, it is generally capitalized in this report. When other names are used, such as the solid waste-resource system, they are generally not capitalized in the text.

[5] Nova Scotia Department of Environment (NSDOE). *Solid Waste-Resource Management: A Strategy for Nova Scotia.*

various components of the Solid Waste-Resource Management Strategy led to an increase in operating and amortized costs from $48.6 million or $53 per person before the Strategy (represented by fiscal year 1996-97) to $72.5 million or $77 per person in the fiscal year 2000-01.[6] [All figures in this report have been adjusted to constant 2000 dollars ($C2000) using Statistics Canada's Consumer Price Index, unless otherwise stated.]

At first glance, the numbers indicate an increased cost of $23.9 million (or $24 per person) for implementing the changes between the fiscal year 1996-97 and the fiscal year 2000-01. The traditional accounting methods used in Table 1, however, fail to consider the full economic, social, and environmental costs and benefits resulting from the major changes in the management of Nova Scotia's solid waste. It should also be noted that 40% of the increase in costs of the new waste-resource management system is due to the front-end processor purchased by Halifax Regional Municipality (HRM), and this processor was not a requirement of the Strategy or of the regulations.[7] However, since some of the benefits of the strategy derive from the functioning of the front-end processor, we have left the costs of the processor in the total operating and amortized capital costs.

**Table 1. Total additional operating and amortized capital costs of Nova Scotia's Solid Waste-Resource Management System ($C2000)**

| Operating and amortized capital costs | Total | Per person |
|---|---|---|
| Total cost 1989 (1996-97 fiscal year as proxy)* | $ 48.6 million | $ 53 |
| Total cost 2000-01 fiscal year | $ 72.5 million | $ 77 |
| Total additional operating and amortized capital costs of 2001 system vs. 1997 system | $ 23.9 million | $ 24 |

* The closest approximation of 1989 cost data available is financial information for 1996-97.

This report presents a comprehensive, full cost-benefit analysis of Nova Scotia's waste-resource management system. It takes into account benefits such as avoided greenhouse gas emissions and liability costs, and the more efficient use of landfills, and it notes additional benefits like increased employment. It also accounts for increased costs that are not included in the operating costs included in Table 1, like the cost of administering the bottle deposit-refund, tire recycling, and stewardship programs in the new system, and the cost of the extra time needed to sort waste.

From a full cost accounting point of view, GPI*Atlantic* estimates that the Nova Scotia solid waste-resource system in the fiscal year 2000-01 produced net savings of between $31.2 million and $167.7 million, when compared to the system in place in the fiscal year 1996-97 (Table 2). This translates into savings of $33 to $178 for each Nova Scotian, rather than a net additional cost of $24 as suggested when comparing strictly the operating and amortized capital costs of the two systems. In other words, the new system has more than paid for itself from a full cost-benefit perspective, while producing new jobs and substantial environmental benefits.

[6] A fiscal year runs from April 1-March 31. For example, the fiscal year 2001 runs from April 1, 2000-March 31, 2001.
[7] Bob Kenney, Solid Waste-Resource Analyst, NSDEL. Personal communication, May 2004.

**Table 2. Marginal savings of the 2000-01 solid waste-resource management system vs. the pre-Strategy system, showing low, medium, and high estimates of variable costs and benefits ($C2000)**

| Pre-Strategy costs (fiscal year 1996-97, proxy for 1989) | | | |
|---|---|---|---|
| Operating and amortized capital costs | $48,600,000 | | |
| **Cost per capita** | **$53** | | |
| **Post-Strategy costs and benefits (fiscal year 2000-01)** | | | |
| **COSTS** | **Low** | **Medium** | **High** |
| Operating and amortized capital costs | $72,459,311 | $72,459,311 | $72,459,311 |
| Beverage Container Recycling Program (net) | $14,307,047 | $14,307,047 | $14,307,047 |
| Used Tire Management Program (net) | $ 2,730,840 | $2,730,840 | $2,730,840 |
| Stewardship programs | $87,710 | $87,710 | $87,710 |
| RRFB operating and administrative costs | $1,627,013 | $1,627,013 | $1,627,013 |
| Non-deposit materials | $25,149 | $25,149 | $25,149 |
| Derelict vehicles | $16,997 | $16,997 | $16,997 |
| Household Hazardous Waste Program | $162,534 | $162,534 | $162,534 |
| Nuisance (value of time) | $218,730 | $911,373 | $1,822,746 |
| Cost to increase participation | $4,978,487 | $7,112,124 | $9,482,832 |
| **Total Costs** | **$96,613,818** | **$99,440,098** | **$102,722,179** |
| **Cost Per Capita** | **$103** | **$106** | **$109** |
| Indirect costs total | $24,154,507 | $26,980,787 | $30,262,868 |
| **BENEFITS** | **Low** | **Medium** | **High** |
| Employment benefits (direct)* | $2,830,820 | $3,262,640 | $3,910,370 |
| Employment benefits (indirect)* | $3,670,470 | $4,246,230 | $5,085,880 |
| Reduction of greenhouse gas emissions | $3,337,180 | $34,196,000 | $84,343,050 |
| Reduction of air pollutant emissions | $9,532,790 | $42,643,964 | $67,440,991 |
| Extended landfill life | $18,848,267 | $18,848,267 | $18,848,267 |
| Avoided siting costs | $174,732 | $174,732 | $174,732 |
| Avoided compensation | $1,270,780 | $1,588,475 | $1,906,170 |
| Export revenue | $1,100,000 | $1,400,000 | $1,650,000 |
| Tourism | $187,184 | $187,184 | $187,184 |
| Energy savings from recycling | $28,682,283 | $28,682,283 | $28,682,283 |
| RRFB diversion credits | $4,979,465 | $4,979,465 | $4,979,465 |
| RRFB approved programs | $4,374,804 | $4,374,804 | $4,374,804 |
| RRFB investment | $248,824 | $248,824 | $248,824 |
| **Total benefits** | **$79,237,599** | **$144,832,868** | **$221,832,020** |
| **Benefits per capita** | **$84** | **$154** | **$236** |
| **Net annual cost ( ) or benefit** | **($17,376,219)** | **$45,392,770** | **$119,109,841** |
| **Annual cost ( ) or benefit per capita** | **($18)** | **$48** | **$127** |
| **Net savings compared to pre-Strategy cost** | **$31,223,781** | **$93,992,770** | **$167,709,841** |
| **Annual savings per capita** | **$33** | **$100** | **$178** |

* Only a portion of new jobs created as a result of the new waste-resource management system is included in the cost-benefit analysis. This is because it cannot be demonstrated that all new waste-resource management jobs were created from the unemployment rolls. Jobs that represent a lateral movement from another industry to the waste-resource management industry cannot properly be shown as providing a *net* social benefit in a cost-benefit analysis, and must therefore be excluded. The assumptions used for estimating direct and indirect employment benefits are explained in Part III of this report.

It is important to note that the waste management costs of the mid-1990s would not have been maintained even with continued reliance on landfills, as several existing landfills, including the Sackville landfill, (serving approximately 35% of Nova Scotia's population), were either at capacity or near capacity. Therefore alternative waste handling strategies needed to be implemented in any case.

GPI*Atlantic* recognizes that it is difficult to attribute an exact dollar value to goods and services that traditionally do not have a market price. Therefore, assumptions and ranges are clearly outlined for each of the costs and benefits addressed in this analysis. In its final assessment, GPI*Atlantic* takes a conservative approach and employs low-end estimates in order to err on the side of caution. Because of the limits of monetary valuation, the report also includes a non-monetary evaluation of the Nova Scotia solid waste-resource system. Highlights and key conclusions follow.

**Benefits**

Total benefits attributed to the 2000-01 solid waste-resource system range from $79.2 million to $221.8 million or $84 to $236 per person, depending largely on the assumptions used in calculating the benefits of avoided greenhouse gas emissions and air pollutants.

Benefits of the 2000-01 (fiscal year) system include:

- $6.5 million to $9 million in increased direct and spin-off employment;
- $12.8 million to $151.8 million in reductions of emissions of greenhouse gases and air pollutants;
- $18.8 million in extended landfill life;
- $9.6 million in RRFB Municipal Diversion credits, funding for approved programs and investment in value-added manufacturing related to the recycling industry;
- $1.3 million to $1.9 million in avoided compensation costs;
- $1.1 million to $1.7 million in increased export revenue of environmental goods and services;
- $187,184 in additional tourism.

**Costs**

Total costs (including operating and amortized capital costs) attributed to the 2000-01 solid waste-resource system range from $96.6 million to $102.7 million, depending on the assumptions employed. Costs of the 2000-01 (fiscal year) system include:

- $72.5 million in operating and amortized capital costs;
- $1.6 million in RRFB administrative and operating costs;
- $218,730 to $1.8 million in nuisance costs related to handling of organic waste;
- $4.9 to $9.5 million in costs to increase participation;
- $87,710 in costs of stewardship programs to support the strategy.

**Key conclusions**

Based on diversion rates (diversion of waste from landfills) and other waste management data, Nova Scotia is a leader both nationally and internationally in waste diversion. At an international level, Nova Scotia's waste diversion rate is among the highest in the world when compared to waste diversion rates in OECD countries.

Within Canada, Nova Scotia is the first province to have achieved the target of 50% diversion of solid waste, according to the criteria established by the Canadian Council of Ministers of the Environment (CCME), which require comparison with 1989 disposal rates. In 2000, on a per capita basis, Nova Scotia disposed of 45% less waste than the Canadian average and between 1994 and 2000 the province increased waste diversion by 43-53% above the average national increase in waste diversion over the same period. In other words, Nova Scotia's improvement in waste diversion was significantly better than improvements in other provinces.

Within Nova Scotia, the HRM and Annapolis Valley regions led the province with 59% and 51% (in 2000-01) waste diversion rates respectively. Several other areas have also attained at least 50% waste diversion, including East Hants, Pictou County, Lunenburg, and Queen's Regional Municipality. HRM, in fact, has the highest waste diversion rate of all Canadian municipalities reporting within the Generally Accepted Principles (GAP) framework – double the average GAP diversion rate. HRM's success can be attributed to many factors including its high level of organic waste diversion, significant construction and demolition diversion to recycling facilities, the high cost of waste disposal, disposal bans, and the pre-processing of waste at its front-end processor before disposal.

Both recycling and composting, the two major tactics embraced by the province to achieve diversion gains, have become more accessible and comprehensive since the inception of the Solid Waste-Resource Management Strategy.

Access to curbside recycling in Nova Scotia increased from less than 5% in 1989 to 99% in 2003, the highest rate in the country. In 2003, 76% of Nova Scotians had access to curbside organics pickup. Before the development of the Solid Waste-Resource Management Strategy, only Lunenburg and Colchester Counties, comprising approximately 10% of the provincial population, had access to curbside organics pickup. By 2001, 51,000 tonnes of organics (dry weight) were being processed in municipal facilities province-wide. This figure is in addition to backyard composting, which is promoted and widely practised throughout the province. While curbside organics collection is effective for urban areas, the benefits of this collection system in rural areas, where backyard composting is easier to practice, may not be as apparent. Backyard composting can reduce the costs and environmental impacts of trucking, but these benefits must be weighed against evidence that diversion rates decline in the absence of curbside pickup. A review of diversion rates and tonnes diverted in both systems, along with a full cost assessment of trucking costs, would therefore provide valuable data to determine long-term policy decisions.

The component of the solid waste-resource system for which least evidence is available is household hazardous waste (HHW). There is currently no monitoring system in place to track reductions in HHW. While the number of HHW depots is expanding throughout the province, it is highly unlikely that the province attained its original goal of reducing HHW by 70% between

1997 and 2000. The recent stewardship agreement with the paint industry to take back leftover paint for recycling will increase the rate of HHW reduction from present levels. Given the potentially adverse environmental impacts of HHW, this is an area that needs to be addressed. RRFB Nova Scotia is currently working with the Nova Scotia Department of Environment and Labour (NSDEL) to adopt a tracking system for HHW and has provided funding for HHW depots and for paint swaps.

Currently, the province also has no strategy to divert construction and demolition (C&D) waste away from landfills, even though C&D waste accounts for 25-30% of the municipal waste stream. In order for municipalities to make further progress and to exceed the 50% waste diversion target, a major effort will be required to divert C&D waste. HRM has developed a progressive C&D waste management strategy that can serve as a potential model for all regions and municipalities in the province.

In summary, the 1995 Solid Waste-Resource Management Strategy has produced a net benefit to Nova Scotians, when assessed both in monetary and non-monetary terms:

1) From a full cost-benefit accounting perspective, the solid waste-resource system in the fiscal year 2000-01 provided a net savings of between $31.2 million and $167.7 million to Nova Scotians, when compared to the system in place in the fiscal year 1996-97. This was despite the increased operating and amortized capital costs in 2000-01.
2) Nova Scotia is a leader both internationally and nationally in solid waste diversion.
3) The accessibility, comprehensiveness, and levels of waste being composted and recycled have all improved since the introduction of the Strategy.

The 2000-01 (fiscal year) solid waste resource system is clearly superior to the pre-Strategy system (1996-97 fiscal year as proxy for 1989) in terms of both waste diversion and net benefits to Nova Scotia. However, this study suggests that the current system could in fact be offering even more to Nova Scotians, with a particular focus needed on reduction of HHW and diversion of C&D materials.

Some critics suggest that the current solid waste-resource system fails to accommodate the needs of rural communities and that a community-by-community waste management approach would lead to greater diversion rates at a lower cost.[8] In addition, aspects of the provincial strategy – such as comprehensive stewardship agreements with all packaging and industry sectors – have not been completed, so that producers of some of the most difficult-to-recycle materials have been able to avoid accountability and have in essence been rewarded by staying outside the recycling system. Finally, despite waste diversion achievements, very little has been done to address overall consumption and to reduce waste at its source.

Although Nova Scotia has achieved remarkable success in diverting a substantial portion of municipal waste in a short period, the challenge for the future will be to avoid the complacency that may result from this achievement. To remain a leader in waste diversion requires a continued commitment by citizens, government, and industry to eliminate waste. Opportunities exist to improve the system further by building upon both the lessons that led to Nova Scotia's current achievement and the lessons from other successful initiatives around the world.

[8] Dittrick, M. *Only in our Backyard: Annapolis Royal and Zero Waste 2005*. See Appendix C of this report.

This study shows that progress toward greater waste diversion rates can be cost-effective. In the Genuine Progress Index, higher rates of waste diversion and waste reduction are counted as signs of genuine progress and sustainable development.

**Report structure**

Part I provides an introduction to the report and a brief overview of how both traditional measures of progress and the Genuine Progress Index assess waste generation and disposal.

Part II assesses the Nova Scotia solid waste-resource system in physical terms. It compares the current situation with the results anticipated in the 1995 Solid Waste-Resource Management Strategy in order to assess whether targets have been reached. The success of the program is further evaluated by comparison with international and national waste diversion rates. The components of the province's solid waste-resource system are also examined, with an emphasis on recycling and composting.

Part III presents a full cost accounting analysis to determine the true or full costs of implementing the changes introduced in the Solid Waste-Resource Management Strategy, which led to the 50% diversion of solid waste in Nova Scotia. This section compares the net costs of the pre- and post-Strategy waste management systems. Although 1989 is the base year for comparison, the closest approximation of 1989 cost data is for the fiscal year 1996-97. Although the bottle recycling program began in 1996-97, and the tire recycling program began in 1997, the basic operating costs of the old system would not have changed substantially between 1989 and 1996-97.[9] The 2000-01 fiscal year was selected since it is the most recent year for which a complete data set was available at the beginning of this study. The marginal benefits achieved and costs incurred during these years therefore provide a more comprehensive assessment of the economic implications of the new system, in comparison with the old one, than is possible with conventional accounting methods that consider only operating and capital costs.

One important caveat is necessary here. The marginal cost comparison provided in Part III is based on an implicit assumption that the costs of the old system could have been maintained. However, a continuation of the old system was not an option in 1996-97, because the Solid Waste-Resource Management Strategy required open burning dumps to close, and at least one landfill (Sackville) was at capacity. Viable alternatives to the current system (e.g. second generation landfills or incineration) would have been more costly than the old system. The operating cost differential between the current system and viable alternatives would therefore be considerably narrower than the cost differential with the old system described in Part III and the net benefits therefore correspondingly greater. The estimates of marginal benefits and costs in Part III, based on the 1996-97/2000-01 difference, are therefore correspondingly conservative.

Part IV very briefly reviews options to improve the current system and concludes with a summary of recommended actions that can help ensure that Nova Scotia remains a leader in solid waste-resource management and continues along the path toward zero waste. This section is complemented by Appendix F, a reproduction of *A Citizens' Agenda For Zero Waste*. This

[9] Bob Kenney, NSDEL. Personal communication, May 2004.

document provides practical examples of communities that have effectively taken control of their waste resources and achieved positive results that have improved their quality of life and contributed to their sustainability. Time and resources did not permit nearly as full an exploration of next steps and ways of improving the current system and increasing diversion rates as would have been desirable. Just as a second volume of the GPI *Forest Accounts* focused on "ways forward" towards more sustainable forestry practices, GPI*Atlantic* strongly recommends that a future, second report expand on Part IV of this analysis.

# ACKNOWLEDGEMENTS

GPI*Atlantic* is grateful for funding support from Environment Canada's Science Horizon Internship Program, Halifax Regional Municipality, Nova Scotia's Resource Recovery Fund Board, the NSDEL, the Greater Vancouver Regional District, the City of Montreal, and the National Round Table on the Environment and the Economy. A portion of the HRM funding came from the 2000 Federation of Canadian Municipalities Sustainable Community Award. We also thank Paul Gregory of the Federation of Canadian Municipalities for his invaluable assistance in securing funding support for this research. Because this study represents the first Canadian evaluation of a provincial solid waste system using the full cost accounting principles of the Genuine Progress Index, it is intended to provide a starting point for evaluations of solid waste-resource systems in other jurisdictions.

In addition to the funding support indicated above, NSDEL, Gorsebrook Research Institute at Saint Mary's University, and Environment Canada's Ecosystem Science and Information Division also kindly provided substantial in-kind support for this project.

Special thanks are due to the reviewers of the final report – Barry Friesen, Bob Kenney, Fred Wendt, Marcus Goodick, and Catherine McCarthy. The authors gratefully acknowledge the GPI Solid Waste-Resource Steering Committee for its guidance and direction in the early stages of the project.[8] Also, in the early stages, several key people provided valuable information and very helpful review comments: Brian Smith, Jim Bauld, Martin Janowitz, Lars Osberg, David Wimberly, and Mark Dittrick. Dr. Osberg's advice on the cost-benefit analysis was invaluable. Bob Kenney, Fred Wendt, and David Wimberly also provided historical and analytical information about the Nova Scotia solid waste-resource system that was integral to the completion of this report.

In particular, we have relied heavily on the pioneering work of Fred Wendt, developed for his MES thesis at Dalhousie University's School for Resource and Environmental Studies. Many of the indicators, methodologies, and calculations in that thesis, entitled *Pay Now or Pay Later: A Cost Benefit Analysis of Halifax Regional Municipality's Waste Management System* (July 2001), have been incorporated into the cost-benefit section of this study and extended to a provincial scale. We are grateful for Mr. Wendt's permission to use his work so extensively.

We also greatly appreciate the generosity of Paul Connett who has kindly allowed GPI*Atlantic* to reprint his insightful document*, A Citizen's Agenda For Zero Waste* in Appendix F of this report. We also thank Marcus Goodick for permission to reprint the executive summary of his Dalhousie University MES thesis, *Assessing Environmental Improvements Resulting from Changes in Waste Management Practices in Nova Scotia from 1990-2000,* as Appendix A and Mark Dittrick for permission to reprint his analysis of Annapolis Royal's zero waste strategy as Appendix C of this report.

[8] Members of the GPI Solid Waste-Resource Steering Committee included: Ronald Colman, Executive Director, GPI Atlantic; Fred Wendt, Waste Resource Analyst, HRM; Barry Friesen, Manager, Solid Waste-Resource Division, NSDEL; Bob Kenney, Waste Resource Analyst, NSDEL; a Representative of the RRFB; Meinhard Doelle, former Executive Director, Clean Nova Scotia; and Eric Hundert, Environment Canada.

We are grateful to Dr. Irene Novaczek, who patiently proof-read and edited this report, generously giving her time to the GPI endeavour as she has so often in the past.

Inspiration for the Nova Scotia Genuine Progress Index came from the ground-breaking work of Redefining Progress, which produced the first GPI in the United States in 1995. Though GPI*Atlantic*'s methods differ in many ways, particularly in not aggregating index components for a single bottom line, we share with the original GPI the attempt to build a more comprehensive and accurate measure of wellbeing than can be provided by market statistics alone. GPI*Atlantic* also gratefully acknowledges the pioneers in the field of natural resource accounting and integrated environmental-economic accounting on whose work this study and other GPI studies build.

***Needless to say, any errors or misinterpretations and all viewpoints expressed, are the sole responsibility of the authors and* GPI*Atlantic.***



**"Oh, I love trash**
**anything dirty**
**or dingy**
**or dusty**
**anything ragged**
**or rotten**
**or rusty**
**yes, I love trash"**

– Oscar the Grouch

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*Part II – Evaluation of Nova Scotia's Solid Waste-Resource System*

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| **Btu** | British Thermal Unit |
| **C&D** | Construction and Demolition |
| **CBRM** | Cape Breton Regional Municipality |
| **CCME** | Canadian Council of Ministers of the Environment |
| **$CO_2$** | Carbon dioxide |
| **$CO_2$ eq** | Carbon dioxide equivalents |
| **CSR** | Corporations Supporting Recycling |
| **EPIC** | Environment and Plastics Industry Council |
| **GAP** | Generally Accepted Principles |
| **GHG** | Greenhouse Gas |
| **GJ** | Gigajoule |
| **GPI** | Genuine Progress Index |
| **HHW** | Household Hazardous Waste |
| **HRM** | Halifax Regional Municipality |
| **ICI** | Industrial, Commercial and Institutional |
| **ISWM** | Integrated Solid Waste Management |
| **kg** | Kilogram |
| **kt** | Kilotonne (one thousand metric tonnes) |
| **kWh** | Kilowatt-hour |
| **MMBtu** | Million British Thermal Units |
| **MSW** | Municipal Solid Waste |
| **NSDEL** | Nova Scotia Department of Environment and Labour* |
| **NSDOE** | Nova Scotia Department of Environment* |
| **OECD** | Organization for Economic Cooperation and Development |
| **RRFB** | Resource Recovery Fund Board |
| **SWRMS** | Solid Waste-Resource Management Strategy |
| **t** | Metric tonne (one thousand kilograms) |
| **USEPA** | United States Environmental Protection Agency |
| **VWMRA** | Valley Waste-Resource Management Authority |

* As a result of government restructuring in October 2000, the former Nova Scotia Department of Environment (NSDOE), the Department of Labour, and other regulatory agencies combined to become what is currently the Nova Scotia Department of Environment and Labour (NSDEL).

# PART I
# INTRODUCTION & OVERVIEW

# 1. Introduction

In 1989, the provincial Environment Ministers of Canada set a target to halve the amount of solid waste per capita being sent to landfills and incinerators by the year 2000.[10] In 1995, the Nova Scotia Environment Act formally adopted the goal of 50% diversion of solid waste by the year 2000, in relation to 1989 levels. The Act states: "There is hereby adopted the Canadian target of a fifty per cent solid-waste diversion goal for the year 2000."[11] In Nova Scotia, the amount of waste sent to landfill in 1989 totalled 641,375 tonnes, or 0.726 tonnes (726 kg) per person.[12]

The challenge for Nova Scotia, therefore, using 1989 as a base year, was to create a system that would divert a minimum of 0.363 tonnes (363 kg) per person per year.[13] In 2000, Nova Scotia was the only province in the country to meet the target set by the provincial Environment Ministers. Although the Nova Scotia diversion rate slipped to 46% in 2001, Nova Scotia, once among the largest per capita waste-producing provinces, is now a national leader in waste diversion, and is even recognized as a global leader in waste-resource management. [14]

What does this mean for Nova Scotia? On the one hand, the province is being applauded for its achievement and has received global recognition as a leader in waste diversion. The system is credited with creating jobs and positioning Nova Scotian companies as leaders in waste technologies and waste management innovation. Representatives from Japan, Hong Kong, China, Vietnam, Russia, Ireland, Guyana, the U.S., Trinidad and several other Caribbean countries – as well as other Canadian provinces – have travelled to Nova Scotia to study how the province does it.

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[10] SENES Consultants Limited, August 1995. *Study of The National Solid Waste Inventory, 1994,* prepared for the CCME Solid Waste Management Task Group. NSDEL uses the official definition of solid waste as defined by the CCME. Solid waste refers to "any material, product, or by-product for which the generator has no further use and which is discarded for management at waste disposal facilities. This definition excludes wastes that are associated with primary resource extraction or harvesting, conventional air pollutants and liquid effluents that may be discharged from processing or manufacturing sites and soil as a result of contaminated sites clean-up programs." See Table 5 of this report for a list of what is and is not included in this definition.

[11] Nova Scotia Environment Act, Section 93(4). The Nova Scotia Environment Act is available at http://www.gov.ns.ca/legi/legc/statutes/environ1.htm. The Solid Waste-Resource Management Regulations are available at www.gov.ns.ca/just/regulations/regs/envsolid.htm.

[12] Bob Kenney, NSDEL. Personal communication, November 4, 2003. The estimate of amount of municipal solid waste generated in 1989 (originally estimated at 623,000 tonnes) has been adjusted upwards by NSDEL for several reasons. First, in 1989 Minas Pulp and Paper did not send solid waste to the landfill but subsequently did so; therefore the baseline amount for 1989 was adjusted to add this amount to the total. Secondly, in 1989 many municipalities did not have weigh stations, so when weigh stations were installed, the totals were adjusted for the baseline year based on the new information, on a per capita basis. The population figure used by NSDEL for 1989 was 883,435, which is slightly lower than that listed by the Nova Scotia Department of Vital Statistics (889,000). Using the Vital Statistics number of 889,000, the per capita amount would be 0.72 instead of 0.73.

[13] NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 2000 to March 31, 2001).*

[14] Statistics Canada 2000. *Waste Management Industry Survey: Business and Government Sectors, 1998*. Catalogue no. 16F0023X1E.. Table 2.1 – Disposal of Waste by Province and Territory, 1998. For more information on historical waste disposal data in Canada, see Table 4 of this report.

There is also a direct correlation between waste diversion and reduced greenhouse gas (GHG) emissions. A recent Nova Scotia study of residential waste found that between 1989 and 2001, waste diversion had produced a reduction in GHG emissions equivalent to the emissions from 42,800 cars.[15] The study used models based on life-cycle analysis of products, which were developed by the plastics industry. It compared the environmental burden created by residential waste in 1989 to that in 2001.

On the other hand, waste management officials are under pressure to rationalize the high operational costs of the province's solid waste-resource system. Implementing the Solid Waste-Resource Management Strategy[16] was originally estimated to increase costs by no more than $26 per person per year for a total operating and amortized capital cost of $77 per Nova Scotian per year. The increased operating and amortized capital costs in 2000-01 were slightly lower than expected – about $24 per person per year – bringing the total operating and amortized capital cost of the solid waste-resource system to $72.5 million per year.[17]

Compared to other provinces, Nova Scotia is estimated to have the smallest budget per capita for government spending on environmental protection.[18] A pledge by the current government to balance the provincial books has meant that budgets have been reduced in many areas of government operation. The Nova Scotia Department of Environment and Labour [NSDEL – formerly the Nova Scotia Department of the Environment (NSDOE)] has seen its budget reduced dramatically and is therefore under pressure to justify its waste management expenditures. Waste managers at the municipal and regional levels must also justify the costs of waste management within their jurisdictions.

There is also a growing movement, particularly in the United States, away from recycling. Although New York City is currently recycling plastics and glass, in 2002 the city suspended glass and plastic bottle collection from their recycling program, arguing that the costs of the system outweighed the environmental benefits, and that the money required to operate the program would be better spent elsewhere. Several other major U.S. urban centres are considering following New York City's lead.

Nova Scotia's waste management program faces more than financial challenges. The impetus that drove the Solid Waste-Resource Management Strategy – public pressure against the Sackville landfill – no longer exists. The Sackville landfill, a high-profile ticking time bomb that served about one-third of the province's population, was near maximum capacity when the waste diversion program began. It was plagued by leachate problems, rodents and pests, foul odours,

[15] Goodick, M. 2002. *Assessing Environmental Improvements Resulting from Changes in Waste Management Practices in Nova Scotia from 1990-2000.* MES thesis, Dalhousie University. See Appendix 1 in this report for Goodick's Executive Summary.
[16] A copy of *Solid Waste-Resource Management: A Strategy for Nova Scotia* can be obtained by contacting NSDEL's Solid Waste-Resource Division at 902-424-2645 or by e-mail at friesebk@gov.ns.ca.
[17] NSDEL 2002. Municipal Solid Waste, Recycling and Composting Summary Tables for fiscal year 2000-01, based on Annual Municipal Waste-Resource Management Diversion and Cost Survey.
[18] NSDEL 2002. *Internal memo.* Provincial spending on environmental protection was estimated by Peter Geddes, policy analyst with NSDEL. Geddes' estimates of provincial government spending on environmental protection are rough calculations extrapolated from publicly available documents.

and leaked gas,[19] prompting waste management consultant Ken Donnelly to describe it as a "brutal" landfill that "you would not expect in Canada."[20]

With the Sackville landfill closed and the Otter Lake landfill facility scheduled to be in operation for at least the next 20 years, is waste management a dead issue in the public mind? The other major public outcry in the early 1990s was over the large number of open burning dump sites around the province. All open burning dump sites have been closed under the new strategy. Now that these tensions no longer exist, what do these changes mean for a system that was largely created through public pressure and citizen participation?

Furthermore, two years after successfully eliminating half the amount of solid waste being sent to landfills and to the Cape Breton Regional Municipality (CBRM) incinerator, Nova Scotia is having increasing difficulty maintaining its 50% waste diversion rate. In 2001, the average diversion rate for the province was 46%, ranging from 25% in Cape Breton to 59% in Halifax Regional Municipality (HRM).[21]

There is also debate about exactly what "50% diversion of solid waste" means. In Nova Scotia, the diversion of solid waste specifically refers to the diversion of "any material, product, or by-product for which the generator has no further use and which is discarded for management at waste disposal facilities. This definition excluded wastes that are associated with primary resource extraction or harvesting, conventional air pollutants and liquid effluents that may be discharged from processing or manufacturing sites and soil as a result of contaminated sites clean-up programs."[22]

Environmental management expert Robert Ayres tried to estimate the percentage of raw materials extracted from the earth that actually end up in finished products. He stated, "The annual accumulation of active materials embodied in durables, after some allowance for discard and demolition, is probably not more than 150 million tons, or 6 percent of the total. The other 94 percent is converted into waste residuals as fast as it is extracted." A 1988 U.S. Environmental Protection Agency (USEPA) report to Congress supports Ayres' conclusions, stating that municipal waste may account for only 2% of total waste generated.[23]

The USEPA[24] summarized types of waste generated in the U.S., and for some categories provides relative proportions. The report has no estimates for radioactive wastes, agricultural wastes, construction and demolition (C&D) wastes, medical wastes, oil and gas wastes, or sludge. Even with no estimates for these major categories, the total solid waste generated is estimated at 7.8 billion tons. Of this total, 232 million tons is municipal solid waste, representing

[19] Even though the Sackville landfill has closed, many of the on-site problems associated with leachate, water pollution and gas leaks still exist today.
[20] Cameron, S.D. 2001. "Recycling By The Sea," *Canadian Geographic*, May/June 2001.
[21] NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 2000 to March 31, 2001)*. In 2000-01, 305,000 tonnes of municipal waste were sent to landfills and 39,000 tonnes were sent to the CBRM incinerator.
[22] NSDOE 1999. *Nova Scotia Solid Waste Resource Recovery Semi-Annual Report, September 1999.*
[23] USEPA 1988. *Report to Congress, Solid Waste Disposal in the United States*, Volume 1, p. 11. Available at http://www.zerowasteamerica.org/Statistics.htm.
[24] USEPA 2000. Environmental Indicators Initiative. *Draft Report on the Environment*. Available at www.epa.gov/Envindicators/roe.

2.9% of the total. Thus, municipal solid waste tends to represent only 3-4% of the total solid waste generated in the U.S.

This indicates that, while the focus in waste reduction to date, throughout the industrialized world, has been largely on municipal waste diversion, real gains in overall waste reduction can only happen through a reduction in waste generation.

In Canada, residential waste constitutes 36% of total non-hazardous solid waste, while commercial and institutional sectors comprise 51% and construction and demolition 12%. In Nova Scotia, municipal waste includes some industrial, commercial and institutional (ICI) wastes (probably because many of these institutions are on a smaller scale) and some C&D waste. Therefore it is not possible to estimate what percentage of total solid wastes is represented by municipal residential waste in Nova Scotia. What is clear from the figures and categories described above is that the 50% diversion target refers to only a portion of solid waste generated.

Regardless of the debate about whether 50% diversion is really 50% diversion, it is correct to assert that in 1999-2000, Nova Scotia *did* prevent 337 kilograms of waste per person from being sent to landfills.

Despite the clear achievement, the question emerges two years after Nova Scotia reached the 50% diversion milestone (and one year after that diversion rate slipped back to 46%): Are the benefits of the Nova Scotia solid waste-resource system worth the investment? Or, in an era of fiscal restraint and debt reduction, might the system face similar pressures to those that prompted New York City to cut back its recycling program?

This study was initiated in response to this very question. The Nova Scotia Department of Environment and Labour (NSDEL) and HRM approached GPI*Atlantic* to determine the true costs and benefits, from a full cost accounting perspective, of maintaining a solid waste-resource system that has achieved a diversion rate of 46%. The current solid waste-resource system, when assessed from the perspective of conventional economic accounting procedures, comes at considerable cost. However, both NSDEL and HRM felt that evaluating the current system based solely on its operating and capital costs excludes key variables and therefore distorts public policy perceptions and underestimates the full merits of waste diversion.

GPI*Atlantic* also had an interest in undertaking this study. First, it complements similar GPI*Atlantic* studies previously undertaken on air quality and water quality, and constitutes a key component of the environmental quality assessments of the Nova Scotia Genuine Progress Index (GPI). Secondly, it demonstrates very concretely that genuine progress and change are possible. The success of the solid waste-resource system in Nova Scotia indicates very clearly that behaviours can change, that genuine progress can be achieved in a remarkably short timeframe and that Nova Scotia is well positioned to take a leadership role in environmental stewardship. If a society can change its behaviours so radically, then there is no reason to believe that Nova Scotia cannot be equally successful in reducing greenhouse gas emissions, changing transportation and land-use planning patterns, and conserving the environment in other ways.

This study calculates, for the first time, the marginal economic, social and environmental costs and benefits of the Nova Scotia Solid Waste-Resource Management Strategy compared to the old landfill-based waste management system. To this end, the report provides a cost-benefit analysis of the new Strategy as represented by the 2000-01 fiscal year, and it compares the operating and amortized capital costs of the province's solid waste-resource system before the strategy was implemented.

HRM's front-end loader, which sorts recyclables, has added 40% of the increase in operating and amortized costs of the system since 1989. Although this front-end loader was not required by the Strategy, we have not subtracted its costs because some of the benefits accrued by the Strategy were also due to the front-end loader.

The comparison is between the years 1989 and 2001. However, since financial statements on operating and amortized capital costs for the province's solid waste-management system were not available for 1989, we have used the fiscal year 1996-97 financial statements as a proxy for 1989, since they were the oldest statements available between 1989 and 2001. Although the bottle deposit-refund system and, to a certain extent, the tire recycling system, had begun in 1996-97, these programs were operated through the RRFB and did not affect the financial statements for basic operating costs of the province's pre-Strategy solid waste management system.[25] The 2000-01 fiscal year was selected, as it represents the most recent year for which data were available when the study began. Monetary comparisons between the two years are given in constant, year 2000 dollars ($C2000), as nine months of the 2000-01 fiscal year were in the 2000 calendar year.

This report also provides an analysis of the current status of solid waste management compared to the anticipated results outlined in the Strategy. It then assesses the success of the program by comparing it with international and national waste diversion rates, and it examines the recycling and composting components of the solid waste-resource system in some detail.

This is the first detailed independent financial evaluation of the Nova Scotia Solid Waste-Resource Management Strategy and the first Canadian evaluation of a solid waste system using the full cost accounting principles of the GPI.[26] This report intends to catalogue baseline information for future GPI updates of Nova Scotia's solid waste-resource system and to provide a starting point for evaluations of solid waste-resource systems in other jurisdictions.

## 2. GDP, GPI & Waste

The Genuine Progress Index recognizes that the human economy depends on the environment both to provide resources and to absorb wastes. How we manage our municipal waste systems is therefore a significant indicator of the sustainability of our communities. If we extract and consume more resources than the earth can provide and if we overload the capacity of the

[25] Bob Kenney, NSDEL. Personal communication, May 2004.
[26] The study by Goodick, M. 2002, op. cit., was the first independent evaluation, but did not include financial data.

surrounding environment to absorb the wastes we generate, then our development is not sustainable. Capitalizing on the use and re-use of waste as a resource is therefore a key component in assessing the efficiency of natural resource use and the prosperity and health of communities.

Resource conservation, materials efficiency, waste prevention, and the re-use and recycling of materials are all integral components of a sustainable economy. Target Zero Canada suggests that making material and energy efficiency a tenet of our economy is an essential precondition both for achieving zero waste and for ensuring long-term economic and environmental health.[27] However, these benefits are not recognized in our conventional accounting mechanisms and measures of progress, which in fact send contrary messages.

A uni-directional flow of materials in our economy, from extraction of raw materials to disposal, contributes significantly to the growth of the Gross Domestic Product (GDP), because additional money is spent at each step of the process. In fact, the GDP grows whenever more money is spent, whether that spending reflects an improvement or a decline in wellbeing. Thus, even the most adverse circumstances such as crime, pollution and natural disasters, can contribute to economic growth through increased spending on prisons, security systems and clean-up operations. Similarly, the more quickly consumer goods wear out and have to be replaced, the more the economy will grow, as further production and consumption are generated. When economic growth measures are misused to assess how "well off" we are, increased waste production can therefore mistakenly signify greater prosperity.

The materials that we discard represent what is left over after a long series of steps including:

1) extraction and processing of raw materials;
2) manufacturing of products;
3) transportation of materials and products to market;
4) use by consumers; and
5) disposal.

An effective waste management model challenges the assumption of a uni-directional flow of materials by re-circulating material back through earlier steps, or by eliminating steps in their entirety. Re-use and recycling, for example, divert an item from disposal, while at the same time precluding the need to extract and process additional raw materials. Re-use and recycling therefore produce a different kind of economic benefit that is not counted in the GDP, which measures higher levels of spending but not economic gains made through conservation and savings.

While each step, from extraction to disposal, contributes to the growth of the GDP, these steps also have impacts on the environment. The ways we manage our wastes therefore have different and possibly conflicting implications for GDP growth, efficient resource use, energy consumption, methane emissions, and the health of the natural environment. Source reduction of paper products, for example, may reduce GDP, resource use, energy consumption, fossil fuel combustion and landfill emissions, while preserving forests and increasing forest carbon storage. However, our current measures of progress are based largely on the economic growth statistics,

[27] Target Zero Canada 2001. *Target Zero*. Available at www.targetzerocanada.org.

and assume that the more the economy grows, the "better off" we are as a society. These measures therefore place a greater value on the GDP and other conventional growth indicators than on environmental and resource conservation, which in turn dominates how we think about and manage our waste.

Economic growth indicators do not place a value on reduced resource extraction and energy use, decreased landfill emissions and leachate contamination, or improving the quality of our air, water and natural environment. The less people trust the water coming from their taps, for example and the more they buy bottled water, the more this spending contributes to the GDP and to economic growth. Free, clean tap water has no value in our conventional measures of progress based on GDP and related economic growth statistics.

So long as economic growth measures remain the primary social and political benchmark of wellbeing and prosperity, waste diversion will continue to be counted as a ***cost*** and not as the ***investment*** that it is. Therefore, the more fundamental task of eliminating waste from the outset through source reduction and decreased consumption will remain difficult to achieve.

Currently, increased resource use, consumption and waste production make the economy grow in many ways. For example, extraction, transportation and use of resources and the manufacture and consumption of finished products all contribute to the GDP. Subsequent defensive expenditures to compensate for the adverse side effects of the extraction, transportation and use of resources all contribute to an expanded GDP. These expenditures – including costs of mitigating climate change impacts; mitigating land quality impacts due to mining, farming, lumbering, and litter; mitigating air quality impacts due to landfill gas emissions; and mitigating water quality impacts due to leachate contamination – all contribute to the GDP.

In these and other ways, the misuse of the GDP to assess prosperity and wellbeing sends misleading signals to the public and policy makers and discourages waste reduction initiatives. By contrast, the GPI recognizes natural resource depletion and degradation, as well as defensive expenditures to compensate for environmental damage, as ***costs*** rather than ***gains*** to the economy. The GPI counts the economic value of what remains in our forests, oceans and other resources, not just what we extract from them, and so recognizes waste reduction initiatives as investments rather than costs to the economy.

Unlike measures of progress based on the GDP and related economic growth statistics, the GPI does not count the over-consumption of natural resources and the clean-up costs of pollution from landfills as progress for our communities and society. Thus, the GPI overcomes some of the flaws of relying on traditional economic indicators to assess wellbeing by quantifying the positive value of reducing waste. It recognizes a reduction in waste as a sign of genuine progress. Unlike measures of progress based on GDP and economic growth, where *more* is always *better*, the GPI recognizes that *less* may often be *best*. The GPI thus examines many aspects of community solid waste management and evaluates progress in the context of a wider range of community values than is the case with conventional measures.

GDP is linked to waste in another way. Studies by the Organization for Economic Cooperation and Development (OECD) show that increases in waste generation are tied directly to increases

in GDP in industrialized nations. Yet increases in waste generation actually point to productive inefficiencies and economic costs to society that are hidden in the conventional growth statistics. The OECD points out:

> "The inordinate generation of wastes represents inefficiency in the use of materials and energy. Despite nearly 30 years of environmental and waste policy efforts in OECD countries, the OECD-wide increase in waste generation is in direct proportion to economic growth. A 40% increase in OECD GDP since 1980 has been accompanied by a 40% increase in municipal waste during the same period. Consumer spending also follows these trends. The delinking of effluence from affluence generally remains elusive."[28]

This "delinking" of economic growth from growth in waste requires a re-examination of the very processes of production and consumption. The GPI contributes to this re-examination by challenging the fundamental assumption that increased consumption and production are automatically and necessarily beneficial to society. From the GPI perspective, production and consumption must instead be understood as parts of a whole system of community sustainability.

The managers of the Zero Waste Plan in Del Norte County, California describe this re-examination of the system of production and consumption:

> "Most objects in our culture are currently viewed more as products than processes. The extraction, manufacturing and distribution of a product, as well as its management after use are all viewed as largely irrelevant to the product's function. Almost by definition, most people don't really want to deal with garbage. After a product has finished its useful life, most people just want a safe place to get rid of it: whether into a trash can, recycling bin or compost bucket. While we each may pay for a product once at the purchase counter, we also pay for the handling of that object again when we pay for someone to collect and manage our discards, again when mining and extraction impacts degrade the environment and again for someone else to clean up waste which has been littered, dumped illegally, or improperly managed. Thus while we may only pay for a product once, we essentially pay for the process at least three times.
>
> "The way we do and make things would take less of a toll on the planet if the service or product with the lowest price also did the least harm. Distortions in the economy created by subsidies for virgin materials, energy extraction and disposal can be changed."[29]

These distortions can be rectified by adopting measures that distinguish economic growth and consumption from genuine progress and that place real value upon the wellbeing and sustainability of our communities. The GPI is intended as a contribution to that goal, and this report as a more accurate assessment of the actual role of waste in our economy and environment than is currently provided by our conventional GDP-based measures of progress.

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[28] Harrison, P., F. Pearce and P. Raven 2000. *Population, Waste and Chemicals,* in *AAAS Atlas of Population and Environment*. Available at www.ourplanet.com/aaas. Accessed on November 11, 2003.

[29] Del Norte Solid Waste Management Authority 2000. *Del Norte Zero Waste Plan*. Del Norte Solid Waste Management Authority, Crescent City, CA. Available at www.grrn.org/order/order.html#del_norte.

# PART II
# EVALUATION OF NOVA SCOTIA'S SOLID WASTE-RESOURCE SYSTEM

All GPI economic valuations are based on prior physical assessments. Thus, economic valuations of voluntary work, crime costs, or forest values, for example, derive from assessments of hours worked, crime rates, and ecosystem services performed, respectively. This report therefore first evaluates the Nova Scotia Solid Waste-Resource Management Strategy in physical terms and only then, in Part III, in relation to its economic benefits and costs. This initial physical evaluation is based on three different assessments of the current system:

- The first section of the physical assessment (Chapter 3) compares the ***projected*** benefits and targets outlined in the 1995 Nova Scotia Solid Waste-Resource Management Strategy to the ***actual*** achievements of the current system (2000-01). In theory, the public and government in 1995 accepted the increased costs of the new system based on the anticipated benefits. This section assesses to what degree the projected benefits have been realized.

- The second section of the physical evaluation of the Nova Scotia solid waste-resource system (Chapter 4) explores international, national, regional, and municipal waste diversion rates and other waste management statistics. This section compares the achievements of Nova Scotia and of HRM with other countries, provinces, and municipalities. It also examines how the different regions within Nova Scotia compare to one another.

- The third section (Chapter 5) examines the major components of the Nova Scotia Solid Waste-Resource Management Strategy, with emphasis on recycling and composting. Where possible, the components are compared within a historical context.

# 3. Projected and Actual Benefits of the 1995 Solid Waste-Resource Management Strategy

The Solid Waste-Resource Management Strategy was enshrined in Section 92 of the Nova Scotia Environment Act in 1995. The impetus for the Strategy was an earlier commitment by Canada's provincial environment ministers, who in 1989 pledged to divert 50% of solid waste from landfills and incinerators by the year 2000. A year before introducing the Strategy – after several years of piecemeal efforts to address waste management concerns – the government held province-wide public consultations to solicit input on how best to address solid waste issues. The two overriding messages that emerged from these public consultations were that Nova Scotians viewed the topic of solid waste as an important environmental, social, and economic issue and that the time was long overdue for concerted and forceful action. At the same time, the Halifax Municipal authorities authorized the Community Stakeholder Committee, a citizens' group, to design an alternate waste-management plan.[30]

[30] Community Stakeholder Committee/Regional Solid Waste Management Project 1995. *An Integrated Resource Management Strategy for Halifax County/Halifax/Dartmouth/Bedford.*

The results of these public consultations and citizen efforts formed the basis of the 1995 Solid Waste-Resource Management Strategy and are the foundations of the solid waste-resource system, as it exists today.[31] In that sense, the development of the strategy was a remarkable exercise in citizen participation and government-citizen dialogue that had a direct impact on government policy.

The Strategy was designed to ensure that the people of Nova Scotia "receive the maximum environmental and economic benefits while minimizing the potential increases in the cost of managing solid waste."[32]

The Nova Scotia Solid Waste-Resource Management Strategy has four main goals:

- Achieve 50% diversion of solid waste by December 31, 2000.
- Implement new disposal standards by December 31, 2005.
- Achieve greater regional cooperation to reduce costs.
- Increase economic opportunities through recognition of waste as a resource.[33]

While the goal of 50% diversion was accomplished in December 2000, by March 2001 the rate had slipped back to 46%.

In addition to these broad goals, the Strategy outlined several more specific projected benefits and targets (summarized below) that would result from its implementation.[34] These projected benefits, as stated in the Strategy, are compared with results actually achieved by the current system by the 2000-01 fiscal year.

## 3.1 Projected Benefit 1: Bans on Selected Materials

"Bans on the disposal of beverage containers, corrugated cardboard, newsprint, scrap tires, used oil, lead-acid batteries, waste paint, automotive antifreeze, glass food containers, steel/tin cans, selected plastics and compostable organic materials."[35]

**2001 situation:**

The bans on most intended materials have been successfully applied.[36] Bans on a few of the HDPE and LDPE (plastics) products included in the original ban list were postponed. LDPE products that were postponed include residential film (plastic bags) and agriculture film (silage wrap). HDPE plastics that were postponed include oil containers and other household hazardous waste containers. These materials have not yet been banned because, to date, there are limited markets to recycle them.[37]

[31] Public Consultation Report 1994. *Towards a Solid Waste Management Strategy for Nova Scotia.*
[32] NSDOE 1995. *Solid Waste-Resource Management: A Strategy for Nova Scotia.*
[33] NSDEL 2001. *Nova Scotia Too Good To Waste, Status Report 2001,* p. 3.
[34] NSDOE 1995, op. cit.
[35] NSDOE 1995, op. cit.
[36] NSDEL 2001, op. cit.
[37] Barry Friesen, NSDEL. Personal communication, 2002.

**Conclusion:** *Benefit mostly achieved*.

## 3.2 Projected Benefit 2: Expanded Deposit-Refund System

"Expansion of the current deposit-refund system on beer and liquor bottles to include all beverage containers with the exception of milk. Milk containers will be recycled through municipal-wide collection programs."[38]

**2001 situation:**

The deposit-refund system was successfully expanded to include all beverage containers excluding dairy containers. A beverage is defined here as "any liquid that is a ready to serve drink, but does not include milk, milk products, soya milk or concentrates."[39] As of September 2001, over 1 billion beverage containers (or more than 1,000 for every Nova Scotian) had been recycled in Nova Scotia since the program's debut in April 1996. The system has achieved an 85% recovery rate on all recyclable beverage containers and a recovery rate of 97% on refillable beer containers. The dairy industry assists in paying for the recycling of its products, which are collected as part of municipal-wide collection programs.[40]

**Conclusion:** *Benefit achieved.*

## 3.3 Projected Benefit 3: Reduce Landfills by 75% by 2005, and Upgrade

"The number of active landfills will be reduced by approximately 75 percent by 2005. Currently, there are 40 active landfills in the province. All landfills will have to meet the Department of the Environment's new stricter guidelines to prevent leachate and other problems associated with the current variety."[41]

**2001 situation:**

There are currently 18 landfills and one incinerator remaining in Nova Scotia, a reduction of 55% from 1995 levels. None of the landfills are open burning sites. Landfill sites in Colchester County, HRM, and Cumberland County meet the new landfill guidelines, which ensure the use of plastic and soil liner systems, as well as treatment and collection of leachate. All landfills in Nova Scotia are required to meet these guidelines by 2005.[42]

**Conclusion:** *On track.*

[38] NSDOE 1995, op. cit.
[39] M. Catherine McCarthy, Director of Communications, RRFB. Personal communication, 2004.
[40] RRFB 2001. *Only In Nova Scotia: Together We Did It!* 2001 Annual Report.
[41] NSDOE 1995, op. cit.
[42] NSDEL 2001. *Nova Scotia Too Good To Waste, Status Report 2001.*

## 3.4 Projected Benefit 4: Create Solid Waste Management Regions

"In order to ensure that cost increases are minimized, municipal units will be encouraged to cooperate on a regional scale. It is recommended that seven solid waste-resource management regions be established."[43]

**2001 situation:**

There are now seven solid waste resource management regions: Cape Breton, Eastern, Northern, Halifax, Valley, South Shore/West Hants, and Western.[44] While many are achieving benefits through cooperation, several have yet to develop a fully cooperative approach.

**Conclusion:** *While the seven regions were established, all the benefits of cooperation have not yet been achieved.*

## 3.5 Projected Benefit 5: Additional Cost Estimated at $28 Per Person Per Year

"The Department of the Environment estimates the Strategy will cost each Nova Scotian an additional 50 cents a week or $26 per year."[45] Converted to 2000 Canadian dollars, this amounts to a projected increase of $28 per person per year.

**2001 situation:**

Counting only operating and capital costs, the 1997 cost of waste management in Nova Scotia was estimated to be $53 per person. The 2000-01 fiscal year cost of waste management was $77 per person, a difference of roughly $24 per year (all figures in $C2000).

**Conclusion:** NSDEL over-estimated the cost of the new system by nearly $4 per person. *Benefit achieved.*

## 3.6 Projected Benefit 6: Job Creation and Reprocessing of Recyclables

"Solid waste resources will be used to create new employment in Nova Scotia through the production of value-added goods. The Department of the Environment and the Resource Recovery Fund Board (RRFB) are working on plans to use scrap tires as the feedstock for a reprocessing plant. Other innovative plans include composting and Nova Scotia-based reprocessing of plastics, corrugated cardboard, disposed diapers and aseptic containers, such as

[43] NSDOE 1995, op. cit.
[44] Bob Kenney, NSDEL. Personal communication, September 2001.
[45] NSDOE 1995, op. cit.

juice packs. The strategy will create approximately 600 jobs in recycling, collection and environmental industries. These jobs will be primarily in the private sector."[46]

**2001 situation:**

Nova Scotia's Solid Waste-Resource Management Strategy has created 1,011 new jobs[47] since the Strategy was developed, exceeding the target of 600 jobs by almost 70%. RRFB set up the Used Tire Management Program in January 1997, and by September 2002, had recycled more than four million tires. Stewardship agreements have been signed with approximately 900 tire retailers. Other jobs have been created in industries producing value-added goods directly attributable to the Strategy, including the plastics processing facility Novapet Inc.; the manufacturing of liner board from corrugated cardboard by Minus Basin Pulp and Power; the manufacturing of paper products by Canadian Keyes Fibre; the production of wallboard using newsprint by U.S. Gypsum; and the manufacturing of cellulose by Thermo-Cell in Debert. Currently there is no successful initiative that deals with disposed diapers.[48]

**Conclusion:** *Benefit mostly achieved.*

## 3.7 Projected Benefit 7: Resource Recovery Fund Board & Marketing Recyclables

"The RRFB will be a private sector, industry driven, non-profit organization. It will be charged with the marketing of recyclable materials in order to ensure Nova Scotia's environmental industries have a critical mass feedstock from domestic sources. These materials will be used to establish industries based on the processing of recyclables."[49]

**2001 situation:**

Between April 1, 1996 and March 31, 2001, the RRFB provided over $3.17 million in funding to industries and municipalities to promote value-added products from materials diverted from disposal and to support new businesses by funding research to develop local markets for waste resources in Nova Scotia.[50] In 2002 and 2003, RRFB provided another $2.8 million for value added assistance to businesses.

**Conclusion:** *Benefit achieved and ongoing.*

[46] NSDOE 1995, op. cit.
[47] RRFB. *Nova Scotia's Waste Diversion Accomplishments*. Available at www.rrfb.com/pages/Secondary%20pages/accomplishments.html. Accessed November 8, 2003.
[48] RRFB 2001, op. cit.
[49] NSDOE 1995, op. cit.
[50] M. Catherine McCarthy, RRFB, Personal communication, May 2004; RRFB 2002. *Champions for the Environment 2002 Annual Report*; and RRFB 2001, op. cit.

## 3.8 Projected Benefit 8: Diversion of 60-70% of Household Hazardous Waste

The strategy will involve diversion of 60 to 70 percent of household hazardous waste from disposal facilities.[51]

**2001 situation:**

While there are several municipal household hazardous waste (HHW) depots scattered across the province, there has been no major strategy undertaken by the province to divert HHW. The recent stewardship agreement with the paint industry to take back leftover paint for recycling should contribute to a reduction in HHW. NSDEL does not track HHW, and therefore there are no data to indicate how much has been diverted. The province initiated a paint stewardship program in 2002, thereby targeting the materials that contribute most to the HHW stream. As of 2004, RRFB Nova Scotia has provided $105,000 in funding for HHW depots and for paint swaps.

**Conclusion:** *Benefit not achieved but is being addressed through the paint stewardship program and establishment of HHW depots.*

## 3.9 Projected Benefit 9: Marketing Innovative Environmental Technologies

The innovative environmental technologies developed for use in Nova Scotia will be marketed to other jurisdictions that are facing the same challenges.[52]

**2001 situation:**

Nova Scotia companies have exported environmental technologies nationally and internationally. Examples include companies such as Remediation Inc., Dillon Consulting, and Vaughn Engineering, which have exported technologies to Serbia, various locations in the Caribbean, Russia, and throughout Canada.

**Conclusion:** *Benefit achieved and ongoing.*

## 3.10 Conclusions

Nearly all of the projected benefits forecasted through implementation of the Nova Scotia Solid Waste-Resource Management Strategy were either fully or mostly achieved. In several cases the forecasted benefits and targets were exceeded – for example, in the number of jobs created. The only projected benefit not yet addressed is the reduction of HHW. The following outstanding actions are required to meet 1995 targets:

[51] NSDOE 1995, op. cit.
[52] NSDOE 1995, op. cit.

1. Reduce HHW from disposal stations by 60-70%. Develop a monitoring system to track HHW.
2. Introduce a system to reprocess disposable diapers.
3. Reduce the number of landfills by a further 20% from 1995 levels (approximately 8 more) and ensure that remaining landfills meet second generation landfill guidelines by 2005.
4. Again achieve the 50% diversion goal, in part by increasing efforts in the Cape Breton and Southern regions, where diversion rates are lower than in other regions.

# 4. Statistical Comparisons – International, National, Provincial & Municipal

## 4.1 Introduction – Data Limitations

One of the most direct ways to assess the success of waste management systems is to examine waste generation, diversion and disposal data. This is especially relevant for Nova Scotia, given that one of the organizing principles behind the solid waste-resource system was a commitment to divert the amount of material being disposed of in landfills or through incineration by 50% by the year 2000. Comparing waste management data indicates how the Nova Scotia system measures up within Canada and within the international community.
In this section, statistical information is examined at the international, national, provincial (Nova Scotia regions), and municipal levels. Inter-provincial and international statistical waste comparisons are inherently problematic in that there is no existing national or international protocol to ensure accountability and conformity of data sources. In addition, at the international and national levels, the definitions of waste and reliability of data are inconsistent. Consequently, Nova Scotia waste data cannot be compared directly to international waste data. Within these data limitations, however, some effort can still be made to paint a general picture of how Canada compares to the international community, and how Nova Scotia compares to other Canadian provinces.

Assessments of how different regions within Nova Scotia compare to one another and how at least some Canadian municipalities compare to one another are more dependable and consistent. The statistical comparison of the different regions within Nova Scotia is more reliable than international and provincial comparisons because the data have been compiled by one source, NSDEL, and are based on Canadian Council of Ministers of the Environment (CCME) principles. In 1989, the CCME set a goal of 50% diversion of solid wastes from landfills by the year 2000. The 50% diversion is in relation to the amount of waste that was sent to landfills in 1989. Although provinces, municipalities, and countries often base their diversion rates on other criteria, such as percentage of total waste handled, in this study we accept the CCME calculation criteria for comparative purposes as the standard for Canada. The municipal statistics of Canadian communities presented here are comparable with those of HRM because they are based on the Generally Accepted Principles (GAP) model, which provides a framework for waste data evaluation that ensures uniform reporting among municipalities. Such common

frameworks, definitions and reporting mechanisms do not yet exist for provincial or international comparisons, and they have not yet been accepted by all Canadian municipalities, so the following comparisons are intended to be rough comparisons only.

## 4.2 International Comparisons

Internationally, the Organization for Economic Cooperation and Development (OECD) maintains the most comprehensive data source on waste management.[53] Although the OECD attempts to provide harmonized data across countries, definitions of municipal waste and surveying methods vary from country to country. The OECD indicators are intended as tools for performance evaluation and public information that can guide policy decisions.

While the OECD countries represent approximately 18% of the world's population, they are estimated to be responsible for 80% of total global waste generation.[54] Because they are clearly responsible for most of the environmental consequences of excessive waste generation, the OECD countries therefore carry the primary responsibility to reduce global waste output.

### *4.2.1 Waste generation and disposal*

Statistics Canada, through surveys, estimates the generation and disposal of waste from residential, C&D, and ICI sources.[55] The OECD provides estimates of municipal, industrial and hazardous wastes.[56] What is included in the municipal waste category varies among countries but generally includes household and commercial waste, including waste from offices, institutions, and small businesses that use the same disposal facilities as municipally collected waste. The OECD municipal solid waste figures for Canada do not include C&D wastes and do include all other waste disposed of, even if not collected by municipalities.

To complicate matters further, the OECD reporting years are different from those provided by Statistics Canada, so that some data referred to in OECD tables as 1997 data are in fact from 1996. However, the main problem in comparing Canadian figures to those of other industrialized countries is that the municipal waste category used by the OECD is not comparable to any of the categories used by Statistics Canada.[57] Because the OECD has made efforts to harmonize the international data for comparative purposes, the OECD statistics for Canada are used in the comparative tables and figures below, even though the numbers differ from Statistics Canada estimates for Canada. The largest per capita generators of waste, according to OECD statistics, are listed in Table 3.

[53] OECD 1999. *OECD Environmental Data Compendium 1999.* OECD Publications, France.
[54] Ibid. Percentage of global waste generation and waste generated in OECD countries is based on 1999 estimates. According to the *OECD Observer in Figures, Volume 2002 Supplement 1*, the total population of OECD countries is 1.1 billion. Available at www.oecd.org. According to the U.S. Bureau of the Census, International Database, the world population is 6.2 billion.
[55] Statistics Canada 2000, op. cit.
[56] OECD 1999, op. cit.
[57] Ibid.

According to Statistics Canada, in 1998 Canadians generated 311 kg per capita of residential waste and in 2000, 353 kg per capita.[58] If we include C&D waste, the figures increase to 437 kg per capita in 1998 and 476 kg per capita in 2000. According to the OECD, the per capita municipal waste generated by Canadians in 1997 was 490 kg.[59] Canada had the eleventh highest rate of waste generation of the OECD countries in 1997, which was slightly lower than the OECD average of 500 kg per capita (Table 3).

Canada's waste generation decreased significantly during the mid-1990s. As recently as 1990, Canada generated 630 kilograms of municipal waste per capita and was the third largest generator of municipal waste per capita in the OECD, behind only the U.S. and Australia.

**Table 3. Largest OECD per capita municipal waste generators**

| Country | kg generated per capita | kg composted or recycled per capita | kg disposed In landfills per capita | kg incinerated per capita |
|---|---|---|---|---|
| U.S. | 720 | 194 | 396 | 122 |
| Australia | 690 | N/A | N/A | N/A |
| Norway | 630 | 158 | 391 | 82 |
| Switzerland | 600 | 240 | 84 | 276 |
| Ireland | 560 | 510 | 510 | 0 |
| Iceland | 560 | 56 | 426 | 62 |
| Netherlands | 560 | 230 | 112 | 174 |
| Denmark | 560 | 162 | 67 | 325 |
| Austria | 510 | 230 | 163 | 82 |
| Hungary | 500 | — | 475 | 25 |
| **Canada** | **490** | **108** | **363** | **20** |
| OECD average | 500 | 98 | 276 | 90 |

Source: OECD 1999, op. cit., Tables 7.2A and 7.2C.

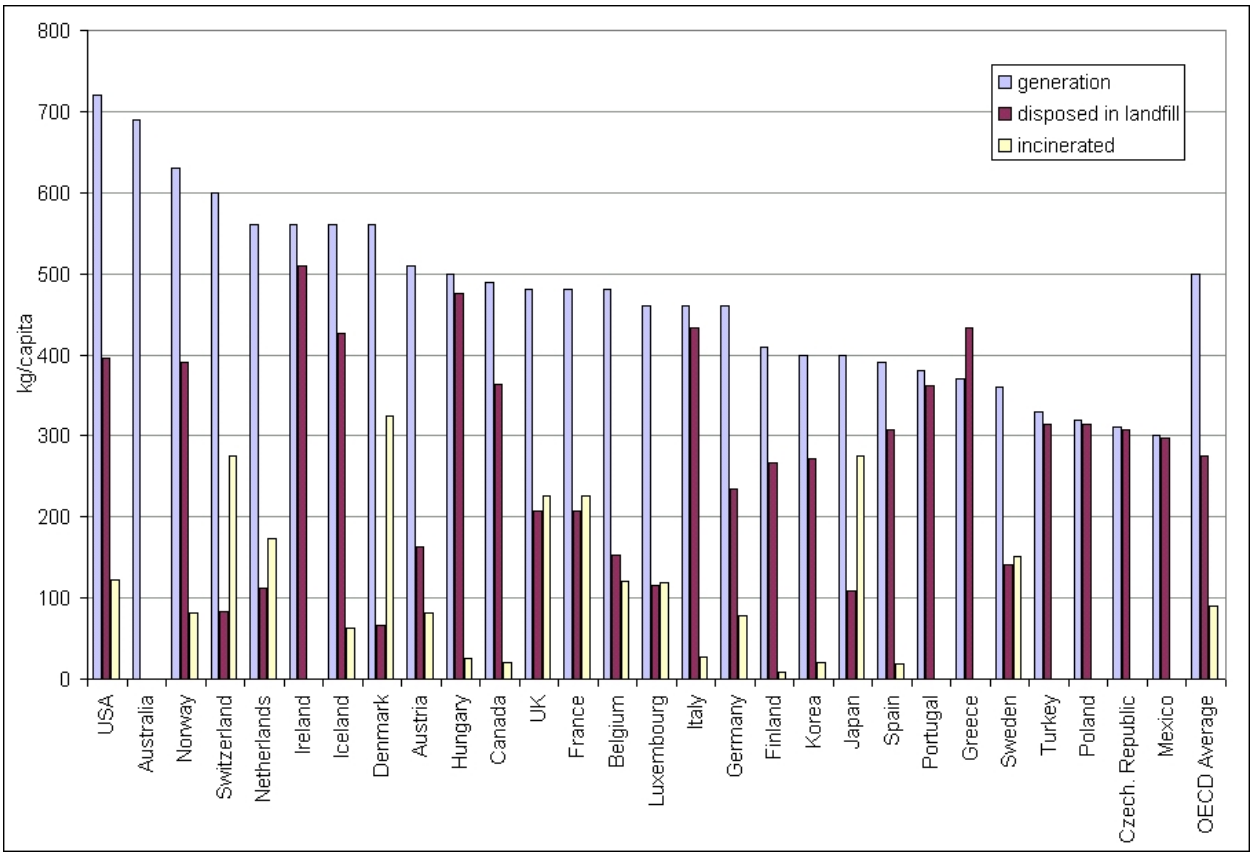
Note: The data on waste generation and disposal are from different years for different countries, depending on data available to the OECD. For Canada, the U.S., the Netherlands, Hungary, and Switzerland, data are from 1996; for France, 1995; and for Austria, Denmark, Iceland, Ireland, and Norway, data are from 1997.

Of the 490 kg per capita waste generated, according to the OECD, Canada recycled 108 kg/capita and disposed of 363 kg in landfills and 20 kg through incineration. Canada's per capita landfill disposal rate is 32% higher than the OECD average of 276 kg per capita, though its incineration rate is much lower (Figure 1). Although Statistics Canada does not provide data on amounts of waste sent to landfills and incinerators, OECD does show that Canada recycled 110 kg per capita in 1998 and 113 kg per capita in 2000. Lower levels of landfill waste disposal in

[58] Statistics Canada 2003. *Waste Management Industry Survey Business and Government Sectors 2000*. Catalogue no. 16F0023XIE, Tables 2.7 and 2.8. Per capita amounts calculated using a Canadian population of 30,248,400 in 1998 and 30,790,834 in 2000.
[59] OECD 1999, op. cit.

countries such as Switzerland, Denmark, Luxembourg, Japan, and Sweden can partly be attributed to high levels of incineration. Japan and Sweden, for example, incinerate 69% and 42% respectively of their waste while Canada incinerates less than 6%.[60]

**Figure 1. Municipal waste generation, disposal and incineration, OECD countries**




Source: OECD 1999. *Towards More Sustainable Household Consumption Patterns, Indicators to Measure Progress*; and OECD 2001. *OECD Environmental Indicators. Towards Sustainable Development*.

Note: Waste generation data are from 1997 OECD estimates. "Disposal" refers to landfill disposal only. Waste incineration estimates are from the mid-1990s. Landfill disposal and incineration data are from mid-1990s OECD estimates. Recycling, composting, incineration and landfill disposal figures are not available for Australia. Recycling, composting, incineration and landfill disposal figures for Turkey do not add up properly and are therefore not considered in this evaluation. Consequently, the OECD average disposal in landfill and incineration estimates do not include Turkey or Australia. Because Figure 1 uses a different OECD source than Table 3, the figures do not match exactly, although they are fairly close.

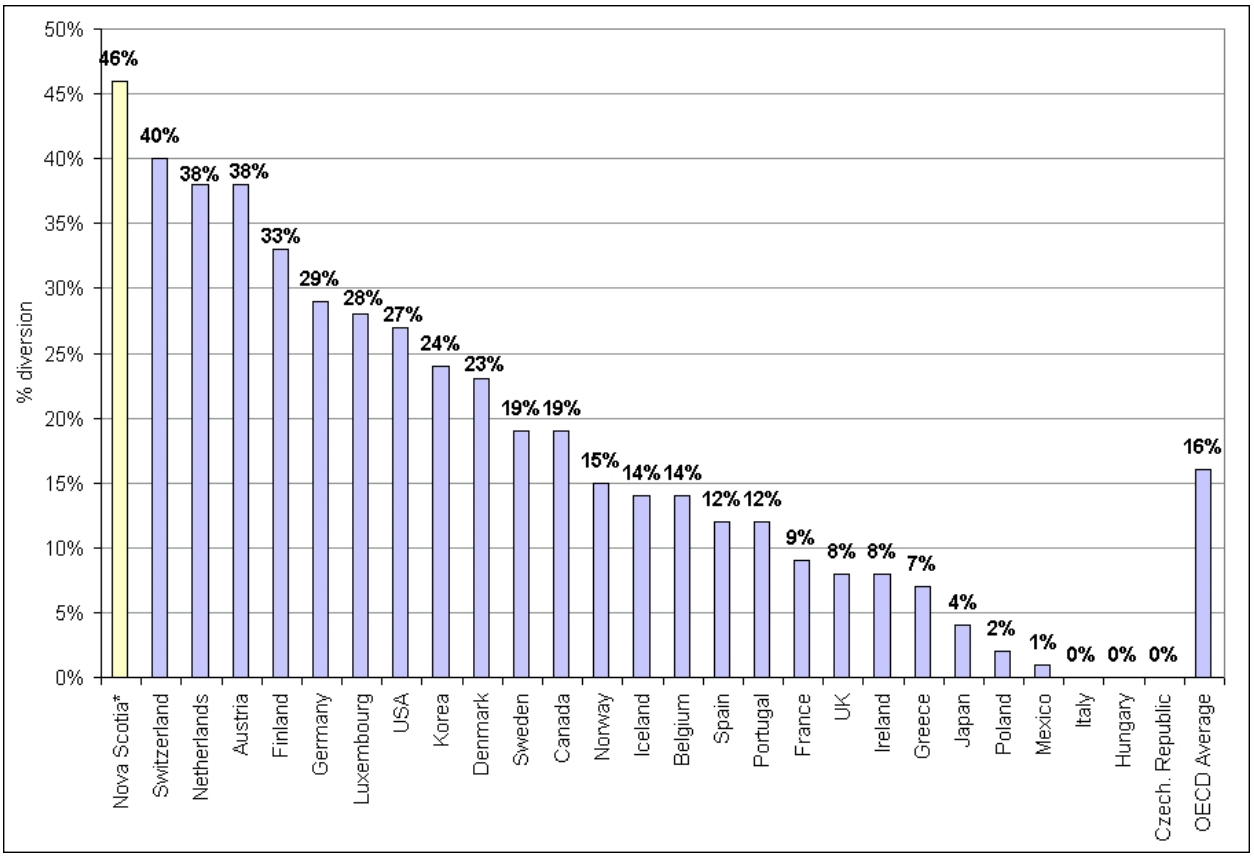
### *4.2.2 Waste diversion*

The OECD waste diversion estimates (Figure 2) are based on the percentage of total waste generated that is recycled and composted. The percentage of diversion in OECD countries ranges

[60] OECD, October 1999. *Towards More Sustainable Household Consumption Patterns, Indicators to Measure Progress*, Working Group on the State of the Environment. Waste incineration estimates are from the mid-1990s.

from a high of 40% in Switzerland to a low of 0% in Italy, Hungary, and the Czech Republic. Canada, with a diversion rate of 19%, ranks slightly above the OECD average of 16%.[61] Using fiscal year 2000-01 data as a basis for comparison, Nova Scotia's 46% diversion rate ranks higher than all the OECD nations.[62]

**Figure 2. Municipal waste diversion from recycling and composting, OECD countries**




Sources: OECD 2001. *OECD Environmental Indicators 2001: Towards Sustainable Development*; and NSDEL 2001. *Waste Diversion Calculations*.

Note: OECD estimates for waste generation are from 1997. The percentages of waste recycled and composted are from the mid-1990s. *The Nova Scotia estimate is based on NSDEL and HRM waste data from 2000-01. Nova Scotia comparison is subject to the major caveats noted in the text and is presented for illustrative purposes only in order to indicate that Nova Scotia is among the leaders in waste diversion internationally.

However, it is important to note that comparisons between Nova Scotia and OECD diversion rates cannot be taken literally, given both the discrepancy in waste data calculation methods and the difference in reporting years, and the Nova Scotia comparison is presented in Figure 2 for illustrative purposes only. Also, the Nova Scotia diversion rate is based on diversion of waste from landfills compared to the amount of waste sent to landfills in 1989. The OECD diversion data are from the mid-1990s, at which time Nova Scotia diverted less than 10% of its waste from

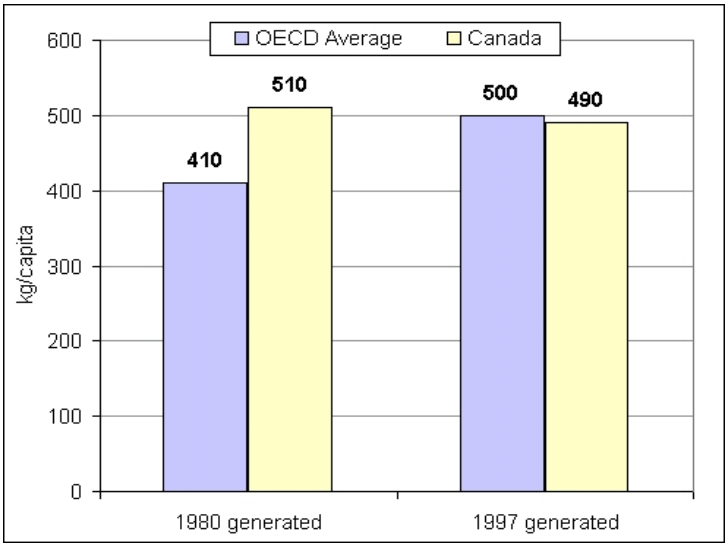
[61] OECD 2001. *OECD Environmental Indicators 2001: Towards Sustainable Development,* op. cit.
[62] NSDEL 2001. *Nova Scotia Waste Diversion Calculations (April 1, 2000 to March 31, 2001)*.

landfills. In addition, the OECD lacks an international protocol for reporting. OECD estimates include three categories of waste: municipal, industrial, and nuclear, with the sources for each of these waste streams varying according to country.

Despite these major caveats, a comparison between Nova Scotia and the OECD countries is useful to demonstrate that Nova Scotia is now among the leaders in waste diversion internationally, though other countries have undoubtedly also improved their waste diversion rates since the mid-1990s.

Whereas there was a 22% increase in the OECD average waste generation between 1980 and 1997 (Figure 3), Canada's waste generation decreased by 4% over the same period.[63] In 1997, Canada's per capita waste generation was slightly below the OECD average. Canada's decrease in waste generation is largely due to the implementation of the National Packaging Protocol[64] and the introduction of recycling and composting programs in the early 1990s.

**Figure 3. Municipal waste generation trends, OECD and Canada, 1980 and 1997**




Source: OECD 1999, op. cit., Table 7.2A.

## 4.3 Canada – National & Provincial Waste Data Comparisons

Canada has long been one of the largest per capita waste producers in the world. From 1980 until 1990, municipal waste generation per Canadian increased by 24%. During the 1990s, however, due to environmental contamination from landfills and increasing public pressure against the placement of landfills and incinerators in local communities, dealing more effectively with waste became a pressing issue for all levels of government. Governments and the public began to recognize the need to give priority to waste management and waste reduction strategies.

[63] OECD 1999, op. cit., Table 7.2A.
[64] For more information on the National Packaging Protocol, see Appendix B of this report.

Consequently, the 1990s marked an end to Canada's trend of increasing waste generation and disposal and arguably the beginning of a revolution in how we deal with and think about waste. Between 1990 and 1997, there was a 22% decline in municipal waste generation per capita in Canada.[65]

In the late 1980s, two key national initiatives marked a transition in how Canadians viewed solid waste. The first was a commitment by provincial Environment Ministers to divert 50% of solid waste from landfills by the year 2000. The second was the introduction of a national packaging protocol, which committed industry to reduce packaging by 50% (by weight), also by 2000.

At the same time, the introduction of municipal recycling and composting programs reduced waste disposal in some provinces, though increases in Quebec and Alberta cancelled out the gains elsewhere. Table 4 indicates that within Canada, success with waste reduction has varied dramatically from province to province. Nova Scotia is the only province that achieved the 50% waste diversion target established by the CCME in 1989. At 356 kg per capita, Nova Scotia's rate of municipal waste disposal was the lowest in the country in December 2000, and represented a 50% decrease from 1989. A waste diversion rate of 394 kg per capita for the 2000-01 fiscal year represented a 46% decrease from 1989 levels, according to Nova Scotia diversion calculations. According to Statistics Canada's *Waste Management Industry Survey*, Nova Scotia disposed of 459 kg per capita of total waste in 2001, including waste from residential, C&D, and ICI sources.

The information on waste disposal per capita in Table 4 is from Statistics Canada and does not correlate with the OECD information in Figure 3 because of differences in the definition of waste stream categories and in methods of calculation.

According to Statistics Canada, Nova Scotia's per capita waste disposal was slightly higher than the Canadian average in 1994. By 1996, the year Nova Scotia implemented its Solid Waste-Resource Management Strategy, the province had the lowest per capita waste disposal rate in the country – 14.6% lower than the Canadian average and 4% lower than the province with the next lowest per capita disposal rate, British Columbia.[66] The gap between Nova Scotia and other provinces continued to widen after implementation of the plan, and by the year 2000, Nova Scotia's waste disposal rate was 39% below the Canadian average and 27% below the next lowest province, New Brunswick.[67]

Between 1994 and 2000, waste disposal per capita in Nova Scotia decreased by 40%, by far the sharpest decline in the country. The next highest rates of decrease were in New Brunswick, British Columbia, and Saskatchewan, which decreased their per capita waste disposal rates by 18%, 16%, and 11% respectively. During this same period, the Canadian average increased by 2%, largely due to increases in waste disposal per capita in Quebec (32%) and Alberta (6%) (Figures 4 and 5).

[65] OECD 1999, op. cit., Table 7.2A.
[66] Statistics Canada 2000, op. cit., Table 2.1.
[67] Statistics Canada 2003, op. cit.

**Table 4. Per capita waste disposal for selected provinces, 1994-2000[68]**

| Province | Kilograms disposed per capita | | | | % change |
|---|---|---|---|---|---|
| | 1994 | 1996 | 1998 | 2000 | 1994-2000 |
| Newfoundland | 840 | 673 | 671 | 762 | -9% |
| Nova Scotia* | 760 | 595 | 537 | 459 | -40% |
| New Brunswick | 760 | 672 | 623 | 625 | -18% |
| Quebec | 710 | 754 | 755 | 936 | +32% |
| Ontario | 670 | 623 | 612 | 640 | -4% |
| Manitoba | 840 | 836 | 848 | 819 | -3% |
| Saskatchewan | 910 | 883 | 827 | 811 | -11% |
| Alberta | 860 | 876 | 869 | 914 | +6% |
| British Columbia | 760 | 622 | 614 | 638 | -16% |
| Canada Average | 730 | 697 | 688 | 746 | +2% |

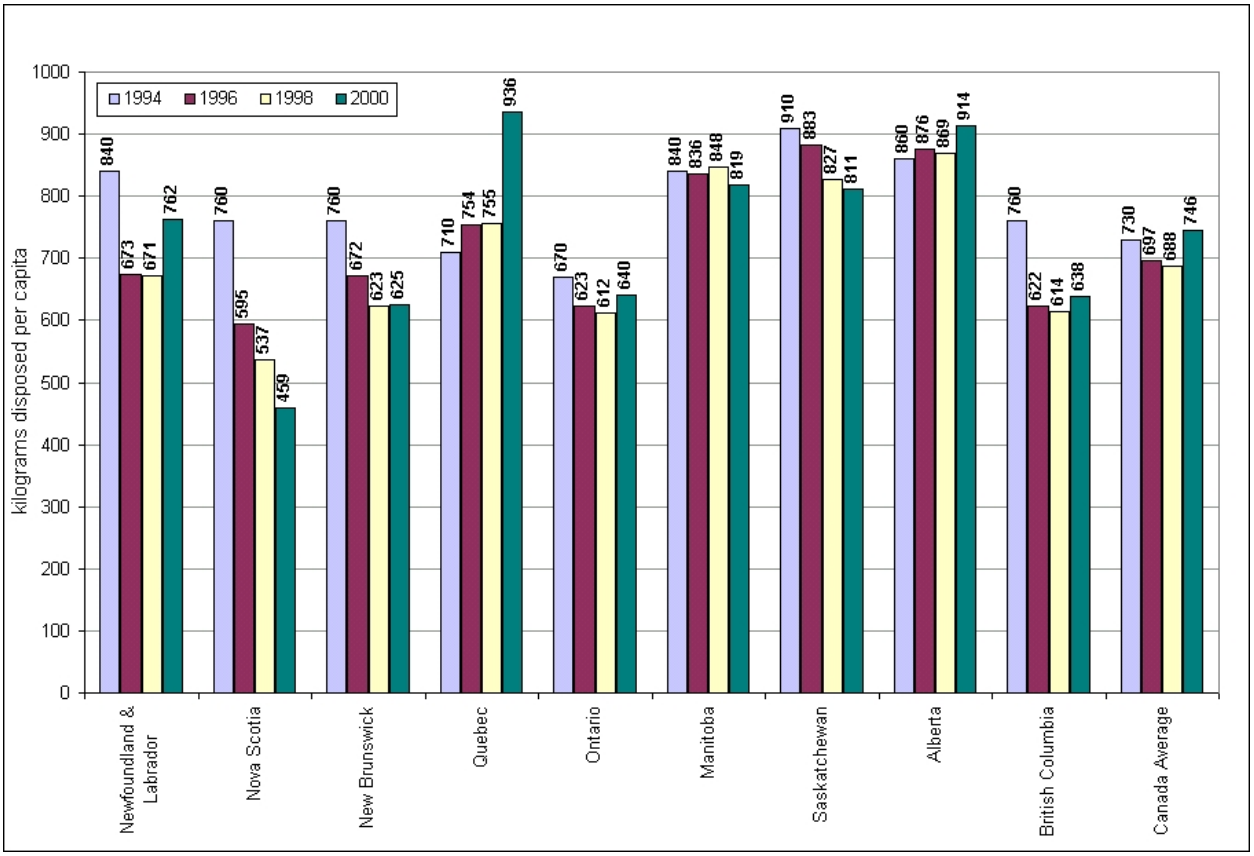
Sources: Statistics Canada 2000, op. cit.; and Statistics Canada 2003, op. cit.

Notes: Data for Prince Edward Island, Yukon and Northwest Territories were suppressed to meet the confidentiality requirements of the *Statistics Act*. Data for Quebec are based on a different survey method and are not necessarily comparable to other provinces. Disposal data are from all sources: residential, C&D, and ICI and are thus higher than the Nova Scotia figures for municipal waste.

* The decrease listed for Nova Scotia is based on fiscal year reporting. The 50% decrease in waste disposal cited elsewhere in this paper is based on percent decrease since 1989 and was only accomplished for one reporting period, December 31, 2000. The figures in Table 4 are not comparable to the 46% diversion figure cited elsewhere, which is the rate of decrease in landfill disposal between 1989 and 2001.

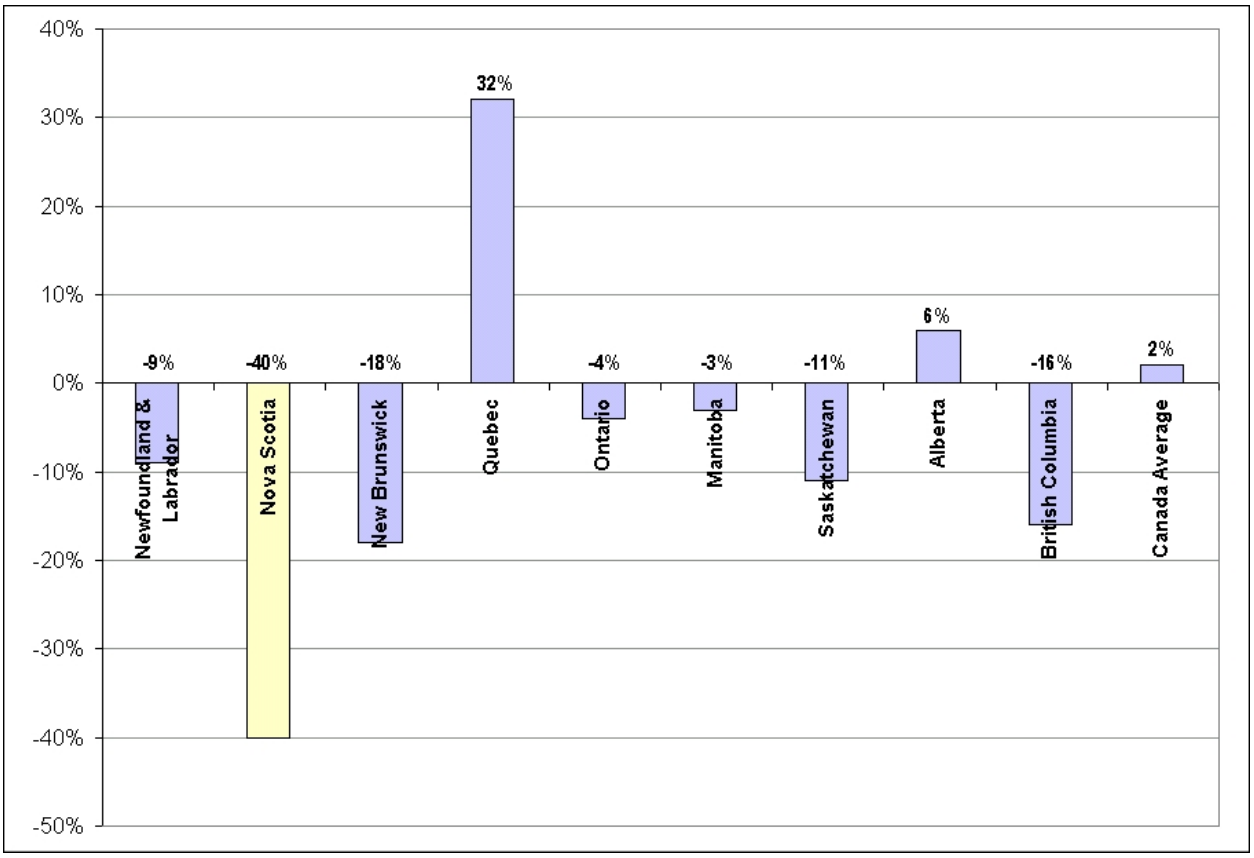
[68] While Nova Scotia was the first province to have achieved the target of 50% diversion of solid waste according to CCME criteria, many other regions have introduced new waste diversion programs and have achieved high diversion rates. Some jurisdictions have claimed diversion rates higher than Nova Scotia, but have used different methods to calculate their diversion rates. Edmonton, for example, has constructed one of the largest municipal composting facilities in the world and has claimed diversion rates of 75%. However, the Edmonton calculations do not follow CCME criteria. For example, Edmonton's diversion rate includes only residential waste and is not based on 1989 disposal rates. PEI introduced a composting and recycling system in 2002 that is similar to that used in Nova Scotia and claims a current diversion rate of 66%. According to Garth Simmons, PEI Department of Environment and Energy (personal communication, April 2004), PEI achieved a 54% rate of diversion in 2000. Simmons claims that PEI "achieved the 50% diversion rate in the year 2000 regardless of how it is calculated." However, PEI calculations are based on percentage of total waste handled and include waste that is incinerated to create energy as a form of diversion. Detailed PEI data comparing current diversion rates to that of 1989 are not available for analysis and therefore the PEI calculations do not meet CCME criteria and are not comparable to those of Nova Scotia. The PEI waste-to-energy incinerator burns 30 kilotonnes of municipal waste per year, with the resulting steam being used to run a district hot water heating system. For more information on the PEI system, see: www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/factsheet_charlottetown_pei_district_heating_system_e.html. According to NSDEL's Barry Friesen (personal communication, May 2004), CCME criteria do not support incineration, with or without energy recovery, as a form of diversion. While the issue of incineration is beyond the scope of this report, Friesen provides three arguments against incineration as a form of solid waste diversion. First is the question of energy efficiency. Because of their chemical makeup, waste-to-energy incinerators require extensive emissions control and this takes a lot of energy from the fuel that is being expended. As such, very little net energy is recovered from the incinerator. Secondly, incineration of municipal waste is highly dangerous to the environment because of the dioxins and furans that are emitted. These substances are so dangerous that they are slated for virtual elimination under the Canadian Environmental Protection Act, the federal Toxic Substances Management Policy, and the CCME Policy for the Management of Toxic Substances. Third, incineration does not capture the energy already spent in making a product. While plastic yields a high amount of energy when incinerated, two to four times the energy available has already been expended in making the plastic. When this energy is taken into consideration, the energy efficiency for incinerating plastics would be only about 4 to 7%.

**Figure 4. Waste disposed per capita, Canada and provinces, 1994-2000**




Sources: Statistics Canada 2000, op. cit.; and Statistics Canada 2003, op. cit.

**Figure 5. Change in percent diversion of waste, Canada and provinces, 1994-2000**




Sources: Statistics Canada 2000, op. cit.; and Statistics Canada 2003, op. cit.

## 4.4 Nova Scotia Diversion Rates

### *4.4.1 The local story*

As noted, in 1989, the CCME established a target to reduce waste disposal per capita by 50% from 1989 levels by December 31, 2000. This target has become the benchmark for waste-resource management strategies across Canada. By this means of calculating diversion rates (comparison with 1989 disposal rates as the baseline), Nova Scotia was the only province to achieve this target in 2000, and remains closest to maintaining the target, with a diversion rate of 46% in 2001.

NSDEL uses the official CCME definition of solid waste: "any material, product, or by-product for which the generator has no further use and which is discarded for management at waste disposal facilities. This definition excludes wastes that are associated with primary resource extraction or harvesting, conventional air pollutants and liquid effluents that may be discharged from processing or manufacturing sites and soil as a result of contaminated sites clean-up

programs."[69] Examples of wastes included in and excluded from this definition of waste are listed in Table 5.

Waste disposal in 1989 totalled 641,375 tonnes, or 0.726 tonnes (726 kg) per capita. The challenge for Nova Scotia, therefore, using 1989 as a base year, was to create a system that would divert a minimum of 0.363 tonnes (363 kg) per capita per year within a four-year period.[70]

**Table 5. Examples of wastes included in and excluded from CCME/NSDEL definitions of "waste"**

| Waste type | Included | |
|---|---|---|
| | Yes | No |
| Municipal sewage sludge and septage | ✓ | |
| Industrial sludge | | ✓ |
| Fish wastes from processing or use as fertilizers | | ✓ |
| Farm manure | | ✓ |
| Market garden waste | | ✓ |
| Tree prunings (including orchard) | | ✓ |
| Rubble (man-made materials) | ✓ | |
| Aggregates (gravel, rocks) | | ✓ |
| Mineral – mine or mill tailings | | ✓ |
| Soil – clean or contaminated | | ✓ |
| Wood pallets | ✓ | |
| Auto hulks/metals | ✓ | |
| Virgin land clearing waste (from lumbering or other resource based industry) | | ✓ |
| Land clearing waste (from construction and demolition, farm clearing and highway construction) | ✓ | |
| Lead acid batteries and household hazardous wastes | ✓ | |
| Liquid wastes | | ✓ |
| Primary resource based waste | | ✓ |

Source: NSDOE 1999. *Nova Scotia Solid Waste Resource Recovery Semi-Annual Report, September 1999.*

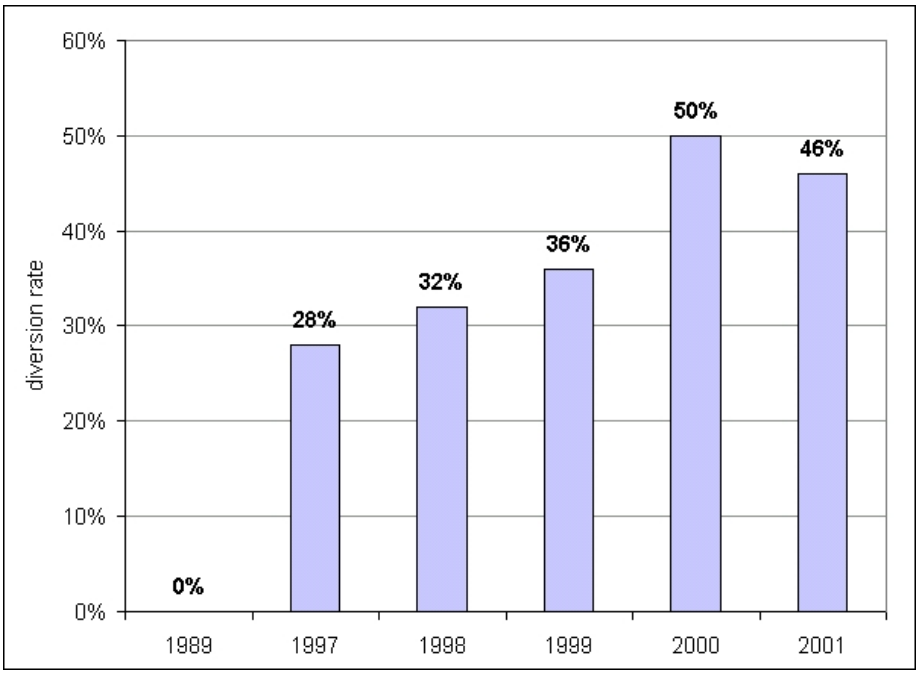
Note that diversion rates are based upon the amount of waste diverted in relation to the amount of waste sent to final disposal (landfills or the CBRM incinerator) in 1989, and are calculated on a per capita basis. Before 2001, the rates were calculated every six months. After 2000, the rates were calculated based on the fiscal year, which ends March 31. For example, NSDEL calculates the waste diversion rate for the 2000-01 fiscal year as the percent difference in waste sent for final disposal between the 2000-01 fiscal year (0.394 tonnes per capita) and the waste sent for

[69] NSDOE 1999. *Nova Scotia Solid Waste Resource Recovery Semi-Annual Report, September 1999.* Based on the CCME definition defined in *Study of The National Solid Waste Inventory 1994,* prepared for the CCME Solid Waste Management Task Group by SENES Consultants Limited, August 1995.
[70] NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 2000 to March 31, 2001).*

final disposal in the 1989 calendar year (0.726 tonnes per capita). The 2000-01 fiscal year waste diversion rate therefore equals 46%.[71] Figure 6 below indicates the tonnes of waste diverted per capita in Nova Scotia from 1997 to 2001.

Nova Scotia successfully met the 50% target by diverting 0.37 tonnes per capita in the second half of 2000, a waste diversion rate of 51% per capita of 1989 levels (Figure 6). In 2000-01, however, Nova Scotians diverted only 0.34 tonnes per capita, a 46% reduction of 1989 levels.[72]

**Figure 6. Estimated tonnes diverted per capita in Nova Scotia, 1997-2001, as percentage of waste disposed in 1989**




Source: NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 2000 to March 31,2001)*.

Note: 1989 refers to the calendar year, whereas 1997-2001 refer to fiscal years. The fiscal year runs from April 1-March 31. For example, the fiscal year 2001 runs from April 1, 2000-March 31, 2001.

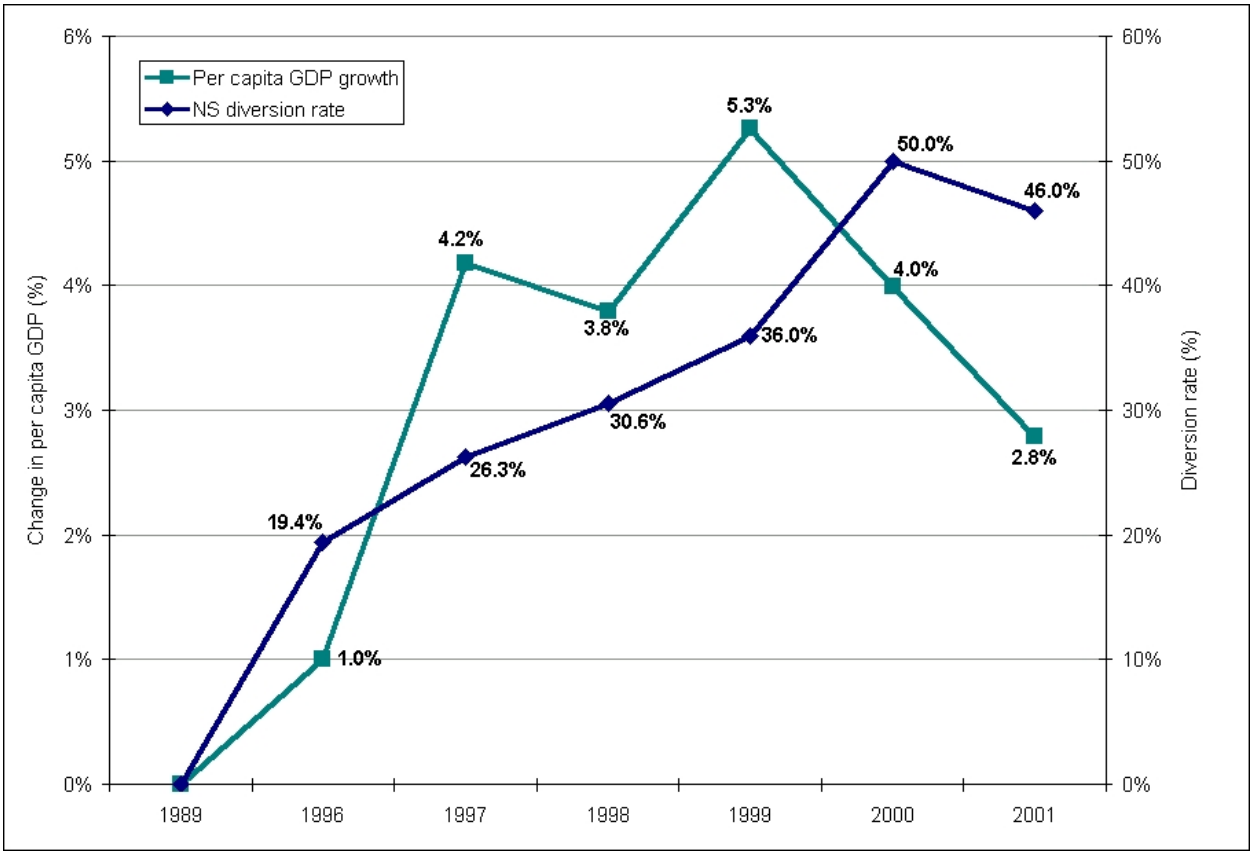
The decline in diversion in the 2000-01 fiscal year could be due in part to higher rates of consumption and therefore greater waste generation, resulting from increased economic growth.[73] However, when one looks at annual changes in GDP per capita in relation to diversion rates, the correlation is not a direct one. The annual rate of GDP growth per capita was greater between 1998 and 1999 (5.3%) and between 1999 and 2000 (4.0%) than it was between 2000 and 2001 (2.8%) when the diversion rate fell (Figure 7). GDP growth per capita increased again to 4.1% between 2001 and 2002, while the diversion rate for 2001-02 held steady at 46%.[74]

[71] Ibid.
[72] Ibid.
[73] Statistics Canada 2002. *Gross domestic product, expenditure based, at 1997 prices. Provinces and territories*. Available at www.statcan.ca.
[74] NSDEL 2003. *Status Report 2003*. Available at www.gov.ns.ca/enla/emc/wasteman.

*Overall* per capita GDP in Nova Scotia has actually grown steadily since 1996, from $20,967 in 1996 to $22,671 in 1998 to $24,815 in 2000 to $26,568 in 2002, signifying increased per capita consumption, which in turn may lead to increased waste generation.

However, this is clearly not the whole story, with many factors at play. For example, early gains in waste diversion are likely to be larger than later gains, as materials become increasingly difficult to recycle. There is also a wide disparity in diversion rates among different regions within Nova Scotia. Further study is clearly needed to assess why Nova Scotia as a whole has not continued to make gains in waste diversion since 2000.

**Figure 7. Annual changes in per capita expenditure-based gross domestic product and diversion rates**




Source: GDP figures: *Statistics Canada Expenditure-Based GDP*, Table 384-0002. Available at www.statcan.ca. Accessed November 2003.

Nova Scotia is divided into seven Solid Waste-Resource Management Regions, as shown in Table 6. Each region sends annual reports to the NSDEL, which then calculates diversion rates for each region. These are calculated in the same way as the provincial rates, i.e., in comparison to the total amount of waste per capita disposed in landfills or incinerated in 1989.

**Table 6. Nova Scotia Solid Waste-Resource Management Regions**

| | |
|---|---|
| **Region 1: Cape Breton**<br>Cape Breton Regional Municipality, Inverness, Victoria, Richmond & Port Hawkesbury | **Region 5: Valley**<br>The Municipalities of Annapolis, Kings, Berwick, Bridgetown, Hantsport, Kentville, Middleton and Wolfville |
| **Region 2: Eastern**<br>Municipality of the District of Guysborough<br>Municipality of the County of Antigonish<br>Municipality of the Town of Antigonish<br>Pictou County | **Region 6: South Shore/West Hants**<br>Towns of Shelburne, Lockeport, Bridgewater, Lunenburg, Mahone Bay and Windsor<br>Municipality Districts of West Hants, Chester, Lunenburg, Queens Region and Shelburne |
| **Region 3: Northern**<br>The Municipality of the County of Colchester<br>The Municipality of East Hants<br>Cumberland County | **Region 7: Western**<br>Town and County of Digby, Clare, Argyle, Town of Yarmouth, District of Yarmouth, Barrington, Clark's Harbour |
| **Region 4: Halifax**<br>Halifax Regional Municipality | |

Within Nova Scotia, HRM achieved the highest diversion rate: 59% in the 2000-01 fiscal year, compared to amounts disposed in 1989. In the 2001-02 fiscal year, HRM's diversion rate stood at 58%. Only HRM and the Annapolis Valley regions successfully attained the 50% waste diversion target in the 2000-01 fiscal year. These two regions, however, represent almost 50% of the population of Nova Scotia. Several areas *within* other regions also attained at least 50% waste diversion compared to 1989 disposal levels. These areas include East Hants, Lunenburg (Municipal District and towns within Lunenburg County), and Queen's Regional Municipality. Cape Breton had the lowest waste diversion rate per capita in the province at 25%, followed by the Western region at 27% per capita (Figure 8).[75]

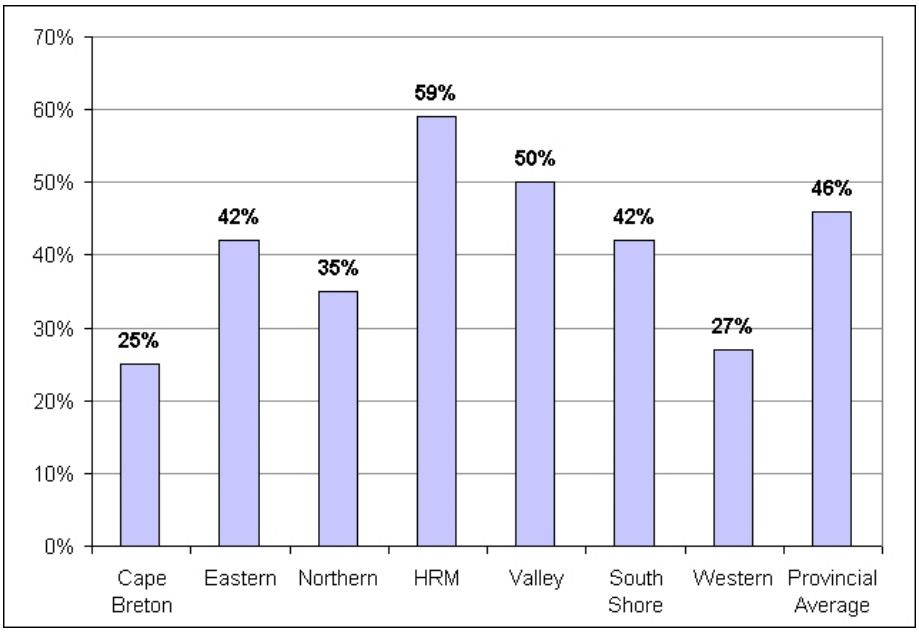
In assessing comparative diversion rates, it is important to distinguish relative from absolute levels of diversion. On a *relative* basis, HRM in 2001 had the highest diversion rate in the province in relation to 1989 levels. However, the Annapolis Valley actually disposed of less waste per capita on an *absolute* basis in 2001. In fact, many regions argue that HRM's success in achieving such a high diversion rate over 1989 levels is partly due to its high level of waste disposal in 1989. For example, to meet its 50% waste diversion target over 1989 levels, the HRM region was required to reduce waste per capita to at least 0.42 tonnes. In contrast, the Western region, which had the lowest waste disposal level in 1989, had to reduce waste disposal to 0.28 tonnes per capita to attain 50% waste diversion. In other words, the use of 1989 benchmarks to assess comparative diversion rates may create a skewed picture of actual levels of current success, as each region's benchmark is different.

To place all regions on an equal footing in terms of *absolute* amounts of waste diverted per capita, Figure 9 indicates the amount of waste disposed per capita in 1989 and 2001. The Annapolis Valley achieved the best results in the province in terms of absolute reductions in waste disposed between 1989 and 2001. The South Shore, including Lunenburg County, tied with HRM for second place. The gap between HRM and the Western, Northern, and Eastern

[75] NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 2000 to March 31,2001).*

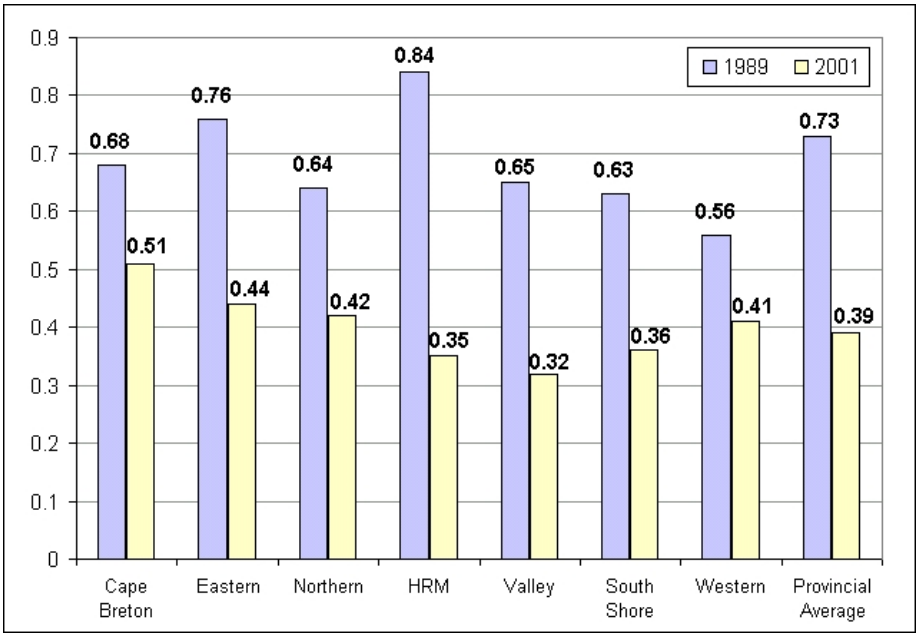
regions is much narrower when absolute quantities of waste are considered, rather than percentages diverted in relation to 1989 disposal levels.

**Figure 8. Waste diversion rates in Nova Scotia Solid Waste-Resource Management Regions in 2001, in relation to total amounts disposed in each Region in 1989**




Source: NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 2000 to March 31,2001).*

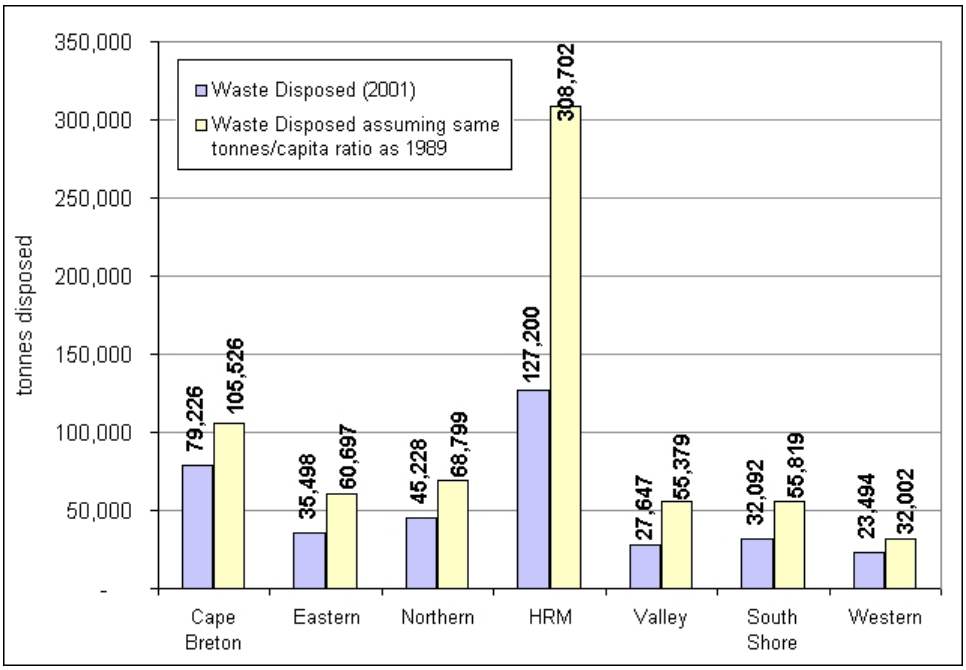
**Figure 9. Estimated waste disposed by Nova Scotia Solid Waste-Resource Management Region, 1989 and 2001 (tonnes per capita)**




Source: NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 2000 to March 31,2001).*

If Nova Scotia had continued to dispose of the same amount of waste per capita in 2001 as it did in 1989, it would have sent almost 700,000 tonnes of waste to landfills in 2001. The actual amount of waste disposed in Nova Scotia in 2001 was just over 370,000 tonnes, a savings of nearly 330,000 tonnes.[76] Figure 10 compares total waste actually disposed in various regions of Nova Scotia in 2001 with waste that would have been disposed had per capita waste disposal rates remained at 1989 levels. Had Nova Scotia continued to dispose of waste at 1989 levels (0.73 tonnes per capita), it would have sent an *additional* 1.1 million tonnes of waste to landfills between 1996 and 2001.[77]

**Figure 10. Total waste disposed in Nova Scotia in 2001 compared to the amount that would have been disposed had per capita waste disposal remained at 1989 levels**




Source: NSDEL 2001. *Nova Scotia Diversion Calculations (1996-97 to 2000-01).*

## 4.5 Municipal Waste Generation and "GAP"

It is extremely difficult to compare diversion numbers between jurisdictions in different provinces and countries because of an array of different approaches to measuring and reporting waste generation figures. For example, some municipalities include disposal of large appliances and furniture, as well as curbside collection of waste from commercial establishments and multiple unit dwellings, while others do not. This lack of consistency in measurement methods

[76] NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 2000 to March 31, 2001).*

[77] This report recognizes that factors other than Nova Scotia's own waste management strategy, such as the National Packaging Protocol, contributed to Nova Scotia waste diversion during this period, since less waste was generated. We use this example to highlight the large amount of cumulative waste that would have been disposed if the 1989 per capita rate of waste disposed had remained constant.

has made it very difficult to compare or aggregate municipal, provincial, and even federal waste generation and diversion data.

In early 2000, a non-profit organization called Corporations Supporting Recycling (CSR) established a Canada-wide group to examine municipal waste flow and diversion statistics in an effort to apply standardized principles and practices to measuring waste flow. The result was the development of "Generally Accepted Principles" (GAP), which is a measurement protocol that ensures a consistent format for measuring and reporting waste flow and waste diversion data at the residential level.[78] The main challenge facing the GAP model is its inability to record subtle differences in waste management systems. In addition, the GAP model is a measurement and reporting tool, and does not include a process to verify the data provided by municipalities.[79] According to the GAP protocol, municipal solid waste is "any material for which the generator has no further use and which is managed at waste disposal, recycling, or composting sites."[80]

Table 7 shows categories included in and excluded from the GAP definition of municipal solid waste. The GAP figures for amounts of waste disposed exclude C&D wastes, which are estimated to be about 30% of the HRM waste stream. Also excluded are wastes from ICI sector and from resource extraction, some of which are included in the HRM figures. For these reasons, the GAP estimates are not directly comparable to those of HRM. However, the usefulness of the GAP estimates is that they allow us to make comparisons among some Canadian municipalities (Figure 11). Use of the GAP protocol is currently confined largely to Ontario and Alberta municipalities, but it will hopefully be adopted more widely over time. HRM is still the only region in Nova Scotia to report according to the GAP protocol.

Although many municipalities have still not endorsed the GAP protocol, the number of participating municipalities is growing, allowing for more consistent municipal waste generation comparisons. It is assumed that most municipalities that participate in the GAP protocol have waste management plans in place, so the GAP diversion numbers are not indicative of Canada as a whole. In fact, the municipalities reporting waste generation, diversion and disposal statistics according to GAP are likely among the leaders of waste management in the country. For this reason, the waste generation and diversion statistics in Figures 11-14 may be assumed to be much better than Canadian averages.

The average residential waste generation for municipalities with available GAP statistics is 374 kg per person per year, 259 kg or 69% of which is disposed of in landfills.[81] As mentioned above, these estimates are considerably lower than those presented earlier because they leave out C&D and resource extraction wastes. Based on calculations by NSDEL, the HRM disposal rate was 350 kg per capita, when construction and demolition and resource extraction wastes are included.[82]

[78] CSR 2001. *Introduction to "GAP" – A Protocol to Measure Municipal Solid Waste Flow.* Available at www.csr.org.
[79] Maria Kelleher, CSR. Personal communication, 2002.
[80] CSR 2001, op. cit.
[81] CSR 2001, op. cit. The information compiled for this report includes only those municipalities which had a complete data set that was accessible through the web site (www.csr.org) in November 2001.
[82] NSDEL 2001. *Nova Scotia Diversion Calculations (April 1, 2000 to March 31, 2001).*

**Table 7. Categories included in and excluded from the GAP definition of "municipal solid waste"**

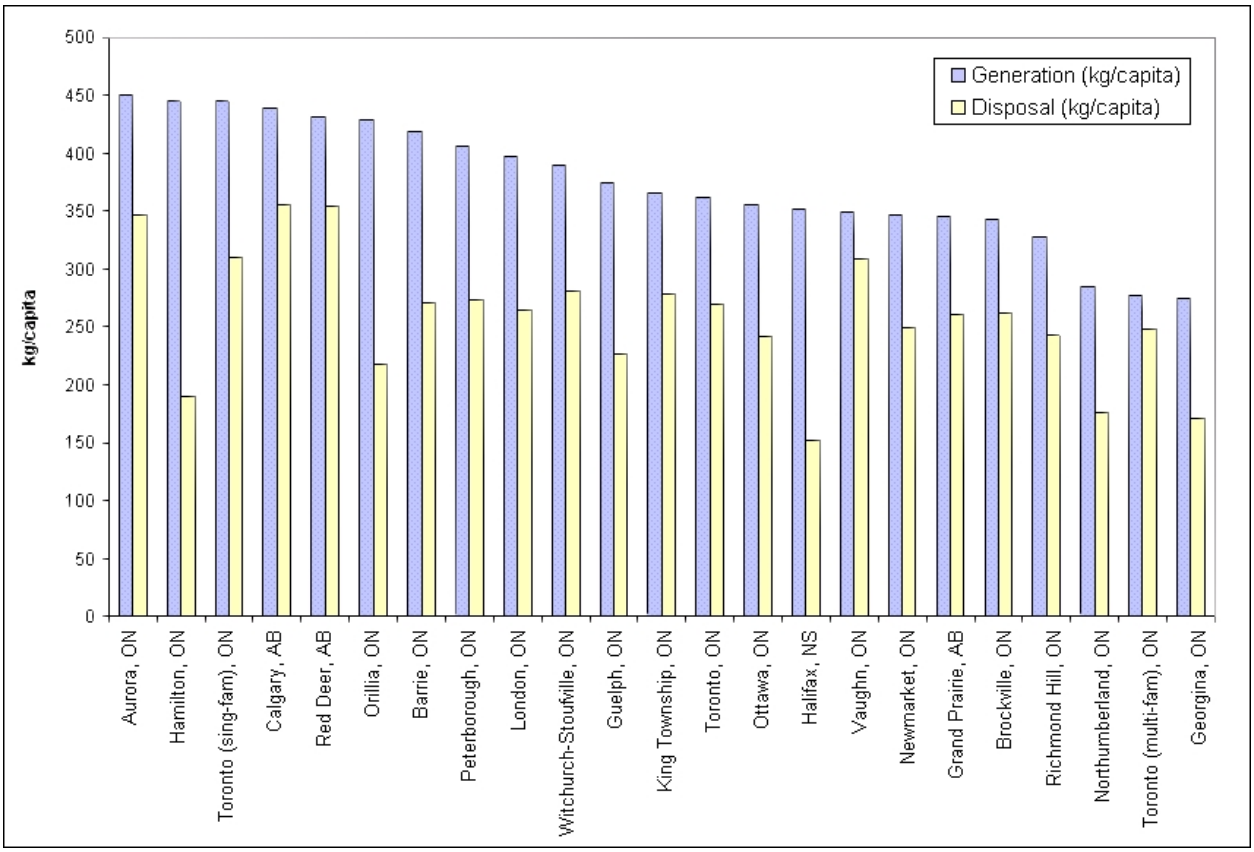
| Category | Included | Excluded | Included, but separate category |
|---|---|---|---|
| Wastes associated with primary resource extraction or harvesting | | ✓ | |
| Agriculture wastes | | ✓ | |
| Mining wastes | | ✓ | |
| Conventional air pollutants | | ✓ | |
| Liquid effluents discharged from manufacturing sites | | ✓ | |
| Clear or contaminated soil used as landfill cover | | ✓ | |
| Nuclear wastes | | ✓ | |
| Liquid and hazardous wastes | | ✓ | |
| Auto hulks | | ✓ | |
| Pathological wastes | | ✓ | |
| Gaseous wastes | | ✓ | |
| Gravel and rocks | | ✓ | |
| Residential waste managed on-site (back-yard composting) and off-site | ✓ | | |
| Industrial, commercial and institutional waste that is managed off-site | ✓ | | |
| C&D waste disposed of at municipal landfills | | | ✓ |
| Biosolids from municipal waste treatment that are managed at landfill sites | | | ✓ |

Source: CSR 2001, op. cit.

When C&D and resource extraction wastes are excluded, according to the GAP protocol, HRM GAP figures indicate an annual residential **waste generation rate** of 351 kg per person. This is 6% below the average for municipalities reporting according to the GAP protocol. HRM's **landfill disposal rate** of 152 kg per person, however, is the lowest disposal rate among all the GAP-reporting municipalities and is 41% below the GAP reporting group average of 259 kg per person. The municipality with the next lowest amount of waste disposal per person is the municipality of Georgina, Ontario, with an average of 171 kg (Figure 11).[83]

[83] CSR 2001, op. cit.

**Figure 11. GAP estimates of generation and disposal of waste per capita, selected Canadian municipalities**



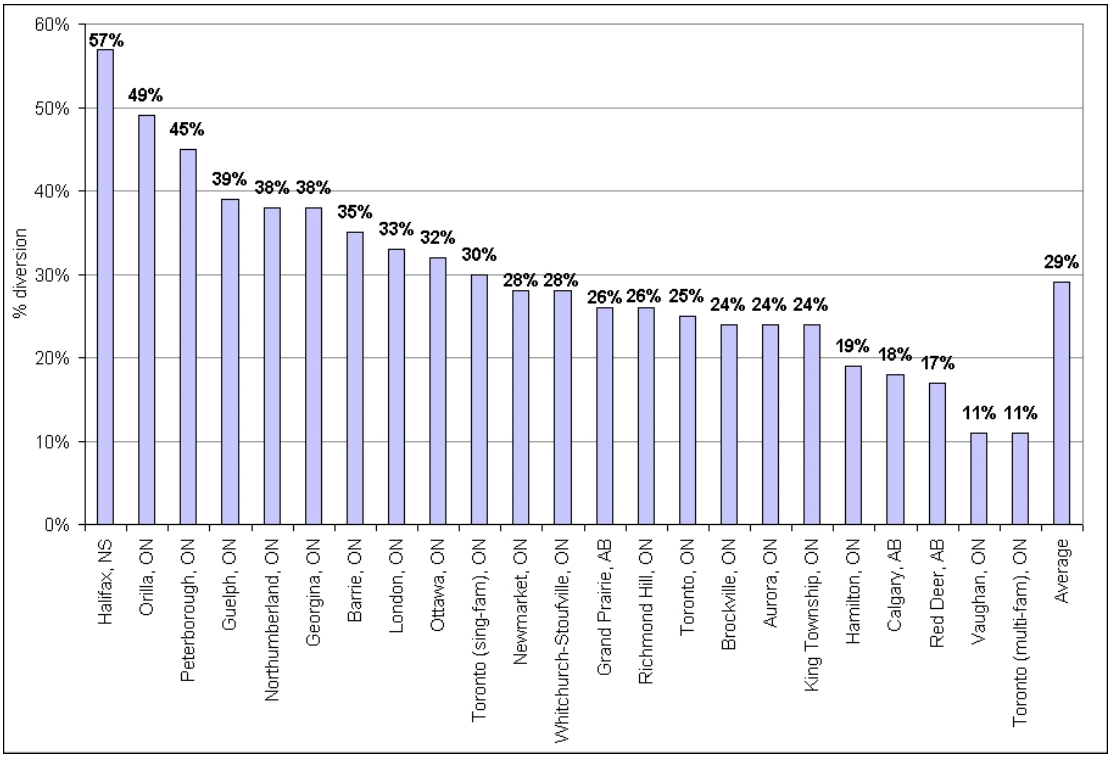

Source: CSR 2001, op. cit.

Diversion rates for the GAP protocol are calculated (as were the OECD diversion rates) as the proportion of the total amount of waste generated that is diverted from landfills by being reintroduced back into the flow of materials. This is different from the diversion definition used by the CCME. The CCME and Nova Scotia diversion goal refers to a 50% diversion of waste from landfills and incinerators compared to the per capita amount being sent to these facilities for disposal in 1989.

HRM, according to the GAP protocol, has a residential diversion rate of 57%, the highest diversion rate out of all the municipalities with GAP reports available. The HRM diversion rate is nearly twice as high as the GAP average (Figure 12).

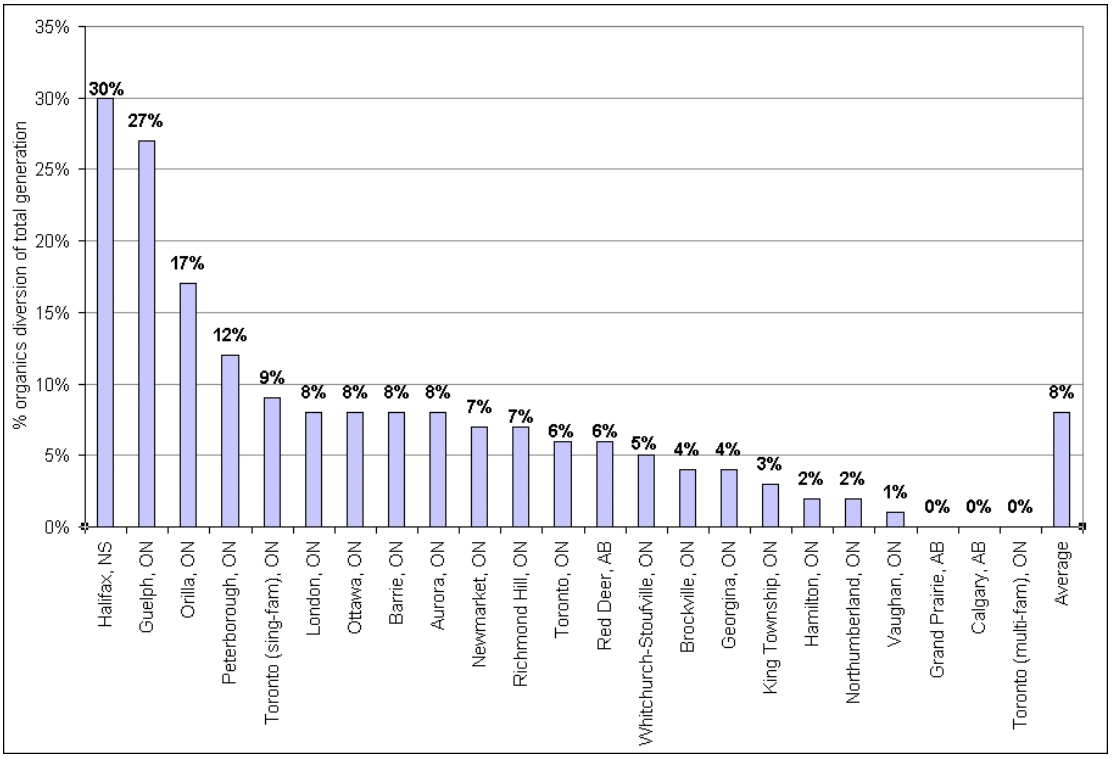
The HRM's leading diversion rate can be attributed to its high level of organic material diversion. Of total waste generated in HRM, 30% is organic material that is diverted from landfills. The GAP average is only 8%. With the exception of Guelph (27%), Orillia (17%), and Peterborough (12%), no other municipalities have an organic diversion rate above 10% (Figure 13).

**Figure 12. GAP total diversion rates, selected Canadian municipalities**




Source: CSR 2001, op. cit.

**Figure 13. GAP organics diversion rates, selected Canadian municipalities**

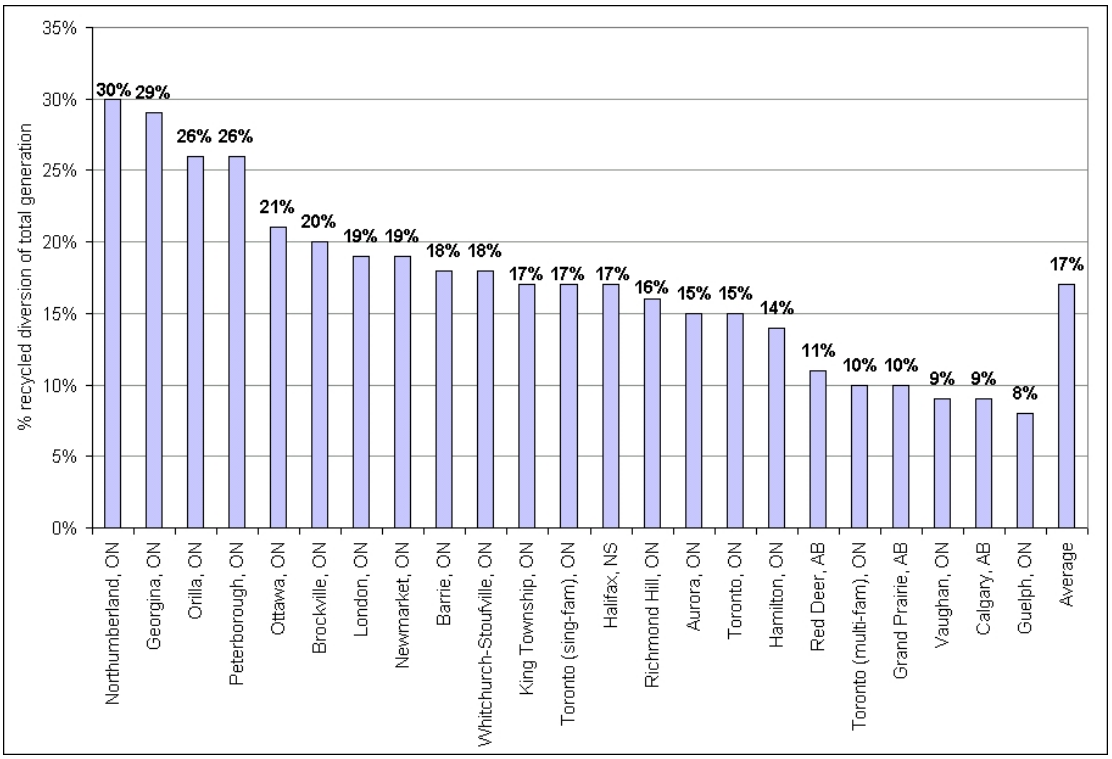



Source: CSR 2001, op. cit.

HRM's recyclable diversion rate is 17%, equal to the GAP average. Northumberland (30%), Georgina (29%), Peterborough (26%), and Orillia (26%) have the highest diversion rates for recyclables (Figure 14).

HRM's average recyclable diversion rate is therefore relatively low compared to some other municipalities. This suggests that this is an area that can be improved upon to further reduce waste disposal rates in HRM and Nova Scotia. It is important to note, however, that boxboard in HRM is composted rather than recycled, which may account for a slightly lower rate of recycling and a correspondingly higher diversion rate for organics.[84]

**Figure 14. GAP recyclables diversion rates, selected Canadian municipalities**




Source: CSR 2001, op. cit.

## 4.6 Conclusions

Based on diversion and other waste management data, Nova Scotia is clearly a leader both nationally and internationally in waste diversion. At the international level, Nova Scotia's waste diversion rate is among the best of all OECD countries. Along with Switzerland, the Netherlands, and Austria, Nova Scotia leads the world in waste diversion.

[84] Marcus Goodick, HRM. Personal communication, 2004. Approximately 2,500 tonnes of boxboard are included with organic material.

Within Canada, Nova Scotia is the first province to have achieved the 50% diversion of solid waste target established by the CCME. Unfortunately, Nova Scotia has not maintained the 50% target achieved in the 2000-01 fiscal year, but has slipped back to a 46% diversion rate in the fiscal year 2001-02. This may be due in part to increased consumption and waste generation, but Nova Scotia's inability to make further gains in waste diversion since the end of 2000 clearly involves a wide range of factors that merit further exploration.

Within Nova Scotia, the HRM and Valley regions lead the province with diversion rates of 59% and 51% respectively (compared to 1989 disposal levels). When absolute levels of waste are considered, the Annapolis Valley disposes of the smallest amount of waste per capita at 0.32 tonnes, followed by HRM and the South Shore at 0.35 tonnes per capita. Compared with other municipalities that report within the GAP framework, HRM has the highest diversion rate, twice as high as average diversion rates of other municipalities. HRM's success can largely be attributed to its high level of organics diversion. Thirty percent of HRM's total generated waste is organic material that is diverted from the landfill, the highest of any Canadian municipality reporting within the GAP framework and well above the GAP average of 8%. HRM's average rate of recycling when compared to other municipalities reporting within the GAP framework indicates the potential for further improvements in this area.

# 5. Strategy Component Evaluation

## 5.1 Introduction

Recycling and composting are the primary methods used by Nova Scotia to meet its diversion goals. The accessibility, material flows, and comprehensiveness of recycling and composting in Nova Scotia help explain the success of the Nova Scotia solid waste-resource system.

In addition to recycling and composting, several other indicators were identified by the GPI Solid Waste-Resource Steering Committee[85] as critical factors affecting the success of solid waste-resource management in Nova Scotia.
Other dimensions of Nova Scotia's solid waste-resource system addressed here therefore include:

- permanent disposal facilities;
- education;
- HHW;
- C&D waste; and
- illegal dumping activity.

[85] Members of the GPI Solid Waste-Resource Steering Committee included: Fred Wendt, Waste Analyst; HRM, Barry Friesen, Manager, Solid Waste-Resource Division, NSDEL; Bob Kenney, Waste Resource Analyst, NSDEL; a representative of RRFB; Meinhard Doelle, former Executive Director, Clean Nova Scotia; Eric Hundert, Environment Canada; Ronald Colman, Executive Director, GPI*Atlantic*.

In addition, it should be noted that the Province's ban on uncontrolled open burning of wastes has contributed to a significant decrease in air pollution (see Section 8.5).

Although these indicators do not address all facets of the solid waste-resource system, they do provide an indication of the program's key strengths and weaknesses. In addition, the data behind these indicators provide baseline information for future evaluations of the Nova Scotia solid waste-resource system.

## 5.2 Recycling

**2001 Nova Scotia Highlights**

- 98% of Nova Scotia's population has access to curbside recycling
- In 2000-01, Nova Scotia collected 51,000 tonnes of residential materials curbside for recycling
- Nova Scotia has recycled more than one billion beverage containers

Based on a waste characterization study done in Lunenburg, Nova Scotia, approximately 56% of the residential curbside waste stream is made up of products that have the capacity to be recycled. Organics, which will be explored in the following section, represent 34% of the residential curbside waste stream.[86]

Reintegrating materials back into the economy through recycling offers several benefits. The most obvious is the landfill space that would otherwise be required to dispose of these materials. In addition, even when the energy costs of recycling are factored in, recycling still creates substantial resource and energy savings by displacing the need for new materials in the economy and by extending the life of materials already in use. Paper produced from recycled paper, for example, is estimated to save 4,100 kWh of energy per tonne compared to paper produced from virgin material. This is enough energy to power the average home for six months.[87] The aluminium industry, which has extremely high energy requirements for extraction and manufacturing, claims to realize up to a 95% energy savings through resource recycling.[88]

The USEPA recently developed energy factors that capture the energy impact of different waste management methods. The results indicate that waste management measures that include diversion through recycling save energy compared to disposal in a landfill. Whereas the specific energy savings vary by type of material, all of the major material categories demonstrate net energy savings when recycled to replace products that would otherwise be manufactured from virgin materials (Table 8).

[86] RRFB 2000. *A Study to Determine the Composition of Residual Solid Waste & Recyclables in the Municipality of the District of Lunenburg, Nova Scotia, Draft Report*. The breakdown of the waste stream is as follows: paper and paperboard 24%; glass 9%; ferrous 9%; aluminium 1%; plastics 10%; multi-material waste 4%; textiles 3%; organics 34%; special care wastes 5%; other wastes 1%.
[87] Grogan, P.L. 2001. "Fat And Happy (And Cold)." *BioCycle Journal*.
[88] Ibid.

**Table 8. Energy savings per tonne of waste recycled**

| Material | Energy savings |
|---|---|
| Paper | 8.5 million Btu |
| Plastic | 20.1 million Btu |
| Glass | 2.4 million Btu |
| Steel Cans | 18.4 million Btu |
| Aluminium Cans | 166.9 million Btu |

Source: Choate, A. & H. Ferland 2002. *Waste Management and Energy Savings: Benefits by the Numbers*. In the above table short tons were converted to metric tonnes.

### *5.2.1 Energy costs of recycling*

The recycling process – from curbside pickup, trucking to recycling facilities, and transformation into a raw resource – requires energy, which can in turn produce greenhouse gases (GHGs) and other air pollutant emissions. The major energy savings created by recycling are outlined above. However, any argument for the environmental benefits of recycling must also look at the environmental impacts of the recycling process itself. Bailey argues that commercial and industrial recycling makes good economic sense but curbside recycling does not.[89] He maintains that the cost of collecting recyclables is so high that residential recycling programs do not pay for themselves and in fact require government subsidies to operate.

After curbside pickup, Nova Scotia's recyclables are trucked to regional material recovery facilities.[90] From there, they are baled and shipped to reprocessing facilities in Nova Scotia, across Canada, the U.S., and even Asia. For example, Nova Scotia's aluminium goes to Alcan Aluminium Ltd. facilities in New York and Kentucky, while most glass goes to New Brunswick. Tetrapaks usually go to Toronto, and milk cartons go to various places including Ontario and Asia.[91]

Goodick examined energy inputs of recycling in Nova Scotia including door-to-door pickup, transportation, and reprocessing.[92] "The energy used in collection wasn't significant compared to the savings you get from recycling these materials" Goodick concluded.[93] Still, he reports that provincial trucking for pick-up of residential waste has nearly doubled since the province introduced its comprehensive recycling and composting program.

Goodick's analysis looks at the life cycle burdens of environmental factors such as GHG emissions, in relation to specific waste management practices. His "life cycle analysis" provides a longer-term look at the costs and benefits of the province's waste system and "…attempts to

[89] Bailey, J. 1995. "Waste of a Sort: Curbside Recycling Comforts the Soul, but Benefits are Scant." *Wall Street Journal* Jan. 19, 1995, p. A1
[90] Recyclables that are not part of the RRFB's deposit system go to various recycling centres, depending on region and market value.
[91] Jerome Paris, Operations Manager, RRFB. Personal communication, January 2003.
[92] Goodick, M. 2002, op. cit.
[93] Marcus Goodick, HRM. Personal communication, January 2003.

encompass all the relevant associated impacts including the upstream and downstream impacts of a particular undertaking from raw-materials acquisition to final disposal."[94]

A straight-up, non-life cycle comparison of the 1989 and 2001 waste management systems shows that the 2001 system uses more energy, yet produces fewer GHGs, acid gases, and smog precursors. The improvements resulted primarily from the ban on open burning of waste combined with reduced emissions from the Sydney incinerator, better leachate collection at landfills, and a reduction in $CO_2$ equivalent emissions at landfills because of diverted organics.[95]

The 1989 waste management system – the "old" system, with no comprehensive recycling and organics pick-up – used an estimated 112,000 gigajoules (GJ) of energy, but produced considerably more GHGs than the 2001 system. By comparison, energy use resulting from the 2001 system more than doubled, to an estimated 227,000 GJ of energy. However, the new system produced $CO_2$ equivalent GHG emission savings of 93,000 tonnes.[96]

A life cycle analysis shows that the 2001 system actually uses *less* energy than the 1989 system and leads to even greater GHG savings than estimated above.[97] When all environmental impacts were converted to energy consumed, the net change between 1989 and 2000-01 was a decrease of 65,165 GJ in the energy consumed. Goodick estimates that overall, the 2001 system produced $CO_2$ equivalent GHG emission savings comparable to the emissions from 42,800 cars.[98]

### *5.2.2 Jobs*

There is a positive correlation between recycling and job creation. For example, studies suggest that for every 10,000 tonnes of plastic recycled, roughly 86 jobs are created.[99] These jobs tend to be local, which contributes to the economic stability of the region. Recycling within Nova Scotia is directly responsible for approximately 1,011 jobs. Some estimates indicate that up to 1,800 waste management jobs in the province can be attributed to recycling.[100] However, it must be acknowledged that some of these are low-paying, low-skilled jobs.

Recycling costs money. Although New York City is currently recycling glass and plastics, in 2002, the city suspended glass and plastics from its recycling program. New York City Mayor Michael Bloomberg defended his decision based on the argument that it costs US$240 a tonne to

[94] Goodick, M. 2002, op. cit.
[95] Ibid, pp. 98-99.
[96] Ibid, pp. 98-99.
[97] Ibid. See Table 44 in Appendix A of this report.
[98] Ibid.
[99] Sierra Club 2001. *Trash Transfer Toolbox*. Online at www.sierraclub.org/trashtransfer/dc.asp. The exact quotation is: "For every 10,000 tons of plastic recycled, 96 jobs are created." For consistency, we have converted the numbers to metric tonnes in the report and adjusted the jobs numbers accordingly.
[100] Bob Kenney, NSDEL. Personal communication, January 2002. The breakdown of total jobs related to waste management in Nova Scotia is estimated as follows: manufacturers 626 (most are recycling related); haulers 522; Enviro-Depots 334; landfills 301; hazardous waste 269; recycling facilities 151; asbestos 80; composting facilities 72; construction and demolition 70; scrap metal dealers 122; tire recycling/re-treading 61; other 488 (many of these are recycling related). 1,800 of these jobs can be attributed to recycling.

recycle these materials as opposed to simply landfilling them at US$130 a tonne.[101] He based his decision entirely on the direct economic costs of recycling and not on a full cost accounting perspective, which would have included the full economic, social, and environmental costs and benefits of the two systems. As indicated throughout this study and in other GPI*Atlantic* analyses, a full cost accounting approach to decision making provides a more accurate and comprehensive mechanism to determine the true economic impacts of policy decisions. One economic benefit of recycling, not included in Mayor Bloomberg's analysis, is job creation.

The cost-benefit section of this report demonstrates that the Nova Scotia Solid Waste-Resource Management Strategy generates direct employment benefits ranging from $2.8 million to $3.9 million and indirect employment spin-off jobs worth $3.7 to $5.1 million annually. This assessment, included in the cost-benefit analysis, includes only a small portion of the jobs actually created as a result of the Strategy. Because a cost-benefit analysis should only include *net* social benefits, it can only count new jobs estimated to have been created from the unemployment rolls and excludes jobs estimated to have been taken by those previously employed in other industries.

### *5.2.3 Access to curbside recycling*

The number of households with curbside recycling is an indication of the solid waste-resource program's accessibility. Curbside recycling provides a convenient means for households to participate in the recycling program and indirectly provides an indication of the quantity of material being recycled. Ideally, more people with access to curbside recycling programs will mean more recyclable materials being diverted from permanent disposal.

Critics suggest that although access to curbside recycling makes recycling easier, ease is not enough to ensure that households comply with the program. HRM has an assertive program to increase participation and compliance. It places stickers on recyclable bags and green bins with non-compliant or improperly sorted material. The stickers include a telephone number that householders can call for information on proper sorting techniques. An HRM representative will visit households that receive recurring warnings, to further educate household members about recycling procedures within HRM.[102]

Lunenburg has a similar program to enforce its collection by-law. If residents fail to sort three or more items correctly, their bag is rejected and returned with a sticker that explains the problem. This system has been in place for about four years. According to Richard Wilson, Lunenburg Recycling Program Coordinator, about 10% of Lunenburg households are still sorting items incorrectly. Lunenburg has found that for every percentage point increase in residential diversion, there is about a half percentage point drop in rejections.[103] This indicates that as participation grows and the program becomes more widely accepted, compliance also increases.

[101] Bradley, J. 2002. "New York City Reneges on Recycling," *E-Magazine* XIII (5), September-October 2002.
[102] Fred Wendt, HRM. Personal communication, October 2002.
[103] Richard Wilson, Recycling Coordinator, Lunenburg Recycling. Personal communication, 2002.

By 2001, 98% of Nova Scotia residents had access to curbside recycling pick-up. The remaining 2% includes several native reserves in the Cape Breton region. While many native reserves within the province have access to curbside recycling programs, reserves such as Eskasoni, Whycocomagh, and Chapel Island do not. (With funding from the RRFB and CBRM, the Eskasoni Band Council introduced a curbside recycling program in 2003.) The remaining portion of the 2% represents residents in Cumberland County (and the towns within) who do not yet have municipal curbside collection of waste or recyclable materials. Residents in these areas must contract collection of these materials privately or bring their materials to a drop-off depot.

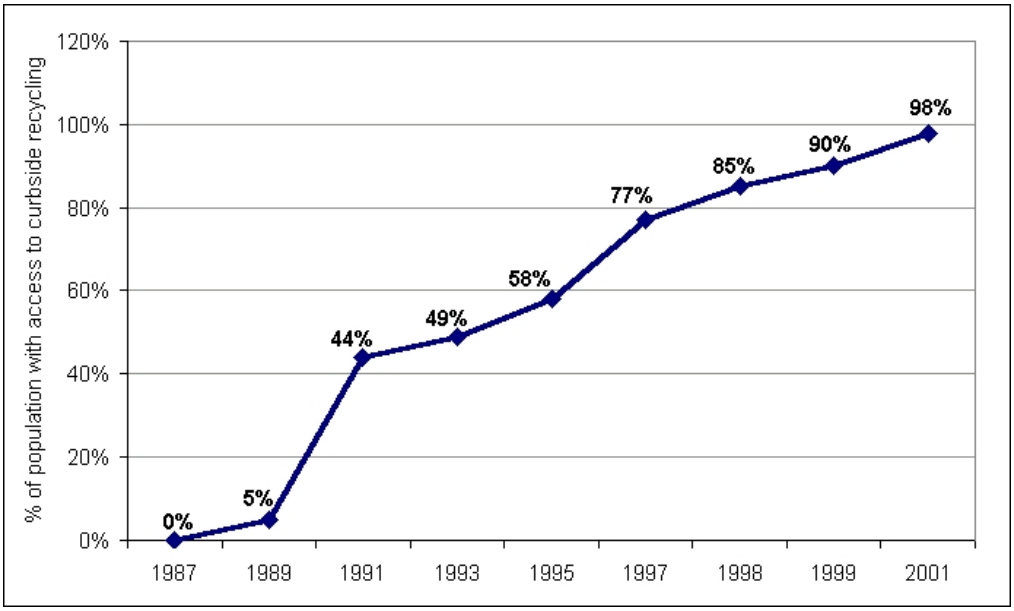
It should be noted that the most recent 2003 RRFB's list of Nova Scotia's waste diversion accomplishments claims that "100% of Nova Scotians have curbside recycling."[104] As well, NSDEL's *Status Report 2003 of Solid Waste-Resource Management in Nova Scotia*, states that "99% of Nova Scotians have curbside recycling."[105] Because this report relies on the full 2001 data set, the latest complete data set available at the time these materials were assembled, we continue to use the 98% access figure throughout this report, while acknowledging that further improvements may have been made since that time.

Between 1995 and 2001, access to curbside recycling increased by about 70% (Figure 15). Hidden in the expansion figures is the fact that the quantity and type of materials picked up in curbside recycling have also grown. When curbside recycling was introduced in Kings County in 1989, for example, the municipality collected only cans, glass and newspaper.[106] Curbside recycling in Kings County now includes corrugated cardboard, newspaper, mixed paper, beverage containers, steel/tin food cans, glass food containers, aluminium food cans, aluminium plates, plastic containers #1- #6, milk cartons, plastic LDPE #4 bags and #2 plastic bags.[107]

Compared to other provinces, Nova Scotia households have the greatest access to curbside recycling in the country. Statistics on access to curbside recycling are not available nationally and are only tracked by certain provinces. Based on those provinces reporting, British Columbia has the second highest level of access to curbside recycling, at 83%, while about three-fourths of households in Ontario and Alberta have access (Figure 16).[108]

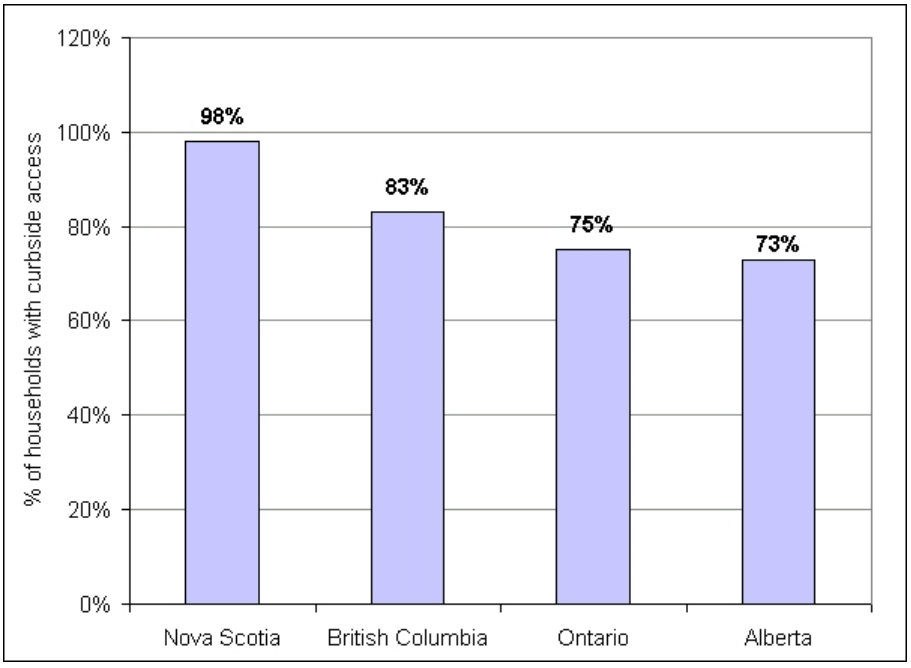
[104] RRFB 2004. *Nova Scotia's Waste Diversion Accomplishments*. Available at: http://www.rrfb.com/pages/Secondary%20pages/accomplishments.html. Accessed April 12, 2004.
[105] NSDEL 2003. *Status Report 2003 of Solid Waste-Resource Management in Nova Scotia,* p. 4.
[106] Brian Van Rooyen, Valley Waste Resource Authority. Personal communication, 2002.
[107] NSDEL 2002. *Accepted Materials Breakdown for Municipalities, August 2002*.
[108] NSDEL 2002. *Status Reports of Solid Waste-Resource Management in Nova Scotia.* Available at www.gov.ns.ca/enla/emc/wasteman/docs/status01.pdf. British Columbia: Recycling Council of British Columbia 2000. *B.C. Municipal Solid Waste Tracking Report.* Available at www.gov.bc.ca/soerpt/03-1-domestic-waste.html; Ontario: Recycling Council of Ontario 2001. *Fact Sheet 2000.* Available at www.rco.on.ca; and Alberta: Licia Paddison, Alberta Environment, Municipal Solid Waste Program. Personal communication, 2001.

**Figure 15. Access to curbside recycling in Nova Scotia, 1987-2001**




Sources: NSDEL 1997-2001. *Status Report of Solid Waste-Resource Management in Nova Scotia* (Years 1997, 1998, 1999, 2000, 2001). Percentage of population with curbside recycling for the years 1989, 1991, 1993, 1995 are estimated based on discussions with Bob Kenney and the late Mike Leblanc of NSDEL, and with Brian Van Rooyen of Valley Waste Resource Authority in March 2002. As noted earlier, the most recent 2003 NSDEL Status Report indicates a 99% recycling access rate, and the RRFB claims 100% access for 2003.

**Figure 16. Households with access to curbside recycling, selected provinces**




Sources: NSDEL 2002. *Status Reports of Solid Waste-Resource Management in Nova Scotia.* Available at www.gov.ns.ca/enla/emc/wasteman/docs/status01.pdf. British Columbia: Recycling Council of British Columbia 2000. *B.C. Municipal Solid Waste Tracking Report.* Available at www.gov.bc.ca/soerpt/03-1-domestic-waste.html; Ontario: Recycling Council of Ontario 2001. *Fact Sheet 2000.* Available at www.rco.on.ca; and Alberta: Licia Paddison, Alberta Environment, Municipal Solid Waste Program. Personal communication, 2001.

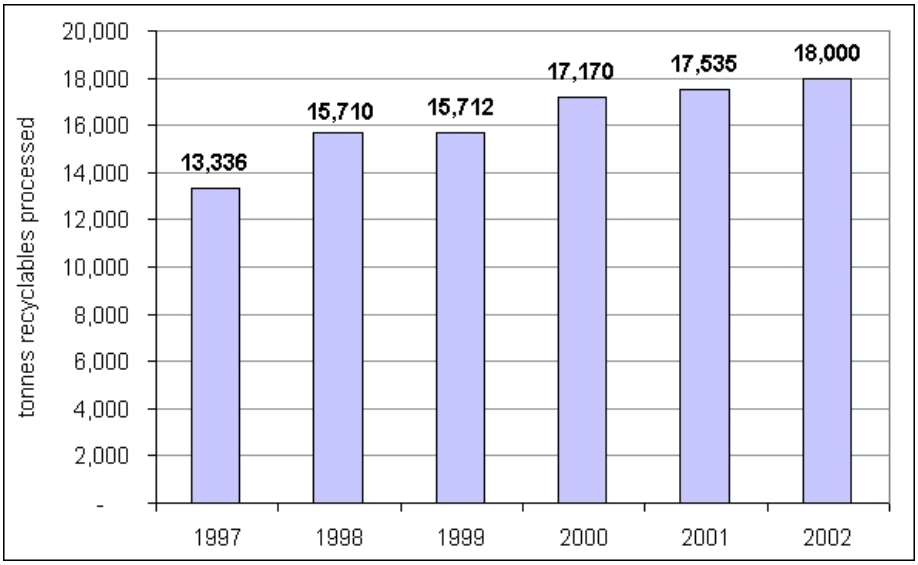
### *5.2.4 Material flows*

The quantity and types of material flowing through the recycling system provide measurable information that can help track the success of solid waste-resource management programs.

While precise records are kept of the amounts of residential waste recycled, Nova Scotia does not have a means of tracking the other types of materials that are recycled. The Solid Waste-Resource Management Strategy bans many materials from landfills and therefore much ICI and C&D waste must be recycled. In assessing the success of the recycling efforts of the province, these other types of recyclables should be included.

Goodick estimated that 51,000 tonnes were collected curbside for recycling in Nova Scotia in 2000-01.[109] This amounts to 54 kg per capita. Based on bi-annual surveys, Statistics Canada reports that Nova Scotia collected 145,602 tonnes of materials for recycling in 2000.[110] This excludes the 12-14% of materials collected for recycling that end up being disposed in landfills because they are not suitable for recycling.[111] This is a conservative estimate because it is based on numbers from the year 2000 and the amount of recycling for 2000-01 is expected to be higher (Figure 17). Estimates for 2001 are not yet available.[112]

**Figure 17. Recycled material processed, Halifax Regional Municipality, 1997-2002**




Source: HRM 2002.

Note: Data for 2002 is a projection based on quantities processed in the first six months of the 2001-02 fiscal year (April 1, 2001-September 30, 2002).

[109] Goodick, M. 2002, op. cit.
[110] Statistics Canada 2003, op. cit.
[111] Jim Bauld, Solid Waste Manager, HRM cited in Di Tosto, J. 2003. The Fate of Your Waste, *Halifax Commoner,* University of Kings College School of Journalism, October 31, p. 7.
[112] Statistics Canada 2003, op. cit.

The Statistics Canada numbers are based on a survey of major haulers, and include C&D and ICI materials, whereas Goodick's numbers do not. Goodick's figures were based on a survey of curbside and ENVIRO-DEPOT™ recycling in Lunenberg County, with results extrapolated to Nova Scotia. There is no single, accurate estimate of the materials recycled in Nova Scotia.

HRM, which accounts for nearly 40% of the Nova Scotia population, has had a 35% increase in the amount of material being recycled since 1997 (Figure 17).[113] However, caution must be exercised in using increased tonnage as an indicator of progress. The quantity of material being recycled is not simply a function of participation in recycling programs; it also reflects the level of household consumption, economic activity, and waste generation. A higher number, therefore, does not necessarily indicate a more benign environmental impact. Instead, it may partly reflect higher levels of waste generation.

### *5.2.5 Comprehensiveness*

The capacity of recycling initiatives to include different materials and reach different segments of the population ultimately leads to higher recycling rates and is indicative of the program's success. We have already noted, in Section 5.2.3, that the quantity and type of materials picked up in curbside recycling have grown in the last ten years from initial collection only of cans, glass, and newspaper to include corrugated cardboard, mixed paper, and plastics. There is no doubt that the 1995 Solid Waste-Resource Management Strategy dramatically expanded the comprehensiveness of recycling programs in Nova Scotia.

**Side Bar 1. Car Bags Help Tourists Recycle**

**Innovative Idea**

In the summer of 2001, NSDEL introduced a mini blue bag program designed to help tourists travelling through Nova Scotia keep their recyclables from ending up on the road side or in the landfill. This program was funded by RRFB Nova Scotia.

In total, 100,000 mini blue recycling bags for cars, trucks and vans were distributed to tourists visiting Nova Scotia.

According to then Minister of Environment and Labour, David Morse, "Nova Scotia is the only place in North America – maybe in the world – offering mini blue bags for vehicles."

For more information visit: www.gov.ns.ca/enla/newsrel.htm.

### *5.2.6 Deposit-refund system for beverage containers*

The Beverage Container Recycling Program is based on a ten cent fee charged on all beverage containers (excluding milk cartons) sold in Nova Scotia. Half of this deposit is refunded when

[113] Fred Wendt, HRM. Personal communication, 2002. HRM population estimate of 367,502 is taken from NSDEL 2001. *Nova Scotia Waste Diversion Calculations (April 1, 2000 to March 31, 2001).*

cans and bottles are returned to an ENVIRO-DEPOT™. The remaining five cents is allocated primarily to enviro-depots, transportation contractors, and regional processing centres to cover handling fees with the remainder used for administrative costs. In addition, at least 50% of RRFB Nova Scotia's net revenues from programs are distributed to municipalities as diversion credits, based on the amount of waste they divert from disposal.[114] This is the only waste management system in Canada that provides, in addition to grants, on-going financial support to municipalities, by a formula that rewards waste diversion.

Table 9 shows the income and expenses for the province's deposit-refund system for the fiscal year 2000-01 (excluding operational administrative expense, which is not broken out for each program by the RRFB).[115]

**Table 9. Revenues and expenses for the Nova Scotia Beverage Container Recycling Program, 2000-01 ($C2000)**

| **Revenues** | |
|---|---|
| Deposits (minus HST) | $22,261,350 |
| Sales of recyclable material | $3,722,331 |
| **Total Revenues** | **$25,983,681** |
| **Expenses** | |
| ENVIRO-DEPOT™ handling fees | $5,816,425 |
| Local cartage | $895,427 |
| Regional processing | $741,077 |
| Freight in | $78,527 |
| Deposit refunds | $9,645,383 |
| **Total expenses** | **$17,176,840** |
| **Net income** | **$8,806,841** |

Sources: RRFB 2001. *Annual Report*; Controller, RRFB. Personal communication, February, 2004.

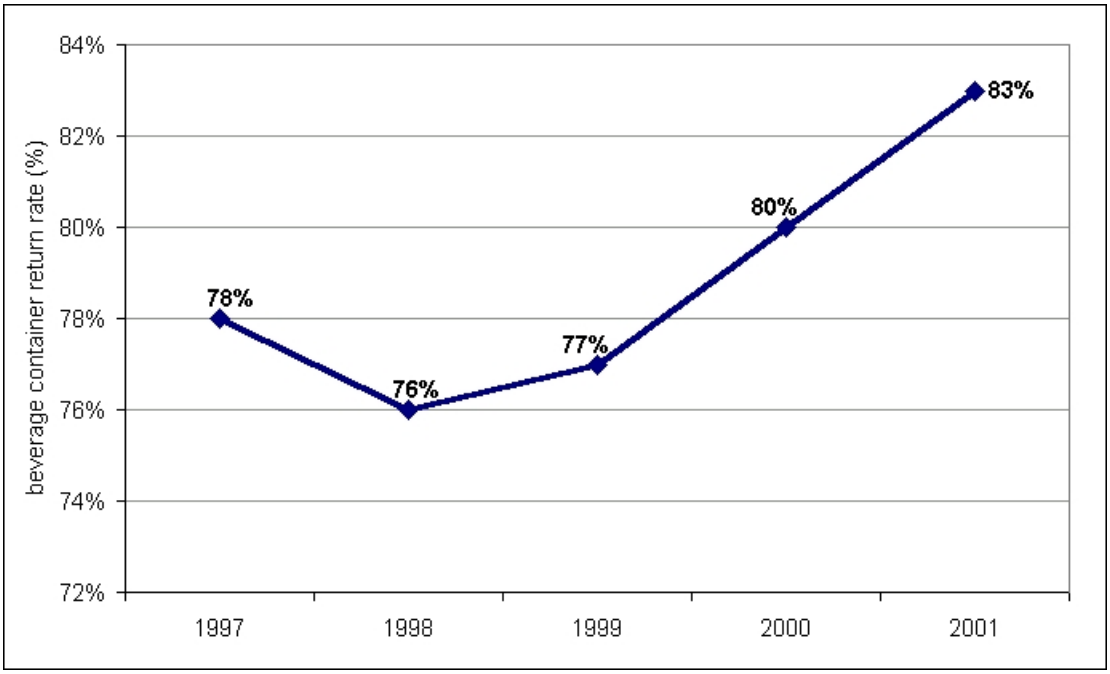
In September 2001, Nova Scotia recycled its billionth beverage container, representing an average of over 1,000 containers recycled per person since the program's inception in 1996.[116] The success of the program has steadily increased, with a return rate of 83% in 2001, up from 78% in 1997 (Figure 18).

There is a direct correlation between deposit-refund programs and higher beverage container recycling rates. A study conducted in the U.S. found that in 1999, the ten states with beverage container deposit-refund programs had a beverage container-recycling rate of 72%. That same year, the forty states without beverage container deposit-refund programs had a beverage container recycling rate of 28%.[117] Nova Scotia's 83% beverage container return rate clearly

[114] M. Catherine McCarthy, RRFB. Personal communication, May 2004.
[115] RRFB 2001. *2001 Annual Report*.
[116] M. Catherine McCarthy, RRFB. Personal communication, 2004.
[117] Beck, R.W. 2001. *Understanding Beverage Container Recycling: A Value Chain Assessment prepared for the Multi-Stakeholder Recovery Project, Stage 1*. Cited in Morris, J. 2002. "Economic Policy Options to Correct the

demonstrates the success of the program and the effectiveness of the province's deposit-refund system.

**Figure 18. Beverage container return rate in Nova Scotia, 1997-2001**[118]




Source: RRFB 2001, op. cit.

## *5.2.7 Tire recycling*

On January 2, 1997, the Used Tire Management Program, run by the RRFB, began collecting used tires for recycling. There are approximately 900 registered tire retailers throughout the province participating in the program.[119] Table 10 shows that over 3 million tires have been recycled since 1997.

**Table 10. Total number of tires recycled in Nova Scotia, 1998-2001**

| | 1998 | 1999 | 2000 | 2001 | Total |
|---|---|---|---|---|---|
| Total number of tires recycled | 572,383 | 755,469 | 831,720 | 842,200 | 3,001,772 |

Source: RRFB 2001.

Failure of Competitive, Free Markets to Correctly Price Recycling Versus Garbage Collection/Disposal," *The Uneconomist*, May-June 2002.

[118] RRFB 2001. *Helping Nova Scotians Help The Environment, 2000 Annual Report*; and RRFB 2001, op. cit.

[119] RRFB 2001, op. cit.

Most of these tires are recycled by Atlantic Recycled Rubber in Kemptown, near Truro, Nova Scotia, and are processed into crumb rubber. Innovative uses of crumb rubber include its application as a road base in Port Hawkesbury and Digby County (the rubber acts as an insulator to reduce damage caused by frost), and as Field Turf on sports fields all over North America, including three in Nova Scotia. Tire recycling directly creates 18 full-time jobs in Nova Scotia.[120]

When tires are purchased in Nova Scotia, a $3 fee per car tire and $9 charge per truck tire is added to the purchase price to fund the initiative. Any surplus funds have been used to clean up old tire stockpiles.[121] The RRFB pays a fee to a private facility for collecting and processing the tires. These costs are indicated below as cost of sales. Other costs incurred by the private facility, as well as proceeds from the sale of recycled products, do not appear in the RRFB financial statements or in Table 11 below.[122]

**Table 11. Revenue generated through the Nova Scotia Used Tire Management Program ($C2000)**

| Fiscal year | Revenues | Cost of sales | Balance |
|---|---|---|---|
| 1998-1999 | 2,829,676 | 1,851,977 | 977,699 |
| 1999-2000 | 3,051,570 | 1,876,903 | 1,174,667 |
| 2000-2001 | 2,730,840 | 1,694,238 | 1,036,602 |

Source: RRFB 2001.

### *5.2.8 Stewardship programs*

Waste reduction depends largely on the cooperation of industry. Stewardship programs highlight industry support for waste management goals and for the diverse range of waste reduction initiatives. Nova Scotia has stewardship agreements with the battery, beverage, dairy, newsprint and paint industries, and with tire and oil retailers. There is also a sharps disposal agreement for disposal of used needles.

Nova Scotia has more stewardship programs in place than any other province in Canada at this time (Table 12). Because no comparative database for these programs exists at the national level, GPI*Atlantic* collected information on these programs from each province.

The Dairy Stewardship agreement with the Atlantic Dairy Council provides funding annually to municipalities for recycling dairy containers and for advertising the recycling program on side panels of milk cartons.[123, 124] The Sharps Stewardship Agreement between NSDEL, the

[120] M. Catherine McCarthy, RRFB. Personal communication, 2004.
[121] RRFB 2001, op. cit.
[122] Controller, RRFB. Personal communication, February 2004.
[123] Nova Scotia Milk Packaging Stewardship Agreement, February 1, 2000. Available at www.gov.ns.ca/enla/emc/wasteman. Accessed February 2004.

Pharmacy Association of Nova Scotia and the Canadian Diabetes Association provides for the safe management of residentially generated syringes, lancets, and pen needles.[125] Members of the Pharmacy Association of Nova Scotia provide containers in which residents may safely dispose of the sharps, and also will accept filled containers for recycling.[126]

**Table 12. Stewardship programs by province**

| | NS | NF | PEI | NB | PQ | ON | MB | SK | AB | BC |
|---|---|---|---|---|---|---|---|---|---|---|
| Beverage containers | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Tire recycling | ✓ | – | – | – | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sharps | ✓ | – | – | – | – | – | – | – | – | – |
| Milk containers | ✓ | – | – | – | – | ✓ | ✓ | – | – | – |
| Paint | ✓ | – | – | – | ✓ | – | – | – | – | ✓ |
| Pharmaceuticals | ✓ | – | – | – | – | – | – | – | – | ✓ |
| Used oil | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pesticide compounds | – | – | – | – | – | – | ✓ | ✓ | ✓ | – |
| Batteries | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**✓ = program in place – = no program exists**

Sources: **Newfoundland**: Department of Municipal and Provincial Affairs 2001. *Solid Waste Management Planning Synopsis Report*; **Nova Scotia**: NSDEL 2001. *Status Report of Solid Waste-Resource Management in Nova Scotia.* Available at www.gov.ns.ca/enla/emc/wasteman/docs/status01.pdf; **New Brunswick**: Tim Leblanc, New Brunswick Department of Environment. Personal communication, 2001; **Quebec**: Recyc-Quebec 2000. *Plan d'action quebecois sur la gestation des matieres residuelles 1998-2008*; **Ontario**: Ontario Ministry of Environment and CSR 2001. *Municipal 3Rs in Ontario: 2000 Fact Sheet*; **Manitoba**: Pollution Prevention Branch, Manitoba Conservation 1999. *Regional Integrated Waste Management Action Plan and Recommendations.* Available at www.gov.mb.ca; **Saskatchewan**: The Saskatchewan Environmental Protection Branch 2000. *Recycling in Saskatchewan, 2000 Annual Report*; **Alberta**: Licia Paddison, Waste Analyst, Alberta Environment, Municipal Solid Waste Program. Personal communication, 2001; and **British Columbia**: Recycling Council of British Columbia 2000. *B.C. Municipal Solid Waste Tracking Report*. Available at www.gov.bc.ca/soerpt/03-1-domestic-waste.html.

Note: For provinces listed as having programs in place, all jurisdictions within that province may not necessarily have access to the specified program.

However, industry contributions to some of these stewardship agreements (newsprint) are modest compared to the full cost of managing their sectors' waste materials. The remaining costs are borne by citizens through general tax revenues. For example, Nova Scotia recently signed stewardship agreements with its daily and weekly newspapers, which produce 20,000 tonnes of paper each year. Together, the newspapers donate about $200,000 of in-kind advertising space to allow the province and municipalities to "educate the public about environmental issues."[127] The $200,000 in-kind payment works out to roughly $10 for every tonne of newsprint generated and does not include flyers. Does it cover the costs of recycling newsprint? "Not by a long shot,"

[124] Bob Kenney, NSDEL. Personal communication, February 18, 2004.
[125] Memorandum of Understanding between NSDEL, the Pharmacy Association of Nova Scotia and the Canadian Diabetes Association. Available at www.gov.ns.ca/enla/emc/wasteman. Accessed February 2004.
[126] Bob Kenney, NSDEL. Personal communication, 2004.
[127] RRFB 2002. *Annual Report*, p. 9.

says Richard Cotton, Chair of Regional Chairs of the waste management districts and a councillor for Richmond County.[128] The newspapers are under no obligation to cut down on newsprint or make payments more reflective of the total cost of recycling newsprint.

While the province has no formal stewardship agreements with the fast food industry, it has made progress on voluntary agreements with many fast food outlets. By law, fast food businesses are supposed to sort their organic and recyclable materials. However, while most comply on the kitchen side of their facilities, many provide no recycling and composting containers for customers' waste.

The regional waste management districts and provincial government have held discussions with the fast food industry with the aim of enacting a stewardship agreement by April 1, 2003. Since April 1, 2003, regional waste facilities have refused to accept organic and recyclable materials from the fast food industry.[129] But no formal stewardship agreement was yet in place as of February 2004.

However, several major fast-food chains, such as Tim Hortons and McDonald's, have begun voluntary source separation, with well-marked bins for organics, recyclables, and other wastes.[130] McDonald's is expected to release a provincial plan for source separation in 2004.[131] Tim Hortons has also conducted clean-ups around its stores and provided some educational material on litter, but the firm continues to manufacture cups that cannot be recycled at municipal facilities.

A number of the materials that are the most costly to recycle or divert, such as some plastics and mixed material packages, have neither been included in disposal bans nor brought into producer-pay stewardship programs. Thus, some industries have, in effect, received a perverse incentive for their continued use of these materials. These materials remain virtually impossible to recycle without industry bearing any of the associated waste management costs. The absence of disposal bans and industry-funded stewardship agreements has therefore encouraged the continued (and even expanded) use of these materials for packaging and product manufacture. Many industry sectors such as the retail dry goods, housewares, toys, and home supplies industries, are still making no contribution to stewardship.

Critics also question the actual commitment of many industries to waste diversion despite their stewardship agreements. Nova Scotia dairies recently introduced twist-off tops on their two-litre milk containers. The new lids cannot be recycled and the new design came with a price increase to consumers. There was no industry consultation on this decision either with the provincial waste division or with recycling facilities throughout the province.

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[128] Richard Cotton, Chair of Regional Chairs of the Waste Management Districts. Personal communication, February 2003.
[129] Idem. On behalf of the province's seven regional waste management districts, Cotton sent a letter in October 2002, to the associations that represent the fast food industry. In that letter, the regional waste facilities stated that as of April 1, 2003, they would reject fast food industry waste trucks carrying organic materials and recyclables mixed in with their regular garbage.
[130] Bob Kenney, NSDEL. Personal communication, February 23, 2004.
[131] Barry Friesen, NSDEL. Personal communication, May 18, 2004.

**Side Bar 2. Prince Edward Island Refillable Container System**

**Global Leaders**

In Prince Edward Island there are over 40 million refillable containers used and re-used every year.

In 1977 PEI banned most non-refillable beverage containers. This means that all beer and soft drinks produced in PEI are in refillable glass bottles. There are over 40 million refillable containers used and re-used every year. On average each container is re-used 17 times (some containers up to 40 times) before being crushed and recycled.

To complement this progressive program, PEI's refillable beverage container system, operated by Seaman's Beverages Ltd., boasts a 97% recovery rate. This incredible recovery rate can be attributed to good citizen stewardship and a highly effective return program that allows containers to be returned to supermarkets, convenience stores, or depots.

Other Global Leaders:

- Denmark: 100% of all domestic beer and soft drinks must be sold in refillable bottles.
- Maine U.S.: Ban on non-recyclable beverage containers.

Sources: Container Recycling Institute 1998. *Beverage Container Re-use and Recycling in Canada*, p. 39-40; Kim Griffin, Seaman's Beverages Ltd. Personal communication, 2001; and Saphire, D. 1995. *Cases Reopened – Reassessing Refillable Bottles, Government and Industry Options for Promoting the Use of Refillable Bottles in the U.S.*, p. 249.

### *5.2.9 Where are our materials recycled and where do the products go?*

The materials being recycled and the products created from the recycled material have a direct impact on Nova Scotia's economy. Resources are re-circulated through the economy, bringing jobs and income to Nova Scotians. Only 7-8 years ago, most of these same materials were regarded as disposable. How these materials are kept within the economy and where they end up sheds light on the impact of recycling on Nova Scotia. Table 13 is based on a similar table published by the NSDEL and is printed here with the Department's permission.

**Table 13. Manufactured products made from recyclable materials**

| Material | Nova Scotia Recycler | End Product in Nova Scotia |
|---|---|---|
| Used tires | Atlantic Recycled Rubber, Colchester | Crumbed rubber (may be used as playground padding) |
| Used tires (mainly truck tires) | A number of companies, e.g., Eastern Tire Services, New Glasgow; Crown Tires Services, Lunenburg; Miller Tire, Dartmouth | Re-treaded into new tires |
| Newspapers | Canadian Keyes Fibre | Egg cartons, carry out trays, food containers |
| | Thermocell | Insulation |
| | Port Hawkesbury | Wall board |
| Cardboard | Minas Basin Pulp and Power, Hantsport | Liner board |
| | Maritime Paper, Dartmouth | Cardboard boxes made from liner board |
| | Crown Fibre Tube Inc, Kentville | Sona tubes and cardboard cores made from liner board |
| PET plastics | NOVAPET Inc., Amherst | PET |
| HDPE plastics | NOVAPET Inc., Amherst | Cleaned and sorted flaked HDPE |
| | ROPAK Canada Inc., Cumberland County | Plastic pails |
| | Scotia Plastics, Shubenacadie | Drainage tubing |
| Mixed plastics | NOVAPET Inc, Amherst | Cleaned and sorted flaked |
| Glass – Wine bottles | Enviro-Glass, Dartmouth | Aggregate |
| | Vintage Glass, Lunenburg | Decorative pieces |
| Food and yard waste | Compost facilities | Compost |
| | Farmers | Direct land application |
| Used cooking oil and animal by products | Rothsay, Truro and S.F. Rendering Ltd., Canard, Kings County | Animal feed |
| Boxboard | Compost facilities | Compost |
| | The Bin Dr., Dartmouth | Compost container (mini-bin) liners |
| Old clothing | Charities | Re-used clothing |
| | Acadian Wipers, Digby | Rags |
| | Adult Service Centres | Rags |
| Pallets | Pallet manufacturers | New pallets |
| | Adult Service Centres | Kindling, bird houses |
| | STORA's paper mill, Port Hawkesbury | Fuel |
| | Brooklyn Energy | Fuel |
| | Touch on Wood, Sydney | Fruit baskets, survey stakes, flower boxes |
| Old computers | Technology Recycling Program, Nova Scotia Department of Education, Halifax | Repaired and given to schools |
| Construction and demolition materials | Many areas throughout Nova Scotia | Clean fill |
| | STORA's paper mill, Port Hawkesbury | Clean wood as fuel |
| | Disposal sites throughout Nova Scotia | Landfill cover and road amendment |
| | Renovators Resource, Halifax | Salvageable products for resale |
| | Brooklyn Energy | Clean wood as fuel |
| Used paint | Paint Recycling Company, Springhill | New Paint |
| Used crankshaft oil | Refined at Inland Technologies Inc, Debert | Refined into fuel |

| Material | External Recycler of Nova Scotia Recyclables | End Product of Recyclables Outside of Nova Scotia |
|---|---|---|
| Used tires | Quebec, Ontario, U.S. | Athletic fields, asphalt, playground padding, rubber insulation for sound barrier, rubberized roofing material, shingles, running shoe soles, etc. |
| Office paper | Paper mills in Quebec, Ontario, U.S. | New office paper, toilet tissue |
| Mixed paper | Quebec and Ontario | Recycled paper, roofing felt, boxboard |
| Steel cans, scrap metal | Quebec and Ontario | Planes, trains, automobiles, and other new steel products |
| Aluminium | Quebec, U.S. | Aluminium ingots and products |
| Milk cartons | Ontario, U.S., Asia | Fine grade paper |
| PET plastics | Manufacturers throughout North America | Carpet, clothing, etc. |
| HDPE plastics | Manufacturers throughout North America | Many different plastic products e.g. containers, toys, etc. |
| Mixed plastics | Manufacturers throughout North America | Various plastic products |
| LDPE plastics | Newfoundland, PEI, U.S., Asia | Plastic lumber, many plastic film products. |
| Glass – Wine bottles | New Brunswick | Glass bottles |
| Boxboard | Toronto | New boxboard |
| Old computers | Quebec | Refined for precious metals |
| Used crankshaft oil | | New/used crankshaft oil |
| Tetra Paks | Ontario | Paper content used to remake paper |

Source: Adapted from NSDEL 2001. Available at: http://www.gov.ns.ca/enla/emc/wasteman/mprm.asp.

## 5.3 Composting

**2001 Nova Scotia Highlights**

- 72% of Nova Scotians have access to curbside collection of organic materials
- 58,000 tonnes of compostable organic materials were processed in municipal composting facilities in 2000-01[132]
- All regions promote and encourage backyard composting

Based on a study conducted in Lunenberg County, 34% of all household curbside waste is organic material such as food scraps, leaves, grass clippings, garden waste, and non-recyclable paper.[133] In November 1998, the NSDOE banned compostable organic material from landfills.[134] This remarkable step was a key factor in enabling Nova Scotia to fulfil its commitment to a 50%

[132] NSDEL 2002. *Municipal Solid Waste, Recycling and Composting Summary Tables for Fiscal Year 2000-01.*
[133] RRFB 2000. *A Study to Determine the Composition of Residual Solid Waste & Recyclables in the Municipality of the District of Lunenburg, Nova Scotia, Draft Report.* The breakdown of the waste stream is as follows: paper and paperboard 24%; glass 9%; ferrous 9%; aluminium 1%; plastic 10%; multi-material waste 4%; textiles 3%; organics 34%; special care wastes 5%; other wastes 1%.
[134] NSDEL 2001. *Organic Composting Facilities in Nova Scotia.* Available at www.gov.ns.ca/enla/emc/wasteman/docs/status01.pdf. Last updated July, 2001.

reduction in waste disposal relative to 1989 levels. It placed Nova Scotia among the leaders in waste management in the world. No other province in Canada has implemented such a ban.[135]

The ban simultaneously addressed several environmental threats and opportunities. First, when organic materials mix with water they form organic leachate, which picks up contaminants from the surrounding garbage, and can pollute water resources if it escapes from the landfill site. Second, organic matter in a landfill does not receive adequate aeration and decays anaerobically, producing methane, a potent greenhouse gas. Third, organic material is a valuable resource that can replenish soil nutrients and replace the use of synthetic fertilizers. When landfilled, this organic resource is wasted. Synthetic fertilizers require large inputs of energy to manufacture and pose a wide range of environmental risks.[136] Finally, decaying organics are responsible for the unpleasant odours and animal pests that are often associated with landfills.[137]

Aside from these avoided costs, composted organics have direct value. They can provide valuable environmental and economic services by enhancing the physical, chemical, and biological properties of soil and thus supporting crop productivity (Side Bar 3).

**Side Bar 3. Benefits of Compost to Soil**

*Improves the Physical Properties of Soils*. Compost enhances water holding, soil aeration, structural stability, resistance to water and wind erosion, root penetration and soil temperature stabilization; and helps to conserve water.

*Enhances the Chemical Properties of Soils*. Compost increases macro- and micro-nutrient content, increases availability of mineral substances, ensures pH stability, and provides a long-term source of nutrient input by acting as a nutrient reservoir.

*Improves the Biological Properties of Soils*. Compost promotes the activity of beneficial microorganisms, reduces attack by parasites and other pathogens, promotes faster root development and promotes higher yields of agricultural crops. Composting reduces reliance on pesticides, herbicides, and fungicides by providing an environment rich in organic matter.

Source: USEPA 1999. *Organic Materials Management Strategies*. EPA-530-R-99-016, p. 40.

### *5.3.1 Access to curbside organics pickup*

Access to curbside organics pickup provides a convenient means for households to compost. In 2001, 72% of Nova Scotians had access to curbside collection of organic materials. The

[135] Idem.
[136] Lampkin, N. 1990. *Organic Farming*. Farming Press, Ipswich, UK; and *Agriculture, Ecosystems and Environment* 26:165-187. Also see Scott, J. 2001 and 2002. *The Nova Scotia GPI Soils and Agriculture Accounts.* Available at www.gpiatlantic.org.
[137] Connett, P. & B. Sheehan 2001. *A Citizen's Agenda for Zero Waste – A United States/Canadian Perspective, A Strategy That Avoids Incinerators and Eventually Eliminates Landfills.* Grass Roots Recycling Network. See Appendix F of this report.

availability of composting carts and the ease of curbside pickup is intended to lead to greater levels of organics being diverted from the landfill, mirroring the success of curbside recycling. Access to curbside organics pickup is not an absolute indication of progress. In many cases, organics can better be dealt with on-site through backyard composting or, for those areas without backyards, through a system of neighbourhood composters. Counting household recyclables, organics, and waste pickup, transportation of wastes has probably doubled provincially since 1989, and higher rates of curbside organics pickup will increase this further.[138] In 2001, the distance travelled for organics pickups in Nova Scotia was 20% of the total distance travelled for all garbage, recycling and organics.[139] The availability of curbside organics collection in small towns and rural areas is further discussed in Section 5.3.4.2 on community composting.

### *5.3.2 Access to centralized composting*

Fifty of Nova Scotia's 55 municipalities offer centralized composting to their business sector, which includes supermarkets, restaurants, food processing and fish plants, and other businesses.[140] Annapolis Royal installed commercial-sized composters near its downtown core to ensure that restaurants and businesses have easy access to composting facilities at a low cost.[141]

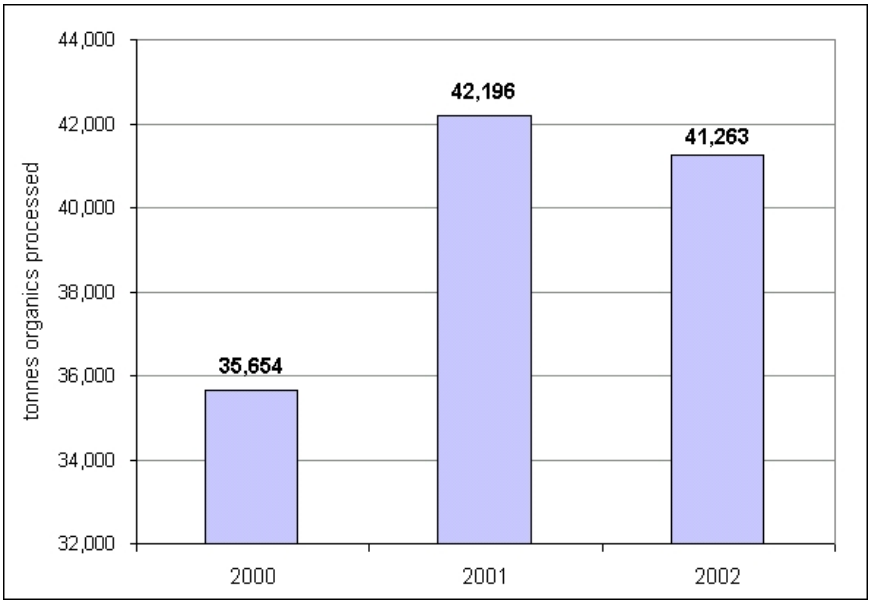
### *5.3.3 Material flows*

In 2000-01, 58,000 tonnes of compostable organic materials were processed in municipal facilities, in addition to materials processed in private facilities, which are not reported. This number does not include most manures or sewage sludge generated in the province, or other organics from farm activity, backyard composting, or small-scale operations that do not require a permit.[142] 2000-01 marked the first year that NSDEL has tracked the quantity of processed organics. No historic comparisons are therefore available at this time.

HRM has tracked the quantity of organics processed since 2000 and there has been an increase since organic materials were banned from landfills in November 1998, although there was a slight decline between the 2000-01 and 2001-02 fiscal years. The total amount of organics processed in 2002 was 41,263 tonnes, a 16% increase over 2000 levels (Figure 19).[143] HRM, with about 40% of Nova Scotia's population, accounts for 57% of all curbside composting in the province.

[138] Goodick, M. 2002, op. cit.
[139] Ibid.
[140] NSDEL 2001. *Status Report of Solid Waste-Resource Management in Nova Scotia.*
[141] Town of Annapolis Royal 2001. *It's Got To Rot,* Zero Waste 2005 section of website. Available at www.annapolisroyal.com/organics.htm.
[142] Bob Kenney, NSDEL. Personal communication, August 2001.
[143] Fred Wendt, HRM. Personal communication, 2002.

**Figure 19. Organics processed, Halifax Regional Municipality, 2000-2002**




Source: HRM 2002.

Note: Based on fiscal years (April 1–March 31). Data are for HRM municipal composting facilities only. Figures do not include backyard or on-site composting.

## *5.3.4 Comprehensiveness of programs*

### 5.3.4.1 Composting facilities

Although the number of composting facilities is not a complete indication of the program's success, a growing number of composting facilities could suggest a correspondingly wider acceptance of composting within the province. There are currently 17 permitted composting facilities in the province, which range from large scale operations (like the Miller Waste Facility and New Era Farms, which handle most of HRM's residential organics), to smaller facilities like the one in East River, Lunenburg County, which composts secondary waste water treatment sludge and sawdust.[144]

### 5.3.4.2 Community composting

Annapolis Royal has implemented a community based composting program that has achieved high levels of organics diversion and which may be more appropriate than curbside pickup for rural communities where distances are a problem. GPI*Atlantic* recommends that rural municipalities in Nova Scotia study the Annapolis Royal program as a waste model strategy.[145]

[144] NSDEL 2001. *Status Report of Solid Waste-Resource Management in Nova Scotia.*
[145] See Appendix C for more information about the Annapolis Royal waste management system.

The Annapolis Royal system includes not only backyard composters but also green cones, which can accept all organic materials including animal products. In addition, community composters called Earth Tubs are available for businesses and larger amounts of residential wastes. Annapolis Royal has set a target of zero waste in the year 2005, and has received several awards for its work in this area. The total waste diversion rate calculated by Annapolis Royal in 2000-01, including both recycling and composting, was around 58%, although the Valley Waste Authority has disputed this figure.

NSDEL responds to the case for community composting by pointing out that, although municipalities support and promote on-site/backyard composting, there is not enough participation to rely upon it solely. Suggested reasons for the lack of extensive participation in backyard composting include aversion to pests and odours, maintenance required, lack of knowledge, and the lack of backyard space.

Because the province has banned organics from landfill disposal, provincial officials maintain that it is the municipalities' obligation to provide households with a convenient approach to separate organics from the regular waste stream. NSDEL argues that a neighbourhood-by-neighbourhood composter system would be a logistical nightmare for municipalities to locate, manage, and operate without strong, ongoing citizen leadership and participation. NSDEL recommends promotion of on-site/backyard composting alongside offering curbside organics pickup, in order to offer more choice to Nova Scotians and to increase overall diversion rates. In addition, not all materials, such as animal products and non-marketable papers such as cereal boxes, can be composted in on-site or backyard composters. However, these materials *can* be composted in the province's state-of-the-art composting facilities.

NSDEL also suggests that this program has not resulted in more trucks being on the road because of alternating collection schedules. Organics and recyclables are picked up one week, with regular garbage pickup the following week. In the past, garbage was picked up on a weekly basis. However, one study shows that province-wide mileage of residential waste trucks has probably doubled since the inception of the comprehensive recycling and composting program.[146] Critics point out that extensive local programs could eliminate the need for trucking of organics altogether, while still maintaining bi-weekly garbage pickup. In addition to reducing trucking costs, this option would reduce emissions of GHGs and other air pollutants, while saving wear and tear on roads.

The authors recognize the merits of both positions. It is clear that access is a key prerequisite for extensive participation and offers greater opportunities for increased waste diversion. However, while access to curbside organics pickup may be highly suitable for large urban regions, other approaches for handling organics may be more appropriate for smaller or rural communities. GPI*Atlantic* therefore recommends that NSDEL study the feasibility of community-based approaches for handling organics in small communities, and continue to promote well-maintained, on-site residential composting with the aim of gradually increasing participation. This feasibility study should employ full cost accounting methods and include impacts of increased trucking, such as increased air pollutant and GHG emissions, and costs of road

[146] Goodick, M. 2002, op. cit.

maintenance, policing, and other trucking costs as outlined in Appendix D of the *Nova Scotia Greenhouse Gas Accounts*.[147]

### 5.3.4.3 Backyard composting

Backyard composting is considered to be the most cost-effective treatment of the domestic organics discard stream.[148] All Nova Scotia municipalities promote backyard composting for leaf and yard waste.[149] Although backyard composting is encouraged throughout Nova Scotia, quantities processed and participation rates are unknown. Separate surveys completed in the mid-1990s ranged from a 20% participation rate in Cape Breton to a 69% participation rate in West Hants.[150]

There are numerous economic benefits to backyard composting, including direct savings through the decrease in curbside collection costs. In addition there are the indirect benefits: a decrease in transportation and energy costs, which in turn reduces GHG and air pollutant emissions and road maintenance costs; and a substitution of some garden fertilizers with nutrient-rich compost. Centralized composting also produces compost used to displace fertilizers and improve soil quality.

The most extensive backyard composting study in Nova Scotia is the Town of Bedford's 1995 *Residential Backyard Composting Promotional, Educational and Monitoring Program*.[151] The study concludes that backyard composting education and promotion is cost-effective and leads to a significant decrease in the amount of organic materials entering the municipal organics pick-up stream.

According to the study, Bedford households that engaged in backyard composting diverted, on average, 124.3 kg per year per household (10.36 kg per month) of household kitchen waste. Estimates indicate that the monthly rate of residential food waste production is 26 kg per household per month (312 kg/household/year).[152] Households that participated in backyard composting in Bedford therefore diverted about 40% of their food waste to backyard composting. If yard wastes are included in the amount that could be diverted, the total per household per year is 143.52 kg per year. The total annual tonnes of waste that could be diverted through backyard composting in Halifax was based on 50% participation by eligible households (single detached dwellings; semi-detached dwellings; row houses; and mobile homes). The total eligible houses in 1995 were 74,470. If 50% of these homes diverted 143.52 kg per year, the total diverted would be 5,344 tonnes per year.

Counting only direct costs, the Bedford study presents a backyard composting costing scenario in order to determine the actual economic cost of a backyard composting promotion campaign to

[147] Walker, S., A. Monette & R. Colman 2001. *The Nova Scotia Greenhouse Gas Accounts for the Genuine Progress Index*. GPI Atlantic, Halifax. Available at www.gpiatlantic.org.
[148] Connett, P. & B. Sheehan 2001, op. cit.
[149] NSDEL 2001. *Status Report of Solid Waste-Resource Management in Nova Scotia.*
[150] Bob Kenney, NSDEL. Personal communication, August 2001.
[151] Town of Bedford Engineering and Works Department 1995. *Residential Backyard Composting Promotional, Educational and Monitoring Program*, *Bedford Backyard Composting Study.*
[152] Ibid.

the Halifax Municipality. The study suggested a net cost of just over $300,000 in its first year, reflecting the initial investment in backyard composting bins, but a net savings of over $500,000 in the program's second year and each year after that. We have updated the study in Table 14 (with current costs), which shows a cost in Year 1 of $773,641, with savings in subsequent years of $604,050. In other words, the initial outlay in promoting backyard composting should be seen as an investment with a substantial short-term rate of return rather than as a simple cost.[153] At the time of the study, which was based on Halifax Municipality, HRM did not exist, and therefore we have not updated the number of households from the Bedford study.

Table 14 demonstrates that this particular costing scenario would pay back the initial investment in 19 months and produce savings thereafter. Clearly, investing in backyard composting is cost effective. As noted, this costing scenario accounts only for direct costs and does not include the social, environmental, and community benefits of composting. Presumably, similar economic benefits to those presented in the Bedford study could be achieved in other jurisdictions throughout Nova Scotia.

**Table 14. Costs and avoided costs of backyard composting in Halifax, based on the Bedford backyard composting study ($C2000)**

| | Year 1 | Year 2 |
|---|---|---|
| Bin subsidization (37,235 bins @ $37) | $1,377,695 | |
| Public education and promotion | $112,042 | $112,042 |
| **Total** | **$1,489,737** | **$112,042** |
| Avoided costs | | |
| Curbside collection (5,344t @ $75) | $400,800 | $400,800 |
| Disposal (5,344t @ $59/tonne net ) | $315,296 | $315,296 |
| **Total** | **$716,096** | **$716,096** |
| **Program costs less avoided costs** | **$773,641** | **($604,054)** |

Sources: Town of Bedford, Engineering and Works Department 1995; *Findings: Weekly Summer Collection Green Cart Pilot Project*, presented to HRM Council February 2004; and NSDEL 2002. *Municipal Solid Waste, Recycling and Composting Summary Tables for Fiscal Year 2000-01*.

Notes: Number of bins based on 50% of qualifying households. The cost to residents was $25, and the municipality payed the rest of the cost, a total of $37. Curbside collection costs based on 11.96 kg organic waste per household per month.

## 5.4 Permanent or Final Disposal

Theoretically, permanent or final disposal within the Nova Scotia solid waste-resource system is only for those items that cannot be reintroduced into the economy through recycling or diverted through composting. A municipal waste stream characterization study indicated that permanent or final disposal can potentially be reduced to 10% of the total amount of waste generated,

[153] Idem, p. 15.

assuming the diversion of *all* materials with recyclable and compostable potential.[154] Reducing this amount further would require redesigning products to ensure they have the capacity to be recycled or composted. In addition, the quantity of waste going to permanent disposal can be lowered through reduced consumption and through generating less waste at the outset.

Barry Friesen, NSDEL Solid Waste Division Manager, suggests that one of the biggest obstacles he faces as a waste manager is the number of products on the market that lack the capacity to be recycled or composted.[155] The Grassroots Recycling Network argues that lack of producer responsibility is the greatest barrier to waste diversion and that pressure must be placed on manufacturers and companies to take greater responsibility for their products to ensure that they can be recycled or composted.[156] Target Zero Canada profiles several innovative companies that have led the way in taking a cradle-to-grave approach to their products.[157]

The Nova Scotia Solid Waste-Resource Management Regulations provide the Minister of the Environment with the authority to compel the packaging and goods-producing industries to bear the costs of managing the diversion or disposal of their materials. The government can enact mandatory bans, levies, or deposits on materials, such as the current system of deposits on beverage containers. However, no additional materials have been banned or faced deposit fees since the program began.

In Nova Scotia, all permanent waste that cannot be recycled or composted goes to landfills for disposal, except in CBRM, which uses a combination of landfill disposal and incineration.

### *5.4.1 Landfill disposal*

To meet the 50% waste diversion goal, the province introduced landfill bans on organic materials and on products that can be recycled. These bans are regulated by the Nova Scotia Environment Act, and banned materials and products are listed in the Solid Waste-Resource Management Regulations under Schedule "B" – Materials Banned from Landfills and Incinerators (Table 15).[158] Material bans not only symbolized the province's commitment to waste diversion but also acted as a catalyst to ensure adequate quantities of material to drive recycling and composting initiatives. The bans also added a regulatory mechanism and the force of law to a strategy that relied in large part on citizen participation and co-operation. Products that cannot be recycled are neither banned nor subject to penalty.

Although diverting organics and toxic materials from landfills drastically reduces leachate problems, environmental contamination from landfills still poses a potential threat to water systems and communities near landfills.

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[154] RRFB 2000. *A Study to Determine the Composition of Residual Solid Waste & Recyclables in the Municipality of the District of Lunenburg, Nova Scotia, Draft Report*.
[155] Barry Friesen, NSDEL. Personal communication, August 2002.
[156] For more information on the Grassroots Recycling Network and producer responsibility, visit www.grrn.com.
[157] The Target Zero Canada website (www.targetzerocanada.org) highlights the achievements of these companies.
[158] Schedule "B" was amended: O.I.C. 2002-94, N.S. Reg. 24/2002. The Solid Waste-Resource Management Regulations are available at www.gov.ns.ca/just/regulations/regs/envsolid.htm. Note that the ban implementation dates listed in Schedule "B" differ from the actual implementation dates listed in Table 15 of this report.

**Table 15. Materials banned from disposal sites in Nova Scotia**

| Banned material | Ban implementation date |
|---|---|
| Redeemed beverage containers | April 1, 1996 |
| Corrugated cardboard | April 1, 1996 |
| Newsprint | April 1, 1996 |
| Used tires | April 1, 1996 |
| Automotive lead-acid batteries | April 1, 1996 |
| Leaf and yard waste | June 1, 1996 |
| Waste paint | April 1, 1997 |
| Ethylene glycol (automotive antifreeze) | April 1, 1997 |
| Steel/tin food containers | September 1, 1998 |
| Glass food containers | September 1, 1998 |
| #2 HDPE non-hazardous containers (e.g. ice cream containers, plastic jugs, detergent bottles etc.) | September 1, 1998 |
| Stretch (pallet) wrap for businesses | September 1, 1998 |
| Compostable organic material (food waste, yard waste, soiled and non-recyclable paper) | November 30, 1998 |

Source: NSDEL 2004. *Materials Banned from Disposal Sites in Nova Scotia*. Available at www.gov.ns.ca/enla/emc/wasteman/banned.asp.

Nova Scotia is addressing this problem by reducing the number of landfills in the province and, by 2005, requiring all landfills to meet second generation landfill standards. Second generation landfills are required to include the following components: landfill liner system; landfill final cover system; leachate management system; landfill gas management system; surface water management system; groundwater management system; disposal material monitoring; separation distances; and quality control assurance.[159]

Twenty years after municipally run landfills were first introduced in Nova Scotia, NSDOE recognized their shortcomings:

> "Until recently, it was felt that natural soils could fully treat or attenuate leachate and thus prevent significant migration of contaminants into the groundwater. It is now known that there are very few low-permeability soil deposits in Nova Scotia of sufficient thickness and uniformity to contain and attenuate large quantities of leachate. Increased use of groundwater for municipal, commercial and industrial purposes has led to greater emphasis on its protection. In addition, public concerns over the siting of landfills and for the environment in general, has prompted higher standards in all areas of waste management."[160]

Of the 18 remaining landfills in Nova Scotia, only the facilities in HRM, Colchester County, and Cumberland County currently meet second generation standards (Table 16).

[159] NSDOE 1997. *Nova Scotia Department of the Environment Municipal Solid Waste Landfill Guidelines.*
[160] NSDOE 1994. *Nova Scotia Standards and Guidelines Manual for Landfills*. Cited in Wendt, F. 2001, op. cit.

**Table 16. Number of disposal sites in Nova Scotia, by type**

| Year | Standard landfill | Second generation landfill | Total |
|---|---|---|---|
| 1970s | 100+ | 0 | 100+ |
| 2000 | 15 | 3 | 18 |
| 2005 (estimate) | 0 | 7-10 | 7-10 |

Source: NSDEL 2001.

To further ensure that toxic materials and organics stay out of the landfill, HRM passes all waste intended for permanent disposal through a front-end processing facility. At this facility, the residuals are placed on conveyer belts, where workers remove any toxic materials and recyclables that were not separated out at source. In addition, the remaining content is shaken in large, rotating screens to separate residual compostables from most inorganic materials. These residual organics are put through an early stage composting process for a period of 21 days to stabilize any organic material that found its way into the permanent disposal stream.[161] The materials are then composted in a facility under negative air pressure, thereby rendering the materials inert and stabilizing them before disposal.[162]

### *5.4.2 Incineration*

Cape Breton Regional Municipality is the only region in Nova Scotia to incinerate a portion of its waste. In addition, there is also a landfill that serves the CBRM community. In 2000, CBRM incinerated 39,393 tonnes of mixed waste.[163]

Incineration has been rejected in the remainder of the province. It was rejected by HRM based on economic costs alone. The City of Halifax Waste Management Task Force concluded that incineration for the Metro Authority (the area including Halifax County, the Cities of Halifax and Dartmouth, and the Town of Bedford, all of which are now collectively referred to as the HRM) would have cost at least 33% more than the option upon which the current system is based.[164] The study concluded that non-incineration based options with source separation were more cost effective.

The study found that the estimated annual costs per tonne (including capital amortization but not including collection costs) were:

- Metropolitan Authority incineration option: $81 per tonne
- Best available technology incinerator option: $104 per tonne
- Three stream collection with commingled recyclables: $61 per tonne.

[161] Fred Wendt, HRM. Personal communication, December 2001.
[162] Jim Bauld, HRM. Personal communication, December 2001.
[163] Bob Kenney, NSDEL. Personal communication, August 2001.
[164] Sound Resources Management Group Inc. & Angus Environmental Ltd. 1992. *Review of Waste Management Systems Options.* Prepared for the City of Halifax Waste Management Task Force.

Annual single-family residential collection costs were estimated at $7.70 per ton for the incineration options and $10.50 per ton for three-stream collection with commingled recyclables. Including collection costs, therefore, the total estimated costs were:

- $88.70 per tonne for the incineration option
- $111.70 per tonne for the best available incineration technology
- $71.50 per tonne for three-stream collection with commingled recyclables.

The study also concluded that non-incineration options provide economic, health, and environmental benefits when compared to incineration.

A discussion of the environmental implications and potential health hazards of incineration is not within the scope of this report. It is important to note, however, that environmental and health concerns have prompted a movement away from incineration as a strategy to handle waste disposal throughout North America and Europe.[165]

## 5.5 Education & Awareness

> "Solving today's and tomorrow's environmental issues depends on people's knowledge, cognition, attitude, and behaviour, so that environmental education is an effective and sustainable way for protecting and conserving the environment."[166]

The success of waste-resource initiatives depends largely on individual and household participation and cooperation. In addition to nurturing the conviction that participation is important, education and awareness play a more basic role in instructing citizens as to how the program works.

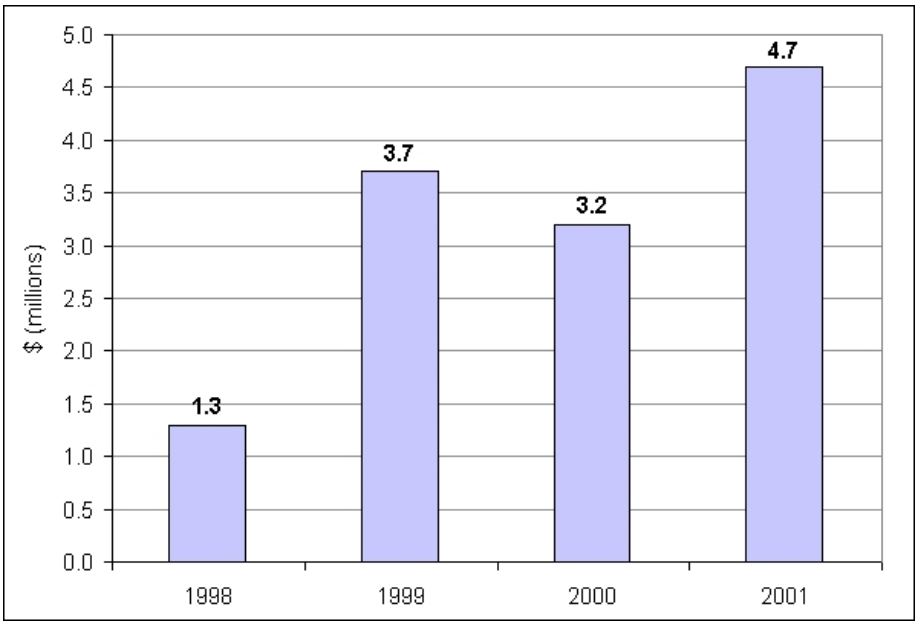
The RRFB operates at arms length from the Nova Scotia Government and is funded entirely from funds generated by deposit and stewardship programs. One mandate of the RRFB is to "develop education and awareness of source reduction, re-use, recycling and composting." In 2001, $4.7 million was allocated to programs that either directly or indirectly increase education and awareness (Figure 20).[167]

In addition, non-profit organizations such as Clean Nova Scotia (with funding from RRFB) have worked diligently over the past decade to educate and motivate Nova Scotians to reduce waste and to conserve by reducing their consumption, as well as to re-use materials, recycle, and compost. As mentioned in Section 5.2.3 on access to curbside recycling, much education is carried out in a hands-on way, for example by placing stickers on recyclable bags and green bins

[165] Connett, P. & B. Sheehan 2001, op. cit.
[166] Ministry of Education and Training, Viet Nam 1997. Cited in Gray-MacDonald, J. 2001. *The Potential for Education to Improve Solid Waste Management in Vietnam: A focus on Hanoi*. Available at www.utoronto.ca/env/st/jg-d/enviro_edu.htm.
[167] RRFB 2001, op. cit. Amount spent on education includes: education and awareness, and RRFB contributions to regional coordinators, approved programs and the NSDEL. Most of this money is directly or indirectly spent on education and awareness.

with non-compliant or improperly sorted material, which is probably the most effective approach.

**Figure 20. Amount spent by Resource Recovery Fund Board in Nova Scotia on education and awareness (C$2000 millions)**[168]




Source: RRFB Annual Reports 1998, 1999, 2000, 2001.

### Side Bar 4. Success Based on Education

"In the late 1980s, Dr. Barry Commoner and co-workers performed an experiment in East Hampton, Long Island, in the state of New York. With the help of 100 volunteer families they measured how much diversion from landfill could be achieved with a four-container system and existing commercial recycling and composting facilities... In this experiment they achieved a remarkable 84% diversion from landfill."

"Critics have argued that this sample is not representative of the American people and that the 100 families were highly committed to the success of the project. We would argue that this is precisely the point. This experiment showed how much diversion was physically possible when you had a very strong commitment from householders. From our point of view, **it clearly underlines the need to spend sufficient money from the waste budget on the kind of education programs that might generate this kind of commitment**."

Source: Connett & Sheehan 2001, emphasis added.

[168] RRFB annual reports 1998, 1999, 2000, 2001. RRFB 2001, op. cit. is available at www.rrfb.org. For other reports, contact RRFB at 902-895-7732.

**Side Bar 5. Innovative Idea – Edmonton Mentoring Program**

**Master Composter/Recycler Program**

"The City of Edmonton developed the Master Composter/Recycler Volunteer Program in 1991. As of May 1999, nine classes of community volunteers have been recruited and have undergone 35-40 hours of training over a three week period. The course gives an overview of the waste management process in Edmonton, with specific emphasis on the areas of home composting and recycling. Trainers use lectures, videos, facility tours, demonstrations and discussion groups. Graduates are then sent out into their own communities to help educate and inform the public about the 4 R's: reduce, re-use, recycle and recover.

"They earn their Master Composter/Recycler status by spending 35-40 hours of their own time in volunteer activities of their choice, such as giving classes on composting and helping people in their neighbourhoods who have requested assistance with composting problems. Other volunteers go into schools and give presentations on vermicomposting and other topics. One group from North Glenora organized a series of 'Re-use Roundups'(garbage fairs), that are now being held all over the city. Volunteers have helped staff waste management display booths at farmers' markets, malls, environmental fairs and special events where they answer questions and distribute information and brochures. Master Composters have also provided staff for specific City projects such as the "Compost Give-Away" and the subsidized "Composter Sale."

"There are currently over 250 citizens who have taken this training. They are an invaluable resource in helping the City educate the public on how to divert recyclable waste from the landfill. The most recent focus for the volunteers has been to encourage people to use the household hazardous waste collection depot so that toxic materials can be kept out of the waste stream."

"Approximately 27% of Edmonton homeowners (around 42,000 families) are composting in their backyards. This results in 10,224 tonnes of organic waste currently being diverted from the landfill each year. With the help of these volunteers and the Backyard Composting Education Centre at John Janzen Nature Centre it is hoped that even more Edmontonians can be encouraged to try composting."

Source: City of Edmonton 2001. Available at www.gov.edmonton.ab.ca/am_pw/waste_management/master_compost_pgrm.html.

## 5.6 Household Hazardous Waste

HHW is waste material generated in our homes that poses a risk to health, safety, or the environment. HHW includes flammable or combustible products such as paint and solvents; reactive products such as pool chemicals; corrosive products such as cleaners; toxic products such as pesticides; products with heavy metals in them; and pharmaceuticals.[169]

The Nova Scotia Solid Waste-Resource Management Strategy set out to reduce HHW by 60-70%. Currently, due to the lack of a tracking system, there are no available data to evaluate progress on HHW disposal. GPI*Atlantic* recommends that NSDEL begin tracking HHW

[169] Manitoba Conservation Department 2001. *What is Household Hazardous Waste?* Available at www.gov.mb.ca/conservation/hhw/index.html.

information and create a concrete action plan to reduce HHW to the intended levels outlined in the Strategy. Such information will also allow timely updates of these GPI Solid Waste-Resource Accounts.

**Side Bar 6. Threats that Household Hazardous Waste Pose to Waste-Resource Systems**

- Flammable or combustible products pose a fire risk during waste collection and in waste disposal operations.
- Explosive, corrosive, poisonous, or reactive products pose elevated risks to people who work with waste and can cause problems in a landfill.
- Metals used in the circuitry of computers and in televisions – including lead, mercury, and cadmium – can be an environmental hazard in landfills. If decomposed over long periods of time and leaked into groundwater, these metals could contaminate water supplies.
- Needles that have not been properly prepared for disposal can be unsafe for garbage and recycling workers.

Source: Manitoba Conservation Department 2001.

RRFB Nova Scotia provides up to $15,000 in funding for HHW and Paint Swaps for each of the seven Solid Waste-Resource Management Regions ($105,000 in total). Many municipalities hold HHW days.[170] Currently, a number of municipalities throughout the province have established HHW drop-off programs. Because increased access is essential for genuine progress in this area, GPI*Atlantic* encourages the province, in cooperation with the municipalities, to ensure that all Nova Scotians have access to HHW drop-off programs. A more far-reaching and longer-term option is to add a red bin or red bag for HHW to the household waste separation stream, to be included in the curbside pickup program on a regular basis.

A few programs have been created to deal with some components of HHW, but again there are no data to measure the success of these programs. A used oil recovery program has been instituted, with the stewardship of the oil retailers. There is also a "safe sharps" program to ensure safe handling of household syringes, needles, and lancets, as well as a paint recovery program that began in June 2002. Various volunteer initiatives, such as Clean Nova Scotia's paint swap, have also resulted in progress. These programs are examples of product stewardship initiatives that many jurisdictions are implementing to deal with HHW. Through these initiatives, manufacturers and retailers of hazardous products become involved in the life cycle of their products and play a role in their safe disposal in partnership with government, citizens, and the non-profit sector.

Manitoba is in the process of implementing a comprehensive set of product stewardship programs for all HHW: "This approach places primary responsibility for managing the wastes associated with designated products on the manufacturers and sellers of those products."[171]

[170] M. Catherine McCarthy, RRFB. Personal communication, May 2004.
[171] Manitoba Conservation Department 2001. Available at www.gov.mb.ca/conservation/hhw/index.html.

Manitoba's HHW program will not allow HHW products to be sold if manufacturers and retailers do not take responsibility to ensure their safe disposal.[172] Because progress in HHW disposal in Nova Scotia has not kept pace with the province's pioneering efforts in residential waste diversion, GPI*Atlantic* recommends that Nova Scotia study the Manitoba HHW program and follow that province's lead in this area.

## 5.7 Construction & Demolition Waste

C&D waste makes up approximately 25-30% of the total municipal waste stream.[173] After the re-usable fraction has been sorted and removed from the C&D debris, most of the debris is ground up and used for landfill cover.[174] There are few historical data monitoring C&D waste diversion and no mechanism to track diversion of material before it reaches C&D disposal sites. C&D diversion includes material sold at on-site sales, and material used as clean landfill by the construction industry. While the province does have regulations defining C&D waste disposal methods, it currently has no specific regulations to encourage C&D waste diversion.[175]

As noted earlier, the Solid Waste-Resource Management Strategy rewards municipalities through RRFB funding based on diversion rates, which encourages C&D waste diversion. Because a large portion of C&D materials are inert and do not require disposal in advanced technology landfills, there are seven private licensed C&D disposal facilities throughout the province.[176] Since these facilities are not included in the landfill diversion calculation upon which RRFB funding is based, there is no provincial incentive to recycle these materials. While there are provincially regulated disposal guidelines defining non-inert C&D materials, there is no incentive to minimize C&D disposal at these sites because revenues are based on the amount of material accepted. Unless the material being disposed of has a resale value greater than the cost of separating the materials, it is generally disposed. This means that C&D materials that can be re-used – such as scrap wood that could be used for mulch, heating, or landfill cover, or glass that has a recycling market – may end up being landfilled.[177]

In fact, there may be a disincentive for C&D disposal facility operators to re-use and recycle C&D material, if it requires capital and labour that may reduce profits.[178] Given that C&D waste represents such a large percentage of the total municipal waste stream, there clearly needs to be more emphasis placed on diverting C&D waste from the private landfills.

In October 2001, the Regional Chairpersons' Committee of Solid Waste Resource Management formed the C&D Management Committee to "assess the current practices of the management of C&D waste by municipalities/regions, with the intent to develop a strategy or best management

[172] More information on the Manitoba HHW program can obtained at www.gov.mb.ca/conservation/hhw/index.html.
[173] Bob Kenney, NSDEL. Personal communication, 2002.
[174] Bob Kenney, NSDEL. Personal communication, February 2004.
[175] Jim Bauld, HRM. Personal communication, November 2002.
[176] NSDEL. *Construction and Demolition Debris Disposal Sites (private).* Available at www.gov.ns.ca/enla/emc/wasteman/construc1.htm. Accessed February 2004.
[177] Jim Bauld, HRM. Personal communication, November 2002.
[178] Ibid.

practices for C&D material for all municipalities/regions of the province" The committee presented a draft "position paper" to the regional chairs in 2004.[179]

C&D waste management strategies currently vary by region/municipality, but the lack of an overall provincial strategy to encourage C&D diversion sends an implicit signal to municipalities that C&D waste is not a priority. In a survey of municipalities conducted by the C&D Management Committee, 44.7% said that C&D recycling is not encouraged within their municipalities or towns, and 79% said there are no "…staff designated to specifically track where and how C&D waste is disposed."[180]

The lack of a provincial C&D diversion strategy has also resulted in an assortment of varying regional/municipal policies for handling C&D waste. As a result, the private sector can circumnavigate stricter by-laws in one region by disposing of materials in another region or municipality with regulations that are more lax.[181]

GPI*Atlantic* strongly recommends that supporting provincial legislation be enacted that requires the maximization of diversion and the minimization of disposal of C&D materials. This should be accompanied by a full cost accounting study that reviews which C&D materials should be diverted, and the potential cost-effectiveness of alternative diversion and disposal options. For example, the study might compare the costs and benefits of diverting wood scraps for recycling, combustion, or clean landfill, and of disposing of them in a private C&D site.

A provincial C&D plan is especially relevant to HRM, which recently passed By-Law L-200, the "C&D Materials Recycling and Disposal License By-Law."[182] The by-law, which is only one component of HRM's progressive C&D waste management plan, prevents private C&D disposal sites from disposing of material that can be diverted. C&D disposal facilities within HRM are therefore required to reject materials with recyclable content, thereby requiring the C&D industry to re-use and recycle their materials.

However, there is little capacity to prevent the private sector from disposing of C&D materials in other jurisdictions. This has negative consequences for HRM. If the waste stays within HRM, it will be diverted from the landfill and increase HRM's diversion rate, ultimately increasing municipal diversion credit funding from the RRFB. If the waste leaves HRM, the recipient C&D disposal operator gains the tipping fee.

To overcome this problem and ensure disposal of materials at facilities within municipal limits, HRM introduced By-Law S602, Section 16.3, which states that "no person shall export or remove solid waste material generated within the Municipality outside the boundaries of the Municipality and all such solid waste shall be disposed of within the boundaries of the Municipality and in accordance with this By-law."[183] Without a uniform provincial standard, however, it will be difficult for the region to enforce this policy.

[179] C&D Management Committee 2002. Presentation given to Nova Scotia Waste-Resource Advisory Committee.
[180] Ibid.
[181] Ibid.
[182] HRM By-Laws are available at http://www.region.halifax.ns.ca/legislation/bylaws/hrm/.
[183] Idem.

Another concern is that, although C&D material actually disposed of or diverted from private C&D facilities is considered in the provincial diversion rate data, there is a large amount of C&D material that is stockpiled. These stockpiles are counted as diverted material, even though the bulk of this material will, likely, eventually be disposed. This causes abnormal fluctuations in the diversion data, inflating some diversion statistics, and raising concerns as to whether the province has actually achieved the 50% diversion rate it claims. In addition, while these stockpiles are inert materials, they may pose potential fire hazards and can be unsightly.[184]

Nova Scotia has 15 recyclers and re-users of building materials, such as Happy Harry's and Renovator's Resource, companies that have recognized the economic value of re-using construction materials.[185] Many examples of the economic benefits of reducing construction waste by using more precise specifications and re-using construction materials are available (see Section 9.6 for recommendations and areas of improvement with respect to C&D waste). Manuals are available for builders, renovators, and demolition companies that show how to reduce, re-use, and recycle materials in the construction industry. One example is *Wastespec: Model Specification for Construction Waste Reduction, Re-use and Recycling*.[186]

A 1997 Ontario study of construction industry waste management practices concluded that minimizing construction waste should be given priority over recycling because it is not only the most effective way to reduce waste, but also has the greatest potential to save money.[187] The study also concluded that grass roots education and work with the home builders association, as well as kits to increase awareness and to provide practical advice were also necessary components of a waste reduction strategy.

GPI*Atlantic* recommends that the province work with municipalities to develop a comprehensive C&D waste strategy based on both the recommendations of the C&D Management Committee[188] and on HRM's C&D waste strategy. In sum, the next steps for forward movement have already been spelled out in these two Nova Scotia based initiatives. It now only remains for the province to adopt and implement the recommended actions.

## 5.8 Illegal Dumping & Littering

### *5.8.1 Illegal dumping*

High levels of illegal dumping can be considered a symptom of the limitations of a waste-resource management plan. Reasons for illegal dumping vary, but the most common causes are

[184] Idem.
[185] NSDEL 2004. *Manufactured Products from Recyclable Materials*. Available at http://www.gov.ns.ca/enla/emc/wasteman/mprm.asp. Accessed May 2004.
[186] Triangle J Council of Governments 2003. *WasteSpec: Model Specifications for Construction Waste Reduction, Re-use and Recycling*. Research Triangle, North Carolina. Available at http://www.tjcog.dst.nc.us/cdwaste.htm. Accessed February 2004.
[187] Paul, T.J., Habitat Associates & Ontario Home Builders Association 1997. *Sustainability in Practice: Reducing Construction Waste in the Ontario Residential Construction Industry.* Prepared for the Canadian Mortgage and Housing Corporation.
[188] C&D Management Committee 2002. Presentation given to Nova Scotia Waste-Resource Advisory Committee.

assumed to be public ignorance and lack of education, perceived high cost of disposal and a lack of easy access to disposal facilities. Critics of the Nova Scotia Solid Waste-Resource Management Strategy suggested that banning materials from landfills would result in increased illegal dumping.

Because there is no baseline information or regular tracking of illegal dumping activities, it is difficult to determine whether there has been a change in the rates of illegal dumping across the province since the Strategy was implemented.

A 1998 questionnaire sent to Area Waste Managers by a government committee on illegal dumping activity attempted to ascertain whether landfill bans led to increased illegal dumping. It asked the following question: "As a field personnel, do you perceive the issue of illegal dumping to be more of a problem than it has been in the past?" Area managers responded as follows:[189]

> **Western Area:** "Illegal dumping has been and continues to be an occasional problem, but there seems to be no increase since the landfill bans."
>
> **Northern Area:** "This region feels that there is only a small percentage increase in clean-ups but have no data on exactly how much."
>
> **Central Area:** "There is definitely an increase in problems associated with illegal dumping in both suburban and rural areas…. There is an increase in dumping each time that there is an increase in tipping fees (no quantitative data available)."
>
> **Eastern Area:** "There does not appear to be an increased problem with illegal dumping."

*A Report on Illegal Dumping – The Current Situation in Nova Scotia and Halifax Regional Municipality*, acknowledged that illegal dumping is a problem but did not find any correlation with the landfill bans or tipping fees.[190] The report stated:

> "Approximately 80% of the representatives from municipalities and towns surveyed felt that illegal dumping and derelict vehicles were more than just a nuisance in their community.… Low or absent landfill tipping fees did not necessarily correspond to a lesser amount of illegal dumping in the region. In fact, in the majority of the municipalities that considered illegal dumping a problem, there were no tipping fees at their landfills or there were only fees for materials weighing over 6000 kg."

Testimony from NSDEL and from the reviewed material above is inconclusive in determining whether there has been an increase or decrease in illegal dumping activity. GPI*Atlantic*

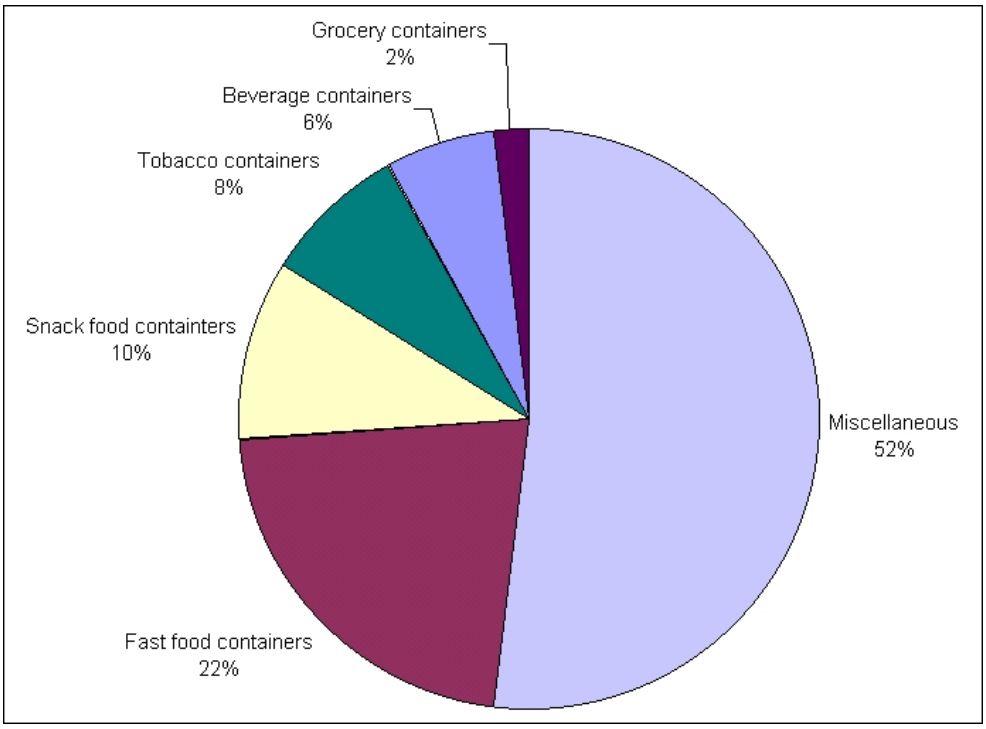
[189] NSDOE 1998. Interdepartmental memo between Barry Friesen, NSDEL and Christene Almon, Nova Scotia Department of Transportation and Public Works.
[190] Greenway, K. & M. Moynihan 1999. *A Report on Illegal Dumping – The Current Situation in Nova Scotia and Halifax Regional Municipality.* The Nova Scotia Youth Conservation Corps Draft Report.

recommends tracking illegal dumping activity in order to establish a baseline set of information for future studies. In 2003, RRFB Nova Scotia provided $190,000 in funding for 11 municipal projects directed at cleaning up illegal dumpsites across the province. Dozens of dumpsites were cleaned up, but the total amount of material either recycled or landfilled will not be known until final reports are submitted. This funding for illegal dumpsite cleanup is in addition to the nearly $50,000 in funding given to Adopt-a-Highway and Clean Nova Scotia for litter cleanup programs.[191]

### *5.8.2 Litter*

In 1998, NSDOE sponsored a study of litter quantities and litter composition across the province.[192] The study surveyed 40 litter sites and classified the litter into six categories: miscellaneous, which comprised 52% of total litter, and five other categories that were classifications of wrappings and containers based on their source. The results are shown in Figure 21.

**Figure 21. Composition of litter in Nova Scotia, 1998**




Source: The Nova Scotia Youth Conservation Corps & NSDOE 1998. *A Characterization of Nova Scotian Litter: A Litter Survey, July and August 1998*, p. 2.

[191] M. Catherine McCarthy, RRFB, Personal communication, May 2004.
[192] Fairbanks, B., J. Flynn, S. Hicks, A. Soley & D. Thompson 1998. *A Characterization of Nova Scotian Litter: A Litter Survey, July and August 1998*. The Nova Scotia Youth Conservation Corps and NSDOE.

It is clear that fast food restaurants are a major contributor to this litter. Of the fast-food litter, 47% was from Tim Hortons, followed by 22% from McDonald's. In fact, Tim Hortons accounts for fully 22% of ***all*** litter found in Nova Scotia, and McDonald's for 10% (Table 17). In the miscellaneous category, the survey found that 42% of the litter was paper and 37% was plastic. The beverage container category contained almost 50% more non-deposit-refund containers than deposit-bearing containers, indicating the effectiveness of the bottle-refund deposit system.

As with illegal dumping, there was a perception among critics that changes to the solid waste-resource system would lead to an increase in litter. It was widely assumed that a more complicated disposal system would encourage litter. Although there are no baseline data with which to compare the findings, the 1998 NSDOE litter study shed light on many solid waste-resource management issues.

**Table 17. Top ten brands as a percentage of litter in Nova Scotia, 1998**

| Rank | Brand category | # of items | % of identified litter |
|---|---|---|---|
| 1 | Tim Hortons | 821 | 22.0% |
| 2 | McDonald's | 380 | 10.1% |
| 3 | Players | 223 | 6.0% |
| 4 | Hostess | 205 | 5.5% |
| 5 | Humpty Dumpty | 110 | 2.9% |
| 6 | Export A | 104 | 2.8% |
| 7 | Sobeys | 98 | 2.6% |
| 8 | Hershey | 91 | 2.4% |
| 9 | Pepsi | 82 | 2.2% |
| 10 | Coke | 77 | 2.1% |

Source: Nova Scotia Youth Conservation Corps & NSDOE 1998.

The composition and quantity of litter found in the study is considered to be a typical assortment and amount of litter found in jurisdictions with and without comprehensive waste diversion programs. If the new waste management system had affected littering patterns, one would expect to find a disproportionately high amount of litter that requires special disposal under the new waste-management plan. While it is difficult to assess the exact proportion of the litter in the survey that would have gone to the landfill, it is likely that the fast food, snack food, and tobacco components of the litter, and perhaps the plastics component of the miscellaneous category, would have been bound for the landfill. This amounts to about 60% of the litter found in the 1998 survey, which suggests that implementation of the solid waste-resource system has not likely increased the levels and types of litter.[193]

Gaynol Keith, Coordinator of the Nova Scotia Adopt-A-Highway Program (funded by RRFB), says that the amount of highway litter her volunteers collect in their highway clean-ups has decreased greatly since the Nova Scotia Solid Waste-Resource Management Strategy was put in

[193] Idem, p. 3.

place. She said that there has been a great decline in the amount of recyclables collected and that it is rare to find recyclable beverage containers.[194]

The fact that only a handful of brands and types of products make up a large proportion of litter points to an area for improvement and an obvious target for policy. Ten company brands account for nearly 60% of all litter and just four brands account for 44% of all litter.

In April 2002, Tim Hortons partnered with NSDEL to promote a modest litter abatement program. However, efforts by NSDEL and HRM to encourage Tim Hortons to use compostable coffee cups have not succeeded.

The development of biodegradable options for the predominant litter products could sharply reduce litter and its persistence. The technology exists, for example, to manufacture compostable coffee cups, successfully used on a very large scale at the Sydney Olympic Games in 2000, and now used by Irving Oil in Nova Scotia (Side Bar 7). Most major retailers of coffee, however, have resisted using them, opting instead to use plastic coated disposable cups.

**Side Bar 7. Biodegradable Options for Fast Food**

The Sydney Olympics made special efforts to be the 'green games.' With a reliance on take-away and fast food, responsible waste management was key to minimizing environmental impacts and litter. Therefore the organizers purchased biodegradable bags, knives, forks, spoons, straws, cups, and plates, as well as compostable coffee cups.

Compostable coffee cups are now available in Nova Scotia, as enterprising Nova Scotians capitalize on the merging of environmental and economic values. Irving Oil now retails a compostable coffee cup with a corrugated insert to provide insulation against the heat.[195] Tim Hortons, which accounts for 22% of all identifiable litter in Nova Scotia, has thus far not followed suit.

There are many options for dealing with disposable coffee cups in the waste-resource management system. These options include: a deposit-refund system or fee for coffee cups, the use of compostable coffee cups, and the promotion of re-usable take-away or travel mugs. A non-governmental committee suggested that the province come up with an incentive for recycling disposable coffee and soft drink cups that would be similar to the deposit-refund system in place for bottles and cans.[196]

Although many fast food restaurants separate organics for composting in their food preparation areas, there has been little progress in retrieving paper packaging wastes for composting after customer use. In 2003, RRFB Nova Scotia contracted Clean Nova Scotia to conduct a study on recycling and composting in quick-service restaurants. The study findings were used to develop

[194] Gaynol Keith, Coordinator, Adopt-A-Highway Program. Personal communication, February 2004.
[195] Michelle Firmbach, Irving Oil Public Affairs. Personal communication, June 2004.
[196] Simpson, J. 2000. "Province Urged to Put Eco-fee on Takeout Cups." *Chronicle Herald,* October 11, 2000: p. A1. Halifax NS.

educational material to help restaurants reduce waste, recycle and compost in customer service areas. This material, which includes waste management signage and an information guide for restaurants, is available from RRFB Nova Scotia.[197] In sum, while Nova Scotia has made remarkable progress in increasing diversion of residential waste, considerable challenges remain in the commercial sector, including the fast food industry.

## 5.9 Conclusions

The indicators explored in this section can be used to assess genuine progress in waste-resource management. Since the inception of the Solid Waste-Resource Management Strategy in 1996, recycling and composting – the two major tactics used by the province to achieve diversion gains – have seen significant increases in accessibility, quantities of materials processed, and comprehensiveness of programs.

Access to curbside recycling in Nova Scotia increased from less than 5% in 1989 to 98% in 2001 and 99% in 2003, the highest rate in Canada. Quantities of material recycled in the province have reached an all time high and the deposit-refund program run by the RRFB achieved an 83% return rate on beverage containers. However, many hard-to-recycle materials are still not banned or covered under producer-pay stewardship programs, meaning manufacturers have few incentives to stop using them. Producers of some of the most difficult-to-recycle materials have been able to avoid accountability and, in essence, have been rewarded by staying outside the recycling system. In addition, despite remarkable waste diversion achievements, very little has been done to address overall consumption and the reduction of waste from the outset.

In 2000, 72% of Nova Scotia residents had access to curbside organics pickup, increasing to 75% in 2001, and to 76% in 2003.[198] The merit of using curbside organics pickup as a relevant indicator of progress for the province as a whole is debatable. It may be more appropriate as an indicator in urban areas, since critics argue this system is not suitable for smaller and rural communities. Over 55,000 tonnes of organics (dry weight) were processed in municipal facilities in 2001. This figure is in addition to backyard composting, which is promoted and widely practiced throughout the province.

Although illegal dumping and littering continue to be problems in Nova Scotia, there is no direct evidence that changes to the solid waste-resource system have led to an increase in illegal dumping and littering.

The most inconclusive indicator is HHW. There is currently no monitoring system in place to track reductions in HHW. The growing number of HHW depots in the province indicates progress. Similarly, a recent stewardship agreement with the paint industry to recycle consumers'

[197] M. Catherine McCarthy, RRFB. Personal communication, May 2004.
[198] NSDEL 2000. *Status Report 2000 of Solid Waste-Resource Management in Nova Scotia*; and NSDEL 2001. *Status Report 2001 of Solid Waste-Resource Management in Nova Scotia.* As of October 2002, the percentage of Nova Scotia residents with access to curbside organics pickup was still at 75%. But the NSDEL *Status Report 2003 of Solid Waste-Resource Management in Nova Scotia,* indicates a slight increase to 76% in 2003.

leftover paint is a positive step. However, it is highly unlikely that the province has attained its original goal of reducing HHW by 60-70%.

Similarly, although HRM has made progress with its C&D waste diversion strategies, the province does not yet have a consistent strategy to reduce C&D waste, which makes up 25-30% of the overall municipal waste stream.

Although the indicators assessed in this study do not address all facets of the solid waste-resource system, they do provide a general assessment of how the program is doing. In addition, the data underlying these indicators provide baseline information for future evaluation of the Nova Scotia solid waste-resource system.

# PART III
# COST-BENEFIT ANALYSIS

**Sources/Acknowledgements: Fred Wendt**

***Pay Now or Pay Later: A Cost-Benefit Analysis of Halifax Regional Municipality's Waste Management System***

We have relied heavily in this section on the pioneering work of Fred Wendt and his cost-benefit analysis of the HRM's waste management system.[199] Many of the indicators and calculations used in Wendt's analysis have been incorporated into our methodology and extended to the provincial level to include the entire provincial Strategy, not just the residential sector. Fred Wendt was a member of the GPI Solid Waste-Resource Steering Committee and his advice and guidance have been invaluable in the completion of this report. In some cases where provincial data were unavailable, we have extrapolated from the HRM data to the province on the basis of population.

## 6. Introduction: Cost-Benefit Analysis

This section presents a full cost accounting analysis to determine the true costs or "full" costs and benefits of implementing the Nova Scotia Solid Waste-Resource Management Strategy. Whereas conventional accounting systems consider only standard market-based capital and operating costs, a full cost accounting mechanism recognizes and includes the economic value of relevant non-market social and environmental benefits and costs. For example, the cost of greenhouse gas emissions and the value of avoided emissions may be invisible in conventional cost-benefit analyses, but would be included in a full cost accounting analysis.

We apply a full cost accounting approach both (1) to determine the real costs and benefits of solid waste management under the Strategy and (2) to compare the net costs/benefits of the post-Strategy system with the pre-Strategy system, in order to assess the marginal costs or benefits of the new system compared to the old. Since costs are not available for years earlier than 1997, we have used operating and amortized capital costs from the 1996-97 fiscal year to represent the pre-Strategy system. The 1996-97 fiscal year also represents the closest year prior to the comprehensive implementation of the major changes outlined in the Strategy. Although the bottle recycling program began in 1996-97, and the tire recycling program began in 1997, the basic operating costs of the old system would not have changed substantially between 1989 and 1996-97.[200] We selected the 2000-01 fiscal year to represent the benefits and costs of the post-strategy system, as this represents the most recent year, at time of study, with a complete data set available. In 2000-01, the diversion rate for solid waste from landfills was 46%, based on the CCME criteria that require comparison with waste disposed in 1989. The study does not analyze the system at its peak, when the diversion rate was 50%.

[199] Wendt, F. 2001. *Pay Now or Pay Later: A Cost Benefit Analysis of HRM's Waste Management System*. MES Thesis, Dalhousie University.
[200] Bob Kenney, NSDEL. Personal communication, May 2004.

It is important to note that waste management system costs in the mid-1990s could probably not have been maintained because several existing landfills – including the Sackville landfill, which served approximately 35% of Nova Scotia's population – were near or at maximum capacity. In addition, open burning dumps were banned. Therefore, the province urgently needed alternative waste handling strategies. In other words, "business as usual" was not actually an option for the province in the late 1990s.

As previously noted, the 1992 City of Halifax Waste Management Task Force Review of Waste Management Options concluded that options based on source separation were more cost effective than incineration, and also provided greater economic, health and environmental benefits.[201] Maintaining the status quo was politically unpalatable. Public opinion would not countenance a landfill similar to the Sackville landfill, which was nearing capacity, and no community was willing to have such a landfill in its own back yard. The old system was relatively costly, had no landfill standards to protect people or the environment, and diverted only 3% of waste from the landfill.

The Community Stakeholder Committee also looked at the Sackville landfill closure and weighed alternatives for Halifax, Dartmouth, Bedford, and Halifax County. The Committee's report showed that other source separation options were available that were comparable in cost to the current recycling and composting system and that offered benefits of greater efficiency through higher rates of waste diversion than the current system.[202]

However, costs of potential alternative waste handling strategies at the provincial level other than the system currently in place in Nova Scotia are not precisely known. As well, the costs of most systems currently in place in Nova Scotia are assessed only on a municipal basis. This report therefore does not provide an intra-provincial cost comparison of various waste-resource management strategies, but considers only the marginal costs and benefits of the current provincial system as a whole compared to the old one.

The key issue here is simply to note that comparing the 2000-01 costs and benefits to the costs of the 1996-97 system actually presents a conservative picture of the benefits of the current system. This is because the capital and operating costs of any reasonable alternative to the old system would likely have been considerably higher than those of the system in place in 1996-97, which was primitive and had to be replaced or updated. This means that the marginal benefits of the current recycling and composting system would likely appear considerably larger if the comparison were with incineration or a second generation landfill rather than with the 1996-97 system.

Various components of the Solid Waste-Resource Management Strategy led to an increase in operating and amortized capital costs, from $48.6 million or $53.50 per person in 1996-97[203] to $72.5 million or $77 per person in 2000-01 (Table 18).[204]

[201] Sound Resources Management Group Inc & Angus Environmental Limited 1992, op. cit.
[202] The Community Stakeholder Committee 1995. *An Integrated Resource Management Strategy for Halifax County/Halifax/Dartmouth/Bedford.*
[203] NSDEL 2001. *Internal document – Operating cost estimate of solid waste management in Nova Scotia 1996-97.* Received from Andrew Murphy.

**Table 18. Total additional operating and amortized capital costs of Nova Scotia's Solid Waste-Resource Management System ($C2000)**

| Operating and amortized capital costs | Total | Per person* |
|---|---|---|
| Total cost 1989 (1996-97 fiscal year as proxy) | $48.6 million | $53 |
| Total cost 2000-01 fiscal year | $72.5 million | $77 |
| Total additional operating and amortized capital costs of 2001 system vs. 1997 system | $23.9 million | $24 |

*Population figures are those used by NSDEL for its diversion calculations, i.e. 1996-97: 909,282; 2000-01: 940,996.

Traditional accounting methods based on the calculations above would therefore assess the changes resulting from the Solid Waste-Resource Management Strategy as a cost to society. However, these methods fail to consider the full economic, social, and environmental benefits and costs resulting from more efficient management of Nova Scotia's solid waste.

A full cost-benefit analysis can provide a valuable policy assessment tool that factors in a more comprehensive range of economic, social, and environmental costs and benefits. The Genuine Progress Index uses this full cost-benefit analysis as its central accounting system to inform its core measures of progress.

It is difficult to attribute an exact dollar value to goods and services that normally do not have a market price. For example, there is a wide range of estimates on the costs of climate change and the value of GHG emission reductions. Assumptions about the costs of damages caused by GHGs influence the value we place on reductions of these emissions. In the current analysis, assumptions are therefore discussed for each of the costs and benefits addressed, and a range of estimates is given, from low to high, based on alternative assumptions.

In order to assess the value of the costs and benefits of the new system, this analysis will consider a wide range of economic, social, and environmental impacts, in addition to the system's operating and amortized capital costs that are already assessed in the 2001 NSDEL balance sheet. Tables 19 and 20 list the costs and benefits that are included in the GPI cost-benefit analysis, as well as economic impacts that cannot be included in a cost-benefit analysis. Each cost and benefit is explained in more detail in Chapter 7. Because the aim of this study is to assess the *marginal* costs and benefits of the new system compared to the old system, it considers only the *additional* costs and benefits that can be attributed directly to the new system. Because cost-benefit analyses have to demonstrate *net* social costs and benefits, only a portion of new job creation attributable to the new system can be included in the cost-benefit analysis – viz. that portion estimated to derive from the unemployment rolls. New recycling jobs that represent a shift from a different industrial sector, for example, are counted as economic impacts but not included in the cost-benefit analysis, because they do not represent "new" jobs for the economy as a whole. For this reason, employment effects appear in both the cost-benefit and economic impact columns below.

[204] A fiscal year runs from April 1 to March 31. For example, the fiscal year 2001 runs from April 1, 2000 to March 31, 2001.

For comparative purposes, 1997 dollars have been converted to 2000 dollars ($C2000) using Statistics Canada's Consumer Price Index for Nova Scotia. We use $C2000, because nine months of the 2000-01 fiscal year (April 1st 2000–March 31st 2001) fall within the year 2000.

**Table 19. Cost and economic impact components of full cost-benefit analysis**

| Costs and Economic Impacts | Costs (1996-97) | Cost-benefits (2000-01) | Economic impacts not included (2000-01) |
|---|---|---|---|
| Operating and amortized capital | ✓ | ✓ | |
| Increased participation (time and exclusion) | | ✓ | |
| Nuisance | | ✓ | |
| Beverage Container Recycling Program | | ✓ | |
| Used Tire Management Program | | ✓ | |
| Stewardship Program | | ✓ | |
| Non-deposit materials | | ✓ | |
| Derelict vehicles | | ✓ | |
| Household hazardous waste program | | ✓ | |
| RRFB administrative and operating costs | | ✓ | |

**Table 20. Benefit and economic impact components of full cost-benefit analysis**

| Benefits and Economic Impacts | Costs (1996-97) | Cost-benefits (2000-01) | Economic Impacts not included (2000-01) |
|---|---|---|---|
| Direct employment | | ✓ | ✓ |
| Economic spin-off employment | | ✓ | ✓ |
| Tax disadvantage adjustments | | ✓ | ✓ |
| Reduction of greenhouse gas emissions | | ✓ | |
| Reduction of air pollutant emissions | | ✓ | |
| Extended landfill life | | ✓ | |
| Avoided siting costs | | ✓ | |
| Avoided compensation | | ✓ | |
| Export revenue | | ✓ | |
| Tourism | | ✓ | |
| Energy savings from using recycled materials | | ✓ | |
| RRFB diversion credits | | ✓ | |
| RRFB approved programs | | ✓ | |
| RRFB investment in value-added manufacturing | | ✓ | |

## 6.1 Tangible Benefits

This study assigns a monetary value to the costs and benefits of the Nova Scotia Solid Waste-Resource Strategy. This approach has been taken in order to compare different variables according to a common standard of measurement. Attributing a monetary value to items not normally traded in the market economy has several limitations. For example, assigning a market value to benefits like cleaner water or air may imply that such benefits are interchangeable commodities and may be substituted or replaced by other forms of capital. In actual fact, some environmental impacts may be irreversible and some ecosystem services are non-substitutable. Moreover, some intangible values that cannot easily be monetized, such as aesthetic quality or community self-image, are omitted from the cost-benefit analysis, even though they do have social value. Thus, the very process of putting a dollar value on social and environmental components will necessarily underestimate and even ignore some important values. Even the most thorough cost-benefit analysis cannot address all the social, economic and environmental impacts of a solid waste-resource management system.

Furthermore, by filtering values through a market evaluation we may unwittingly reinforce the philosophy that the market determines priorities and values. We must be careful not to lose sight of intangible benefits, which cannot easily be monetized – from community pride to reduced reliance on virgin materials such as lumber – but which accrue from more efficient use of our waste resources. For these reasons, GPI*Atlantic* recognizes monetization as a temporary strategy necessary in a social environment dominated by market considerations, rather than as an end in itself.

Indicators that are excluded from this analysis, and therefore not explicitly monetized here, include:

- Aesthetic value
- Public health costs from pollutants emitted when virgin materials are used in manufacturing
- Certain kinds of pollution such as odours and noise
- Public health costs associated with landfills and incineration
- Community pride (perception/self-image) and other social and community values
- Wildlife/nature (greater access to unspoiled, safe parklands and preserves)
- Biodiversity
- Reduced litter

These and other indicators are not included in this cost-benefit analysis due to the challenges of assigning them an explicit monetary value. However, their exclusion here does not diminish their social value.

## 6.2 Evaluation: Calculating Value & System Costs

The full cost-benefit analysis provides a means of assessing some of the key marginal costs and benefits of implementing the Solid Waste-Resource Management Strategy. It also provides

baseline comparison data for future cost-benefit valuations of the solid waste-resource system. The difference in the 2000-01 full cost valuation and the 1996-97 base case cost of the system is an estimate of the true value of implementing a leading-edge solid waste-resource system. The results can also be referenced by other jurisdictions considering improvements to their solid waste management systems. To ensure that the valuation is credible we have used conservative estimates and assumptions for every line item and, wherever possible, have provided low, medium and high estimates of costs and benefits.

### *6.2.1 Operating and amortized capital costs*

As stated earlier, the operating and amortized capital costs of the Nova Scotia solid waste-resource management system in 1996-97 fiscal year totalled $48.6 million, or $53 per Nova Scotian ($C2000). The operating and amortized capital costs of the system under the Strategy in 2000-01 fiscal year totalled $72.5 million or $77 per Nova Scotian, an increase of $24 per person. Although the HRM front-end loader, which was not required by the Strategy, is responsible for 40% of the increase in these costs, we have not subtracted its costs because this loader is also responsible for some of the benefits of the recycling program in HRM.

### *6.2.2 Full cost-benefit analysis of the 2000-01 system: Summary of results*

Based on a full cost-benefit accounting approach applied to the 2000-01 fiscal year alone, the net costs/benefits of the new system range from an $18 per capita cost to a $127 per capita benefit. Comparing ***marginal*** benefit and cost increases between pre-Strategy (using 1996-97 as a proxy for 1989) and 2000-01, we estimate that the Nova Scotia solid waste-resource system in the fiscal year 2000-01 produced an estimated annual net savings of between $31.2 million and $167.7 million when compared to the fiscal year 1996-97. As Table 21 indicates, this translates into savings of between $33 and $178 for each Nova Scotian when the two systems are compared, rather than the cost of $24 indicated by a comparison of operating and amortized capital costs alone. Total gross benefits attributed to the 2000-01 solid waste-resource system range from $79.2 million to $221.8 million or $84 to $236 per person.[205]

Table 21 presents a summary of the cost-benefit analysis. The calculation process for each category is explored in the rationale and calculations section that follows in Chapter 7. It should be noted again that the phrases “full costs” and “full benefits” used in these tables and in the text do not imply that *all* relevant costs and benefits are included. As noted above, there are important indicators that are excluded because they are difficult to monetize. However, the phrase is used here to distinguish “full cost accounting” as an assessment tool that includes a wider range of social, economic and environmental benefits and costs from conventional accounting mechanisms that consider only capital and operating costs.

[205] Employment and economic spin-offs are largely excluded from the cost-benefit analysis, except for a portion estimated to have been generated from the unemployment rolls. Most employment gains and economic spin-offs, therefore, are considered separately as additional economic impacts.

**Table 21. Marginal savings of the 2000-01 solid waste-resource management system vs. the pre-Strategy system, showing low, medium, and high estimates of variable costs and benefits ($C2000)**

| Pre-Strategy costs (fiscal year 1996-97, proxy for 1989) | | | |
|---|---|---|---|
| Operating and amortized capital costs | $48,600,000 | | |
| **Cost per capita** | **$53** | | |
| **Post-Strategy costs and benefits (fiscal year 2000-01)** | | | |
| **COSTS** | **Low** | **Medium** | **High** |
| Operating and amortized capital costs | $72,459,311 | $72,459,311 | $72,459,311 |
| Beverage Container Recycling Program (net) | $14,307,047 | $14,307,047 | $14,307,047 |
| Used Tire Management Program (net) | $ 2,730,840 | $2,730,840 | $2,730,840 |
| Stewardship programs | $87,710 | $87,710 | $87,710 |
| RRFB operating and administrative costs | $1,627,013 | $1,627,013 | $1,627,013 |
| Non-deposit materials | $25,149 | $25,149 | $25,149 |
| Derelict vehicles | $16,997 | $16,997 | $16,997 |
| Household Hazardous Waste Program | $162,534 | $162,534 | $162,534 |
| Nuisance (value of time) | $218,730 | $911,373 | $1,822,746 |
| Cost to increase participation | $4,978,487 | $7,112,124 | $9,482,832 |
| **Total Costs** | **$96,613,818** | **$99,440,098** | **$102,722,179** |
| **Cost Per Capita** | **$103** | **$106** | **$109** |
| Indirect costs total | $24,154,507 | $26,980,787 | $30,262,868 |
| **BENEFITS** | **Low** | **Medium** | **High** |
| Employment benefits (direct)* | $2,830,820 | $3,262,640 | $3,910,370 |
| Employment benefits (indirect)* | $3,670,470 | $4,246,230 | $5,085,880 |
| Reduction of greenhouse gas emissions | $3,337,180 | $34,196,000 | $84,343,050 |
| Reduction of air pollutant emissions | $9,532,790 | $42,643,964 | $67,440,991 |
| Extended landfill life | $18,848,267 | $18,848,267 | $18,848,267 |
| Avoided siting costs | $174,732 | $174,732 | $174,732 |
| Avoided compensation | $1,270,780 | $1,588,475 | $1,906,170 |
| Export revenue | $1,100,000 | $1,400,000 | $1,650,000 |
| Tourism | $187,184 | $187,184 | $187,184 |
| Energy savings from recycling | $28,682,283 | $28,682,283 | $28,682,283 |
| RRFB diversion credits | $4,979,465 | $4,979,465 | $4,979,465 |
| RRFB approved programs | $4,374,804 | $4,374,804 | $4,374,804 |
| RRFB investment | $248,824 | $248,824 | $248,824 |
| **Total benefits** | **$79,237,599** | **$144,832,868** | **$221,832,020** |
| **Benefits per capita** | **$84** | **$154** | **$236** |
| **Net annual cost ( ) or benefit** | **($17,376,219)** | **$45,392,770** | **$119,109,841** |
| **Annual cost ( ) or benefit per capita** | **($18)** | **$48** | **$127** |
| **Net savings compared to pre-Strategy cost** | **$31,223,781** | **$93,992,770** | **$167,709,841** |
| **Annual savings per capita** | **$33** | **$100** | **$178** |

Notes: Totals and per capita costs may not add exactly due to rounding. Details on calculations are in Chapter 7. Operating and amortized costs are from estimates and surveys conducted by the NSDEL. NSDEL population figures used for diversion rates are 2000-01: 940,996; 1996-97: 909,282. *Only that portion of new employment estimated to have been created from the unemployment rolls is included here. Other new waste management resource employment, estimated to have been created by transfer of jobs from other industrial sectors, is excluded from the cost-benefit analysis, which must demonstrate net social costs and effects.

Annual gross benefits of the post-Strategy (2000-01 fiscal year) system include:

- $3.3 to $84.3 million in reduction of greenhouse gas emissions
- $9.5 to $67.4 million in reduction of air pollutant emissions
- $18.8 million in extended landfill life
- $28.7 million in energy savings from using recycled materials in manufacturing
- $1.4 to $2.1 million in avoided compensation costs and landfill siting costs
- $1.1 to $1.7 million in additional export revenues of goods and services
- $187,184 in additional tourism revenues
- $9.6 million in RRFB diversion credits, program funding, and investment in value-added manufacturing

Total costs (including operating and amortized capital costs) attributed to the 2000-01 solid waste-resource system range from $96.6 to $102.7 million. In addition to operating and amortized capital costs of the 2000-01 solid waste-resource system, these total costs also include:

- $5.2 to $11.3 million in additional household handling time required (nuisance costs) and costs to increase participation.
- $14.3 million in costs of bottle recycling program to consumers
- $2.7 million in costs of tire recycling program to consumers
- $87,710 in average cost of stewardship program

# 7. Rationale and Calculations: Indicators of Cost & Benefit

The following Sections explain each item included in the cost and benefit estimate, the rationale for including that item and an explanation of the valuation and range of valuations for that item, including the assumptions underlying low, medium, and high estimates.

## 7.1 Costs

### *7.1.1 Operational and capital (internal) costs*

The following is an explanation of what is included in the calculation of operating and amortized capital costs, as provided by NSDEL. Table 22 provides a summary of operational and capital costs for the 2000-01 fiscal year. Figures for costs are from a survey of municipalities[206] and from Mr. Bob Kenney of the NSDEL.[207] The following list provides details on costs that are included in and excluded from the waste management costs summarized in Table 22.

[206] NSDEL 2002. *Municipal Solid Waste, Recycling and Composting Summary Tables for fiscal year 2000-01.*
[207] Bob Kenney, NSDEL. Personal communication, December 2003.

- Costs include collection (including curbside pickup), disposal, recycling, composting, administration, and education.
- All capital costs (even those costs that have been paid by municipalities or outside sources) have been amortized at 7% as follows: equipment over 10 years and buildings over 20 years.
- Organic cart capital costs are included in collection costs. Blue, clear, garbage, paper or biodegradable bag costs incurred by residents are not included.
- Landfill storage units or "cell" costs for second generation landfills were amortized over the life of the cell at 7%. These cells are the containers of the landfill. Each cell holds similar materials.
- Internal revenues from the sale of recyclable materials, compost, and metals are included, as these are an integral part of the operations of the recycling and composting facilities. Therefore, the operational cost estimates are *net* rather than gross costs.
- Costs do not include tipping fees, because these fees are external to the system and can be arbitrary rather than market driven.
- External revenues from the RRFB (diversion credits or approved program funding), the NSDEL or the federal government are not included.
- ICI waste hauling fees are not included. ICI disposal tipping fees paid to private C&D sites are not included.
- Costs are for the current solid waste-resource management system. Costs incurred due to remediation of old disposal sites, legal issues due to old disposal site environmental impacts, and payments to residents living near old disposal sites are not included in operating cost estimates. However, the benefits section does include avoided liability costs estimated for the new system.
- Siting costs, including direct consultant costs, municipal staff costs and indirect social costs due to residents who oppose the siting of disposal and composting facilities, are not included. These costs are indirectly referenced in the benefits section when estimating the value of extended landfill life and avoided liability costs.
- Net RRFB costs pertaining to the ENVIRO-DEPOT™ system are not included in overall system operating costs in the line 1 of the cost statement (Table 21), but they do appear as an external cost in the RRFB operating cost category in line 5 of Table 21.
- Back yard composting costs (costs of bins, public education and administration) are included under "other costs" in NSDEL's operational cost estimates.
- Waste, recyclable and compostable materials diverted through re-use, enviro-transpiration, garborators, green cones and vermi or backyard composting, and those same materials illegally dumped or burned in wood stoves, are not included in the operational cost calculations.
- Property taxes paid by private composting facilities are included as revenue, again indicating that the operational cost estimates provided here are *net* rather than gross costs. Property taxes paid by private haulers, recyclers and disposal facilities are currently not included, as they were not surveyed.
- Cost savings and revenues due to materials diverted from disposal and increases in employment are not included in the operational cost estimates, although the revenues from exported recycled materials are included in the benefits section under "Export Revenue of Goods and Services." Also a portion of employment benefits, reflecting new

employment estimated to have been created from the unemployment rolls, is included in the benefits section.
- Costs due to future environmental impacts and decreased property values are not included.

**Table 22. Summary of direct costs of the Nova Scotia Solid Waste-Resource Management Strategy in 2000-01**

| Item | Cost | |
|---|---|---|
| | **Actual, $C2001** | **Converted to $C2000** |
| Collection | $20,753,524 | $20,377,885 |
| Disposal (excluding tipping fees) | $36,372,516 | $35,714,173 |
| Recycling (processing plus transfer and line hauling; includes municipal revenues from recycling) | $4,501,679 | $4,420,199 |
| Composting | $5,644.363 | $5,542,200 |
| Education, administration, and other | $6,522,918 | $6,404,853 |
| **Total** | **$73,795,000** | **$72,459,311** |

## 7.2 Social (External) Costs

The following social or external costs to the system, which are considered in this cost-benefit analysis, are described below:
- Costs of the Beverage Container Recycling Program
- Costs of the Used Tire Management Program
- Costs of stewardship programs
- Costs to increase participation
- Nuisance costs

### *7.2.1 Resource Recovery Fund Board costs*

As mentioned earlier, as part of the Nova Scotia Solid Waste-Resource Management Strategy, the RRFB was established. This non-profit organization is mandated to:
- Fund municipal or regional diversion programs;
- Develop and operate a deposit-refund system for beverage containers;
- Develop and implement industry stewardship programs;
- Develop education and awareness of reduction, re-use, recycling, and composting; and
- Promote the development of value-added manufacturing in the province.

All line items from the income and expense statements of the RRFB are included as costs or benefits in this study. On the cost side, these include the bottle deposit-refund and tire recycling programs, both of which constitute a cost to the consumer. The primary tangible benefit provided

by the RRFB is in support of diversion programs by the municipalities. All RRFB figures are taken from the RRFB Annual Reports[208] and from the advice of RRFB.[209]

#### 7.2.1.1 Administrative and operating costs

According to Derek Firth, RRFB's Chief Operating Officer, the administrative costs of the RRFB for 2000-01 were $1,226,140 ($C2000) and central processing costs were $400,873 ($C2000), totalling $1,627,013.

#### 7.2.1.2 Costs of the Beverage Container Recycling Program

One of the mandates of the RRFB is to administer a beverage deposit-refund system through enviro-depots. Most ready-to-drink beverages (except for milk drinks) carry a deposit of ten cents, which goes to the RRFB. When the beverage containers are returned to an ENVIRO-DEPOT™, the consumer may receive a five-cent refund on each bottle. Although the system provides net income to the RRFB, we are considering the cost of the program to the consumer. In the benefits section, we discuss how the net income from the program to RRFB is distributed to the municipalities. As noted above, the bottle deposit-refund system was already in place in 1996/97, although it was greatly expanded in the new system. However, since we are comparing the cost with the 1989 situation, the total net cost to the consumer of the program in 2001 is considered the marginal cost.

It could also be argued that the many spin-off benefits of the bottle deposit-refund system more than cancel out the net costs to the consumer, but spin-off benefits such as those described below are not included in this cost-benefit analysis.

To illustrate the full range of potential benefits from a deposit-refund system, we refer here to a Massachusetts study, which looked at expanding the state's deposit-refund program from beer and carbonated drink containers to include bottled water, juice, etc.[210] Researchers estimated the expanded program would provide a total annual monetary value of $62.3 to $98.7 million. In addition, the program was estimated to provide substantial, non-quantifiable economic and environmental benefits. These benefits would result from the projected annual recovery of between 160,000 and 164,000 tons of beverage containers for recycling.[211]

Quantifiable benefits reported in the study included:

- $9.4 to $26.8 million from employment opportunities in industries that make new containers and other products from recycled materials;

[208] RRFB 2002. *2001 Annual Report*.
[209] Derek Firth, Chief Operating Officer, RRFB, & M. Catherine McCarthy, RRFB. Personal communication, May 2004.
[210] Morris, J. 1998. *Economic & Environmental Benefits of Beverage Container Recycling: The Case for Updating Massachusetts' Bottle Bill*. Prepared for the Massachusetts Public Interest Research Group by Sound Resource Management Inc.
[211] Ibid. Total collections would include: 119,000-135,000 tons of glass; 15,000-21,000 tons of plastic and 14,000-20,000 tons of metal (mostly aluminium).

- $18.8 to $24.8 million in revenues from selling recovered beverage containers to recycling markets;
- $13.5 to $20.2 million from reduced litter and waste management costs;
- $18.1 to $24.0 million in reduced public health costs from pollutants emitted when virgin materials are used in manufacturing beverage containers;
- $1.1 to $1.2 million in reduced public health costs for emergency room visits resulting from cuts on broken glass litter; and
- $1.3 to $1.9 million in reduced GHG emissions from energy used in manufacturing beverage containers from virgin materials.[212]

Non-quantifiable benefits reported in the study included:

- stronger local economies as a result of using recycled materials to manufacture products;
- reduced emissions of pollutants whose public health costs have not yet been quantified;
- public health, recreational and aesthetic gains from reduced litter (other than reduced emergency room visits for cuts on broken glass, which are included in quantifiable benefits);
- slower on-site accumulation of solid and radioactive wastes in resource extraction and processing, energy generation, and manufacturing operations; and
- reduced ecosystem impacts and resulting productivity improvements in agriculture, fishing and forestry.[213]

Because this report is an evaluation of the entire solid waste-resource system and not of one component, some of the quantifiable benefits listed in the Massachusetts deposit-refund program study are addressed under other headings in this report. For example, job creation is addressed under direct employment in this analysis. The Massachusetts study also includes dollar values for some benefits and costs that are not quantified in this analysis. For example, it estimates the dollar value of reduced litter and decreased emergency room visits due to injuries resulting from broken glass, neither of which is included as a quantifiable benefit in this report. If such benefits were added to the GPI cost-benefit analysis, then the benefits of the new Nova Scotia system would be larger than indicated here. Although our analysis does not extrapolate values from the Massachusetts study, we have highlighted the Massachusetts findings here in order to demonstrate the very wide range of potential benefits of beverage container deposit-refund programs.

Table 23 shows the revenues collected for the Beverage Container Recycling Program. The deposits, minus the refunds and HST, are a direct cost to the consumer. Thus, the net cost to the consumer in 2000-01 was $14.3 million.

It should be noted that revenue from the approximately 20% of unredeemed beverage containers actually funds RRFB programs and helps provide funds to municipalities.

[212] Ibid.
[213] Ibid.

**Table 23. Net costs of the Bottle Deposit-Refund Program, 2000-01 ($C2000)**

| | |
|---|---|
| Bottle Deposits | $25,597,547 |
| Minus Refunds and HST | $11,290,500 |
| **Net Cost to Consumer** | **$14,307,047** |

Sources: RRFB 2002. *Annual Report 2000-01*; M. Catherine McCarthy, RRFB. Personal communication, May 2004; and Controller, RRFB. Personal communication, February 2004.

#### 7.2.1.3 Costs of the Used Tire Management Program

The RRFB also operates a tire recycling program. Under the Nova Scotia Solid Waste-Resource Management Strategy, tires are banned from landfills in order to encourage recovery of the rubber, reduce landfill requirements, and encourage industry to recover the recycled materials through value-added manufacturing. All tires sold in Nova Scotia carry an environmental fee of $3 per tire for passenger cars and $9 per tire for small trucks. In 2000-01, the RRFB took in $2,730,840 ($C2000) from the tire program.[214] This is a cost to the consumer.

#### 7.2.1.4 Costs of Resource Recovery Fund Board stewardship programs

As noted in Part II, Nova Scotia has a number of stewardship programs through which companies contribute to recycling efforts. These contributions are counted here as a cost to the private sector and, indirectly, to consumers when the added costs are passed on by industry in the form of higher prices. The cost of stewardship programs in 1997 was $385,910 ($C2000). In 1998, the cost was $36,564; in 1999, $7,147; in 2000, $8,139 and in 2001, $788. Because of the wide variation among years, we have averaged the figures to estimate an average annual cost for the stewardship programs of $87,710.

### *7.2.2 Costs to increase participation*

Changes to the solid waste-resource system place new demands on individual citizens. Individuals are required to sort their garbage into separate waste streams and place each container at curbside according to the collection schedule. This system therefore imposes costs on citizens through the additional ***time*** it takes to sort and organize their household waste, and to learn and follow the waste collection schedule. Moreover, people must devote more space within their homes to various containers for recycling, composting, and general refuse. This system replaces the previous single waste container and curbside collection system.

Citizens who do participate by sorting their waste incur a small cost by using (or "volunteering") their personal time to ensure the smooth functioning of the solid waste-resource system. The rate of participation is therefore a good indicator of individual citizens' willingness to accept a cost or inconvenience in order to achieve a social benefit.

[214] RRFB 2002.

The non-participation of some segments of the population confirms that there is a cost to participation. There are individuals who feel the increased time or trouble is not worth the social benefits gained by participating in the program. Some non-participants also include segments of the population who are ***excluded*** from the current system. These include apartment dwellers whose landlords do not offer composting and recycling options, as well as seniors and disabled people who are physically unable to move and carry the organic recycling bins. As the province moves to upgrade accessibility, assistance services for seniors and disabled people could be implemented to improve the system. Non-participation is therefore a function of two factors – time and exclusion.

In order to calculate the cost of time taken to participate in the 2001 solid waste-resource system, we used Wendt's estimate of one minute per day extra contribution in time per household.[215] Thus:

**1 min/day × 365 days = 365 minutes = 6.1 hours per year per household**

In order to value this annual contribution in time, Wendt placed a value on the time by using an average hourly wage. However, based on GPI*Atlantic*'s valuations of unpaid work, we assume here that the extra minute of time per day can rightly be considered an additional burden of unpaid household work rather than paid work. Few individuals are likely to adjust their regular paid work schedules to account for the extra minute spent sorting waste, and that minute per day would more likely be spent on household chores or leisure time, rather than on paid work time. We therefore multiply the annual hours required per household by the economic value of unpaid domestic and household work. That value has been estimated by Statistics Canada on the basis of the market value of equivalent work. In Nova Scotia, that hourly rate, used by GPI*Atlantic* in its report on *The Economic Value of Unpaid Housework and Childcare in Nova Scotia,* is $9.56 per hour ($C2000).[216]

**6.1 hours × $9.56 per hour = $58.32 per household per year**

We then multiply the cost per household per year by the number of households in the province.[217]

**$58.32 × 406,500 households in Nova Scotia = $23,707,080 per year for the province**

This figure assumes 100 percent participation, which is not the case at this time. The participation rate in HRM, which has one of the highest participation rates in the province, is estimated at 79%.[218]

[215] Wendt, F. 2001, op. cit., p. 59.
[216] Colman, R. 1998. *The Value of Unpaid Housework and Childcare in Nova Scotia*. Available at www.gpiatlantic.org. The hourly value of unpaid housework was estimated at $9.02 in 1997 dollars, which translates to $9.58 in 2000 dollars.
[217] Nova Scotia Department of Finance 2000. Cited in Wendt, F. 2001, op. cit., p. 92.
[218] Wendt, F. 2001, op. cit., p. 58.

In his analysis Wendt assumes that those who participate are doing so for external reasons – to be good citizens, for example.[219] In other words, they are already being "compensated" for their extra effort by non-monetary rewards such as feeling good about their participation. After all, they are participating voluntarily and are presumably satisfied with the system and their own environmental stewardship role.

Wendt therefore calculates the cost to the system according to how much it would cost to compensate the *non-participants*, in order to persuade them to participate. Thus, Wendt multiplies the total time value per year by the number of households in HRM *not* participating. Based on the HRM participation rate of 79% (data for participation rates in other regions are not available), we have calculated low-end costs based on the HRM non-participation rate of 21%, while recognizing that province-wide non-participation rates are certainly higher. For the current study, it was not possible to obtain participation rates for the province as a whole. Therefore we have estimated low, medium, and high costs, assuming non-participation rates of 21%, 30%, and 40% respectively.

**Low estimate:** **$23,707,080 × 21% = $4,978,487**
**Medium estimate:** **$23,707,080 × 30% = $7,112,124**
**High estimate:** **$23,707,080 × 40% = $9,482,832**

### *7.2.3 Nuisance costs*

The separate collection of organic waste for composting brings with it some nuisances. Nova Scotian households bear the costs of these nuisances by tolerating them. Fruit flies and foul odours, especially during the summer months, are the two nuisances most often mentioned.[220] The gathering and holding of organic wastes in households brings with it the likelihood of such nuisances, particularly in the summer months when waste decomposes at a faster rate. HRM recommends several measures for reducing odours and flies. These include placing wet food waste in boxboard; alternating layers of wet waste and dry waste; and emptying the mini bin on a daily basis and rinsing it out with mild detergent.[221]

In the summer of 2003, HRM conducted a pilot project in which compost was picked up weekly from 15,500 homes during July and August.[222] The results were compared with a control area of 6,000 homes that received bi-weekly pickup of organics. The pilot project resulted in 81% participant satisfaction regarding weekly collection of organics, and an increase of 15.9% in tonnes collected. The cost per tonne of weekly collection was $110, in comparison with $80 per tonne for bi-weekly collection. The weight of organics collected was 10.2 kg over a two week period for the weekly collection compared with 8.8. kg over two weeks for the bi-weekly collection, an increase of 15.9%. HRM staff concluded that the marginal benefit of the service does not warrant the cost of providing weekly pickup, though assessment of this benefit was

[219] Wendt, F. 2001, op. cit.
[220] *Halifax Herald*. March 11, 2001, p. A5. Cited in Wendt, F. 2001, op. cit., p. 60.
[221] HRM 2002. *Organics Green Cart – Tips for Proper Use*. Available at: www.region.halifax.ns.ca/wrms. Accessed Jan 14, 2004.
[222] HRM 2004. *Findings: Weekly Summer Collection Green Cart Pilot Project*, presented to HRM Council.

based on increased tonnage rather than participant satisfaction. Participation in the weekly collection program was 53%.

A previous survey had found that only about 6% of HRM householders felt that weekly collection was necessary.[223] Goodick states that in HRM most homeowners who live on larger lots indicate that weekly collection is not necessary and that the extra cost would be better spent on municipal programs like health care or education.[224] Since we are trying to estimate the value of an extra pickup to those householders who expressed dissatisfaction with the bi-weekly pickup, we have again used Wendt's assumptions, logic, and calculations as a basis for this estimate. Wendt suggests that the calculation of these nuisance costs can be based on the projected costs of eliminating the nuisance. We have based our calculations on the HRM pilot project discussed above. Using a cost of weekly collection of $110 per tonne, or $0.11 per kg, and a rate of collection of 10.2 kg every two weeks, or 5.1 kg every week, the cost per household would be $0.56. For four extra collections (weekly collection during the two hottest summer months), the total cost per household would be $2.24.

**5.1 kg/household × $0.11/kg = $0.56**

**4 weeks × $0.56 per household = $2.24 per household**

To develop a province-wide estimate, this percentage was extended to all Nova Scotian households that currently have curbside pickup (76%) and multiplied by the total cost for the extra four summertime pickups. We have calculated low, medium and high estimates using participation rates for potential weekly pickups of 6%, 25%, and 50%. The low participation rate is based on the 1999 survey; the high participation rate is based on the 2004 HRM pilot study. Even though only a proportion of householders indicated a need for extra weekly pickup, it should be pointed out that if the province or a municipality offered the service, it would have to be offered to all residents, and it is likely that more people would participate than the number who requested it.

**406,500 households in Nova Scotia × 76% (households that have curbside pickup) = 308,940 households with curbside pickup**

**$2.24 per household × 308,940 households × 6% participation = $41,522**
**$2.24 per household × 308,940 households × 25% participation = $173,006**
**$2.24 per household × 308,940 households × 50% participation = $346,013**

This calculation is oversimplified, as it does not take into consideration varying rates of participation across the province or varying trucking costs. Nonetheless, the calculation does provide a rough estimate of the costs reducing the nuisance of green carts during hot weather.

In addition we have valued the time required for extra handling of compost by householders. In the two hottest months, it is recommended that people put the compost in the bin on a daily basis.

[223] Smith, B. and M. Bernard 1999. *Green Cart Nuisance Control and Collection Frequency*. Report to Solid Waste/Resource Advisory Committee.
[224] Marcus Goodick, HRM. Personal communication, May 2004.

This would require an estimated one extra minute of time per day per household. Again valuing this time as the cost of unpaid housework, we calculated a low, medium, and high estimate based on participation rates of 6%, 25%, and 50%. Table 24 summarizes the estimated costs of the nuisance of composting in hot weather.

**1 minute per day × 60 days = 60 minutes, or 1 hour per household**

**1 hour per household × 308,940 households = 308,940 hours**

**308,940 hours × 6% participation × $9.56 per hour = $177,208**
**308,940 hours × 25% participation × $9.56 per hour = $738,367**
**308,940 hours × 50% participation × $9.56 per hour = $1,476,733**

**Table 24. Summary of estimated costs of nuisance of composting during hot weather ($C2000)**

| Type of Activity | Estimated cost ($C2000) | | |
|---|---|---|---|
| | Low | Medium | High |
| Extra collections in hottest months | $41,522 | $173,006 | $346,013 |
| Time to put out compost daily | $177,208 | $738,367 | $1,476,733 |
| **Total** | **$218,730** | **$911,373** | **$1,822,746** |

## 7.3 Summary: The costs

The costs of the solid waste-resource system in 2001 are summarized in Table 25. In addition to the direct costs discussed above, other direct costs include the costs of handling non-deposit materials, derelict vehicles, and HHW, as well as administrative operating costs of the RRFB. The indirect costs (those other than standard operating and capital costs) amount to and substantially increase the overall costs of the strategy. Hence the cost-benefit analysis identifies and highlights many hidden and indirect costs that are excluded from conventional accounting procedures.

**Table 25. Summary of direct and indirect costs of the Nova Scotia Solid Waste-Resource Management Strategy, 2000-01 ($C2000)**

| | Estimated cost ($C2000) | | |
|---|---|---|---|
| | **Low** | **Medium** | **High** |
| **Direct costs:** | | | |
| Operating and Amortized Capital | $72,459,311 | $72,459,311 | $72,459,311 |
| **Indirect Costs:** | | | |
| RRFB Bottle Deposit-Refund (cost to consumer) | $14,307,047 | $14,307,047 | $14,307,047 |
| RRFB Tire Recycling (cost to consumer) | $2,730.840 | $2,730,840 | $2,730,840 |
| RRFB Administrative and operating expenses | $1,627,013 | $ 1,627,013 | $ 1,627,013 |
| Non-deposit materials | $25,149 | $25,149 | $25,149 |
| Derelict vehicles | $16,997 | $16,997 | $16,997 |
| Household Hazardous Waste Program | $162,534 | $162,534 | $162,534 |
| Stewardship Programs | $87,710 | $ 87,710 | $ 87,710 |
| Increased participation (time and exclusion) | $4,978,487 | $7,112,124 | $9,482,832 |
| Nuisance | $218,730 | $911,373 | $1,822,746 |
| **Sub total: Indirect costs** | **$24,154,507** | **$26,980,787** | **$30,262,868** |
| **Total direct and indirect costs** | **$96,613,818** | **$99,440,098** | **$102,722,179** |

## 8. Benefits & Economic Impacts

The following benefits are considered in this study:

- Direct employment
- Economic spin-off
- Greenhouse gas emission reductions
- Air pollutant emission reductions
- Extended landfill life
- RRFB municipal diversion credits, support of programs, and investment
- Avoided liability costs
- Export revenue of goods and services
- Additional tourism
- Lost opportunity/tax disadvantage

Lost opportunity/tax disadvantage is considered a benefit, but is not directly added into the cost-benefit analysis. Instead, as explained below, it is considered separately as an economic impact.

## 8.1 Direct Employment

The implementation of the Nova Scotia Solid Waste-Resource Management Strategy is directly responsible for generating an increase in employment in the waste-resource management and manufacturing sector. New employment was created in all areas of the sector from waste collection and handling to manufacturing and high tech jobs. According to Bob Kenney, NSDEL Waste Resource Analyst, roughly 50% of all new jobs were created in waste collection, landfills, enviro-depots, and recycling facilities.[225]

Entrepreneurs have established facilities such as a plastic flaking plant, a paint recycling facility, a cardboard re-manufacturing plant, many commercial compost facilities and a cryogenic, used tire processing facility designed to re-use this raw material. These facilities have created hundreds of jobs, many of which are located in high unemployment areas.

Since 1996, a total of 1,011 new solid waste-resource related jobs have been created in Nova Scotia.[226] It is not known whether or to what extent the new solid waste-resource jobs reduced the province's unemployment rolls. This information is important for cost-benefit analysis, which demonstrates *net* social costs and benefits, rather than transfers from one sector to another, and therefore only allows inclusion of employment creation benefits that reflect new jobs for the economy as a whole. It is possible that new employment created by the Strategy may have come at the expense of jobs in other areas of the economy. In other words, the new jobs could simply be a transfer of workers from one sector to another, in which case it is more difficult to argue that the new jobs provide a net benefit to society. This scenario is more likely in a full employment economy.

Levels of unemployment in Nova Scotia were particularly high when the Strategy was introduced (Figure 22). According to Statistics Canada, the real unemployment rate in Nova Scotia, including discouraged workers and the underemployed portion of involuntary part-time work, was close to 19% in 1997.[227] It is therefore highly likely that many new jobs in the solid

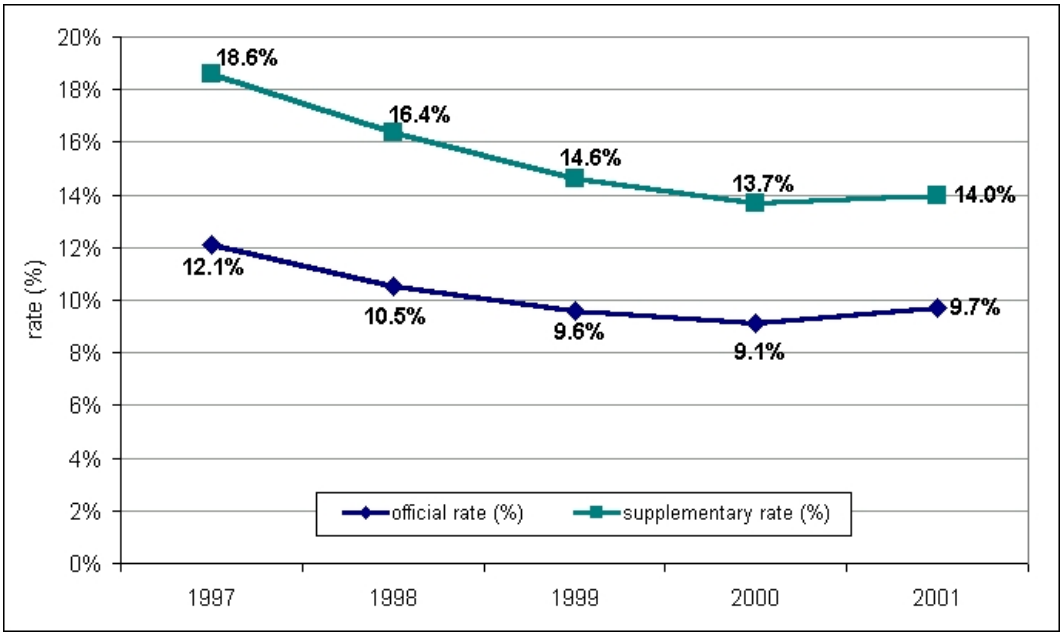
[225] An attempt was made to determine what proportion of these new jobs provided fringe benefits and were well-paid and secure, but such data were not readily available. These important job quality indicators should be included in any comprehensive assessment of the economic and social impact of the Solid Waste-Resource Management Strategy. Jobs that are temporary, low-paying, and insecure provide less value to workers and society than better paid, secure jobs. Thus, the simple *number* of new jobs provides limited information on employment impacts. It is hoped that future updates of this report will be able to fill this gap as new data become available.

[226] Bob Kenney, NSDEL. Personal communication, January 2003. According to Kenney this figure is based on estimates provided by businesses.

[227] Statistics Canada 2002. *Labour Force Historical Review 2001.* Catalogue no. 71F0004XCB. Statistics Canada derives estimates for underemployment by analyzing answers to questions in its Labour Force Survey that assess the portion of part-time workers who are working part-time involuntarily because they cannot find full-time work due to current business conditions. These workers are distinguished from "voluntary" part-time workers, who are working part-time due to family, school, or personal responsibilities or needs. The actual hours of work of "involuntary" part-time workers are then subtracted from full-time working hours to assess the underemployed portion of involuntary part-time work. The difference between the actual hours of involuntary part-timers and full-time hours are then calculated as full-time job equivalents (FTE) to assess the rate of underemployment, and those underemployed FTEs are then added to the official unemployment statistics in Statistics Canada's "supplementary" and "comprehensive" unemployment rates. For example, if an involuntary part-timer worked 20 hours a week, the supplementary unemployment statistics would indicate the equivalent of an additional 0.5 FTE.

waste-resource sector were filled by those who were previously out of work or underemployed in other economic sectors.

**Figure 22. Official and supplementary unemployment rates in Nova Scotia, l997-2001**




Source: Statistics Canada 2001. *Labour Force Historical Review*. Catalogue no. 71F0004XCB.

Note: According to Statistics Canada, the official rate of unemployment, while a key indicator of job conditions, does not adequately capture the complexity of the labour market. Supplementary measures have been developed to "shed further light on the degree of labour market slack and the extent of hardship associated with joblessness." The supplementary rates present a more realistic picture of unemployment in Nova Scotia as they include a portion of the so-called "hidden unemployed" – those who are out of work but have given up looking for work (discouraged workers) and those who are working part-time but would rather be working full-time (involuntary part-timers).[228]

For a conservative estimate of the employment benefit that can legitimately be included in the cost-benefit analysis, we assume here that the percentage of newly created employment, as opposed to lateral movement of workers from one job to another, is roughly equal to the unemployment rate. As Figure 22 shows, unemployment in Nova Scotia decreased from 18.6% in 1997 to 14% in 2001. Although we do not know the proportion of new jobs created that were in HRM, it is likely that many of the jobs were created in HRM. We have therefore used the basic unemployment rate for Halifax (which is a lower figure and gives a more conservative estimate) rather than for Nova Scotia during this period, as an indication of the proportion of new employment likely to have been created from the unemployment rolls. The HRM rate decreased from 16.1% in 1997 to 13.9% in 2001.[229] The average rate of unemployment in Halifax over these years provides the medium estimate (13.5%); the lowest rate (11.7% in 2000) provides the low estimate; and the highest rate (16.1% in 1997) is used for the high estimate.

[228] Statistics Canada 2002. *Labour Force Historical Review, 2001*. Catalogue no. 71F0004XCB.
[229] Statistics Canada 2003, op. cit..

**Table 26. New jobs in the waste-resource management sector in Nova Scotia, 2000**

| Job category | 1995-96 | 2000 | New jobs |
|---|---|---|---|
| Enviro-depots (handling and administration) | 194 | 334 | 140 |
| Haulers (includes private sector) | 389 | 522 | 133 |
| Scrap metal dealers | 117 | 122 | 5 |
| Landfill and municipal disposal sites (increased source separation) | 193 | 301 | 108 |
| Manufacturers and spin-off jobs such as Minas Basin Pulp and Power, Therma-cell | 546 | 626 | 80 |
| Material recovery (recycling facilities) | 48 | 151 | 103 |
| Composting | 11 | 72 | 61 |
| Building material sales (e.g. Happy Harry's), C&D facilities | 17 | 70 | 53 |
| Hazardous materials (solid waste, only at metropolitan landfills) | 180 | 269 | 89 |
| Asbestos (recovered from buildings and handling) | 72 | 80 | 8 |
| Tires (retreading) | 36 | 61 | 25 |
| Other (consultants, government staff; vermicomposters; eco-efficiency centres; cloth diaper service; programs for mentally challenged) | 282 | 488 | 206 |
| **Total** | **2,085** | **3,096** | **1,011** |

Source: Bob Kenney, Waste Resource Analyst, NSDEL. Personal communication, January 2003.

A study by the U.S. Institute of Local Self Reliance found that one direct job is created for every 15,000 tons (13,608 tonnes) of solid waste landfilled each year. For a similar amount of waste composted, seven jobs are created, and a comparable quantity of material recycled generates nine jobs in collection and processing alone. This assessment counts only jobs created through actual direct handling of materials and does not include jobs created in manufacturing using recovered and composted materials, nor would it include jobs in enviro-depots, the tire flaking plant, education, or other secondary and derivative industries that rely on recycled and composted materials.[230] In sum, the recycling and composting sectors can provide considerable stimulus to a stagnant economy and are historically associated with considerably greater job creation than systems that rely on landfills.

According to the U.S. Environmental Defense organization,

> "Recycling creates jobs and makes manufacturing industries more competitive. Recycling provides manufacturing industries with less expensive sources of raw materials, a long-term economic advantage that translates into value for consumers who spend less on products and packaging. The industrial development effects of recycling are significant. For example, one recent study found that in ten north-eastern states alone, recycling adds $7.2 billion in value to

[230] The Jobs Research Trust 2000. *The Jobs Letter: Jobs From Waste*. No. 118. New Zealand. Available at www.jobsletter.org.nz/jbl11800.htm#jobs

> recovered materials through processing and manufacturing activities. Approximately 103,000 people were employed in recycling processing and manufacturing jobs in this region in 1991, 2.7% of the region's total employment."[231]

The economic value of the benefit created by new employment is calculated in this cost-benefit analysis, by multiplying a percentage of the number of new jobs created since 1996 by the average weekly earnings in the solid waste-resource management sector in Nova Scotia.[232] The number of new jobs not transferred from other economic sectors is estimated here by taking the percentage of total new jobs in the waste management industry that corresponds to unemployment rates in the region.

Average weekly pay (including overtime) in the solid waste-resource management sector[233] in Nova Scotia in 2001 was $469.82 ($C2001),[234] or $461.34 ($C2000) per week and $23,990 ($C2000) per year. Estimates for the annual value of new jobs created, based on different unemployment rates, are calculated below.

**Low estimate:** **1,011 jobs × 11.7% unemployment = 118 new jobs**
**118 new jobs × $23,990 = $2,830,820**

**Medium estimate:** **1,011 jobs × 13.5% unemployment = 136 new jobs**
**136 new jobs × $23,990 = $3,262,640**

**High estimate:** **1,011 jobs × 16.1% unemployment = 163 new jobs**
**163 new jobs × $23,990 = $3,910,370**

## 8.2 Economic Spin-offs

Beyond the direct creation of jobs within the waste-resource management and manufacturing sector, these new waste management jobs generate economic benefits of their own, or "spin-offs" to the rest of the economy. Beck showed that the recycling and re-use industries of the U.S. provide 1.1 million jobs with an annual payroll of nearly US$37 billion.[235] The study estimates that economic spin-offs to other businesses from the recycling and re-use industry support 1.4 million additional jobs with a payroll of US$52 billion and annual receipts of US$173 billion. Economic spin-offs to other businesses include economic activity generated in office supply companies, legal firms, accounting firms, building and landscape maintenance firms, etc. Considering only the additional jobs created (and not the spin-offs related to spending of employment income), Beck estimates that for every direct job, there are 1.3 spin-off jobs created

[231] Environmental Defense 2001. *Advantage Recycle*. Available at www.edf.org/pubs/Reports/advrec.html
[232] Statistics Canada 2001. *Survey of Employment, Payrolls and Hours*. CANSIM II Table 281-0027.
[233] This includes wholesaler-distributors of recyclables; waste management and remediation services; waste collection; waste treatment, disposal and remediation; and related services. Statistics Canada's selected industries are classified using the North American Industry Classification System.
[234] Statistics Canada 2001, op. cit.
[235] Beck, R.W. 2001. *U.S. Recycling Economic Information Study*. Available at www.nrc-recycle.org.

(a ratio of 1:1.3). The ratio of the payroll (dollar value) of direct jobs to the payroll for spin-off jobs is 1:1.4, according to Beck's calculations.

Another level of economic activity is generated when employees in the recycling and re-use industries spend their wages in the economy. In the U.S., experts estimate that the personal spending by employees in the recycling and re-use industries supports 1.5 million additional jobs with a payroll of US$41 billion. This produces receipts of US$146 billion.[236]

A traditional measure of the indirect economic impact of new jobs, regardless of industry, is the formula that every new direct job creates one additional indirect job in terms of economic impact. This formula was recently put to the test in an American study of employment in the environmental industry sector, which includes waste resource management:

> "Input-output analysis suggests that there is roughly an equivalent number of workers employed in jobs that depend indirectly on the environmental industries, producing the parts, raw materials, office supplies, support services and other items that the environmental industry uses."[237]

Using Beck's 1:1.3 ratio and the number of new jobs created as a result of the Solid Waste-Resource Management Strategy, as described earlier, we have arrived at an estimate of economic spin-offs that is based only on increased jobs.

**Low estimate:** **118 jobs × 1.3 = 153 spin-off jobs**
**153 spin-off × $23,990 = $3,670,470**

**Medium estimate:** **136 jobs × 1.3 = 177 spin-off jobs**
**177 spin-off × $23,990 = $4,246,230**

**High estimate:** **163 jobs × 1.3 = 212 spin-off jobs**
**212 spin-off × $23,990 = $5,085,880**

## 8.3 Reduction of Greenhouse Gas Emissions

Reduction of GHG emissions is a significant benefit of the diversion of waste from landfills. The diversion of organics into a productive composting system reduces the amount of methane, a potent GHG that is emitted from landfills. As well, the use of recycled materials in place of virgin materials in manufacturing reduces energy use, resulting in lower levels of GHG emissions from manufacturing processes.

[236] Ibid.
[237] Hoerner, J., A. Miller & F. Muller 1995. *Promoting Growth and Job Creation through Emerging Environmental Technologies*. Centre for Global Change, University of Maryland, Washington. Available at www.globalchange.org/ctrforgc/cgcdoc5.htm#FN7.

According to the USEPA:

> "For many wastes, the materials that we dispose represent what is left over after a long series of steps including:
>
> - extraction and processing of raw materials;
> - manufacture of products;
> - transportation of materials and products to markets;
> - use by consumers; and
> - waste management.
>
> At virtually every step along this "life cycle," the potential exists for GHG impacts."
>
> "Waste management affects GHGs by affecting one or more of the following:
>
> (1) Energy consumption (specifically, combustion of fossil fuels) associated with making, transporting, using and disposing the product or material that becomes a waste.
> (2) Non-energy-related manufacturing emissions, such as the carbon dioxide released when limestone is converted to lime (which is needed for aluminium and steel manufacturing).
> (3) Methane emissions from landfills where the waste is disposed.
> (4) Carbon sequestration, which refers to natural or man-made processes that remove carbon from the atmosphere and store it for long time periods or permanently. A store of sequestered carbon (e.g., a forest or coal deposit) is known as a carbon sink."
>
> "The first three mechanisms (in the list above) add GHGs to the atmosphere and contribute to global warming. The fourth – carbon sequestration – reduces GHG concentrations by removing carbon dioxide from the atmosphere. Forests are one mechanism for sequestering carbon; if more wood is grown than is removed (through harvest or decay), the amount of carbon stored in trees increases and thus carbon is sequestered. Different wastes and waste management options have different implications for energy consumption, methane emissions and carbon sequestration. Source reduction and recycling of paper products, for example, reduce energy consumption, decrease combustion and landfill emissions and increase forest carbon sequestration."[238]

The danger of GHG emissions for global climate change is recognized by environmental scientists, national governments, and international organizations alike. Recognition of the severity of potential damage and the urgent need for action has led governments, including Canada, to sign and ratify the Kyoto Protocol,[239] which is designed to reduce global GHG emissions. According to the Protocol, Canada will reduce its GHG emissions to 6% below 1990 levels by 2008-2012. This amounts to a reduction of 20-25% below emissions projected for 2010 under a "business as usual" scenario.[240] Even in the absence of binding international adoption of the Protocol, Canada has stated its intention of meeting the Kyoto targets.

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[238] USEPA 1998. *Greenhouse Gas Emissions From Management of Selected Materials in Municipal Solid Waste*, pp. ES-3, 4. Available at www.epa.gov/epaoswer/non-h/muncpl/ghg.htm.
[239] The full text of the *Kyoto Protocol to the United Nations Framework Convention on Climate Change* is available at http://www.unfcc.int/resource/docs/convkp/kpeng.pdf.
[240] Walker, S. et al. 2001, op. cit., p. 31.

With regard to climate change, different gases have different potentials to cause global warming (called global warming potentials). For example, methane has 21 times the global warming potential of carbon dioxide ($CO_2$). In order to have a standard measurement of contribution to global warming from different gases, all gases are converted to $CO_2$ equivalents, expressed as $CO_2$ eq. Thus, to convert methane emissions into $CO_2$ eq, one would multiply the tonnes of methane emissions by 21. In this report, all GHG emissions are reported as $CO_2$ eq in metric tonnes (t $CO_2$ eq) or kilotonnes (kt $CO_2$ eq). GHGs from landfills are almost totally in the form of methane. Side Bar 8 describes the potency of methane as a GHG and the contribution of landfills to GHG emissions.

**Side Bar 8. Methane Quick Facts**

The significance of reducing methane emissions from landfills cannot be overstated. Methane is a very potent GHG. Indeed, methane is 21 times more potent than $CO_2$.

"Methane represented 13% of all of Canada's GHG emissions in 1995 with landfill source being the largest contributor. Canada is expected to reduce GHG emissions by 140 million tonnes $CO_2$ equivalents per year by 2010, or to 6% below the GHG emissions for 1990. Methane is 21 times more potent as a GHG than $CO_2$, so steps taken to curtail this emission will have a dramatic impact."

"The U.S. Environmental Protection Agency has concluded that the largest source of manmade methane entering the atmosphere is from landfilled municipal solid waste."

"Methane from our landfills accounts for 26% of the human-made methane emissions from Canadian sources. Estimates have shown that over 25 Megatonnes of $CO_2$ equivalent are being generated annually from Canadian landfills or roughly the equivalent of the annual greenhouse gas emissions of over 6 million automobiles."

Sources: Holbein, B.E. 1999. "Reducing Global Warming Through Improved Management of Municipal Solid Waste: Municipalities Can Play a Leadership Role." *Forum*, May/June 1999; and Perkin, M.E. 1999. *Landfill Gas: A Climate Change Solution, 21st Canadian Waste Management Conference Calgary, Alberta. October 19-21, 1999*. See www.nccp.ca for more information on the current status of the landfill gas industry in Canada.

GPI*Atlantic* recognizes the reduction of GHG emissions as a key indicator in the GPI. *The Nova Scotia Greenhouse Gas Accounts* explore the global and local impacts of GHG emissions and their potential costs.[241] Among the predicted local effects of climate change in Atlantic Canada, the report notes the following, based on Environment Canada projections:

> "The chief impacts of climate change that are expected in Atlantic Canada include sea level rise, drought, increase in extreme weather events and changes in rainfall, all of which can have an adverse impact on our social infrastructure, tourism, fisheries, forestry, agriculture, ecosystems and water resources."[242]

[241] Walker, S. et al. 2001, op. cit.
[242] Walker, S. et al. 2001, op. cit., p. iii.

The GPI*Atlantic* report finds that a reduction in GHG emissions is highly cost effective by comparison with potential damage costs:

> "[U]sing low estimates of both control and damage costs from the literature, every $1 invested in reducing GHG emissions will produce $27 in savings due to avoided climate change damage costs. Using the high estimates from the literature, every $1 invested in reducing emissions will produce $53 in savings. Using a ten year estimate from 2000-2010, rather than a single year snap-shot, every $1 invested in reducing GHG emissions will save $17 in avoided damages using low end estimates and $31 using high end estimates. Even more significantly, the cost effectiveness of reducing GHG emissions is shown... not to be dependent on the differing assumptions of the climate change economists who have calculated both the high and low end damage and control costs as well as intermediate estimates. Even using optimistic (low) estimates of potential climate change damage costs and pessimistic (high) estimates of control costs, the savings from avoided damages exceed the cost of reducing GHG emissions. In short, **greenhouse gas emission reductions are cost effective at any price when compared to potential climate change damage costs – using any range of estimates in the accepted literature**."[243]

Because the potential damages caused by GHG emissions are widely recognized, any reduction in GHG emissions can be counted as a benefit. Effective solid waste-resource management can contribute to a reduction of GHG emissions in several ways. First, composting organics reduces methane emissions in landfills. Second, reducing the dependence on virgin materials by using recycled materials as feedstock for new products reduces the energy required to manufacture those products.[244] Third, the recycling and re-use of paper and paperboard reduces the need for timber and thereby maintains the carbon sequestration capacity of forests.

The cost-benefit analysis provides estimates of the value of two means by which the Nova Scotia Solid Waste-Resource Management Strategy reduces GHG emissions: (1) by reducing the methane and $CO_2$ emissions from landfills; and (2) by reducing the overall emissions from manufacturing by using recycled materials rather than virgin raw materials. In order to determine the monetary value of reductions in GHG emissions associated with the Strategy, two values must be established: (1) the amount of the reduction (in t $CO_2$ eq) between pre-strategy levels and 2000-01 levels, and (2) the value of that reduction (in dollars per t $CO_2$ eq).

### *8.3.1 Estimating the reduction of greenhouse gas emissions*

The USEPA has provided the most detailed analysis to date of GHG emissions from municipal solid waste.[245] In this analysis, emissions from the entire life-cycle of a material (including emissions from manufacturing processes and transportation to waste management facilities), as well as the carbon sinks associated with its decomposition, are included. Table 27 shows the

[243] Walker, S. et al. 2001, op. cit., p. iv. Emphasis in original
[244] Wendt, F. 2001, op. cit., p. 43.
[245] USEPA 2002. *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks*.

components of the municipal solid waste (MSW) strategy that were considered in deriving net emissions. One important point to take into account in this calculation is that paper that is decomposed in the landfill is added to the carbon storage in the land. This increases carbon sinks because carbon has been returned to the ground through decomposition. Therefore, the main GHG reduction benefit derived from recycling paper is that recycled paper reduces the need for paper made from virgin materials, thus eliminating the emissions from wood extraction and virgin paper manufacturing. In addition, carbon storage is not further depleted by removal of additional trees.

**Table 27. Municipal solid waste management strategy components of net greenhouse gas emissions analysis**

| Management strategy | Impact on raw materials acquisition and manufacturing | Changes in forest or soil carbon storage | Waste management emissions |
|---|---|---|---|
| Source reduction | Decrease GHG emissions relative to the baseline of manufacturing | Increase forest carbon sequestration (for organic materials) | No emissions/sinks |
| Recycling | Decrease GHG emissions due to lower energy requirements compared to manufacture from virgin inputs; avoid processing (non-energy) GHGs | Increase forest carbon sequestration (for organic materials) | Process and transportation emissions[(a)] associated with recycling are counted in the manufacturing stage |
| Composting (food discards, yard waste) | No emissions/sinks | Increase soil carbon storage | Compost machinery emissions; transportation emissions |
| Combustion | No change | No change | Non-biogenic $CO_2$ and $N_2O$ emissions; transportation emissions and avoided utility emissions[(b)] |
| Landfilling | No change | No change | $CH_4$ emissions, long-term carbon storage, transportation emissions[(c)] and avoided utility emissions[(d)] |

Source: USEPA 2002. *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks*, p. ES-9.

Notes: (a) Refers to transportation of raw materials related to manufacture; does not include transportation to recycling plant.
(b) Assumes waste is used to generate electricity that can replace energy produced by fossil fuel utilities (waste-to-energy plants).
(c) Refers to emissions from transportation of wastes.
(d) Refers to electricity production from combustion of captured methane.

In order to derive these detailed measurements, it would be necessary to have much more comprehensive data about the types of materials present in municipal solid waste in Nova Scotia,

as well as the amount of each type of material composted, landfilled, or recycled. In a study of environmental improvements resulting from changes in waste management practices in Nova Scotia, Goodick examined many of these factors through the use of the Environment and Plastics Industry Council/Corporations Supporting Recycling (EPIC/CSR) Integrated Solid Waste Management (ISWM) model.[246] However, as will be discussed below, the quantities used in Goodick's study differ from the quantities used in the present study.

In the absence of an information base for this kind of detailed analysis, we have used the amount of landfill waste reduction between 1989 and 2001 provided by NSDEL and have adapted the methodology of Wendt to estimate amount of GHG emission reduction, the cost savings from GHG emission reductions from landfills, and the savings from using recycled materials in manufacture.

#### 8.3.1.1 Reduction of landfill greenhouse gas emissions

Landfills emit methane gas from decomposing organic wastes. In 1996, Nova Scotia landfills were generating approximately 28,000 tonnes of methane.[247] This converts to 588,000 tonnes $CO_2$ eq. In 1996, Nova Scotia landfilled an estimated 513,829 tonnes of MSW.[248] From these figures, one may estimate that each tonne of Nova Scotia MSW produces approximately 1.14 tonnes of $CO_2$ eq. Table 28 provides a variety of estimates of the amount of $CO_2$ eq produced from each tonne of MSW. These estimates represent the potential range of reductions to be realised by diverting all organic material from the landfill.

**Table 28. Reduction of landfill greenhouse gas emissions by removal of organic waste stream**

| Source | Type of estimate | t $CO_2$ eq emissions per t MSW |
|---|---|---|
| Environment Canada[249] | Calculated based on estimate of methane emissions from Nova Scotia landfills and tonnes MSW produced in Nova Scotia in 1996 | 1.14 |
| Pratt[250] | Removal of carbon from landfills by incineration | 1.11-1.91 |
| USEPA[251] | Based on finding that 1tonne MSW produces 61.5kg of methane (0.0615 t) × 21 = 1.29 t $CO_2$ eq | 1.29 |
| Holbein[252] | t $CO_2$ eq emitted from each tonne of MSW landfilled | 1.6 |

Source: Adapted from Wendt, F. 2001, op. cit.

[246] Goodick, M. 2002, op. cit.
[247] Nietzert, F., K. Olsen & P. Collas 1999. *Canadian Greenhouse Gas Inventory, 1997 Emissions and Removals with Trends*. Environment Canada, Ottawa.
[248] NSDEL 1996 Diversion Calculations.
[249] Nietzert et al. 1999, op. cit.
[250] Pratt, M.G. 1995. Energy Recovery vs. Landfilling. *Hazardous Materials Magazine*. October/November 1995.
[251] USEPA 1999. *Pay-as-you-Throw: A Cooling Effect on Climate Change*. EPA 530-99-002a. Available at www.epa.gov/mswclimate.
[252] Holbein, E.E. 1999. Reducing Global Warming Through Improved Management of Municipal Solid Waste. Municipalities Can Play a Leadership Role. *Forum* 002-004, May/June 1999.

Table 29 shows the amount of MSW disposed of in landfills, in 2000-01 and in 1989. In order for our data to be comparable with that used in deriving the emission coefficients in Table 28, we have subtracted the C&D waste, since it is not included in the studies in Table 28. C&D waste generally constitutes 25-30% of the Nova Scotia waste stream.[253] Therefore we have subtracted 25% from the total MSW in both 1989 and 2001. It should be noted that since much of the C&D waste was being diverted by 2001, this presents an over-estimate of the total MSW landfilled in 2001 and therefore an underestimate of the reduction in waste landfilled between 1989 and 2001. To estimate the potential GHG emission reductions resulting from the Nova Scotia Solid Waste-Resource Management Strategy, we have compared 2000-01 disposal and emissions to 1989 disposal and emissions, the latter representing the pre-strategy situation. Table 30 shows the range of potential reductions in emissions based on various emission coefficients. Nova Scotia reduced MSW disposal in landfills by 203,243 tonnes in 2000-01, compared to the pre-Strategy system. The estimated reduction in $CO_2$ eq that resulted from this was between 231 and 262 kt (Table 30).

**Table 29. Municipal solid waste disposed in landfills in 1989 and 2000-01 (tonnes)**

| Year | MSW disposed | Total MSW disposed minus C&D waste |
|---|---|---|
| 1989 | 641,375 | 481,031 |
| 2000-01 | 370,385 | 277,789 |
| Decrease in amount landfilled | | 203,243 |

Source: NSDEL Diversion Calculations. Amount landfilled in 1989: For the CCME calculations of waste diversion compared to 1989 levels, the 1989 rate of disposal per capita is multiplied by the 2001 population to give the comparative tonnes disposed in 1989 on the basis of an equal population. For a more conservative estimate of the GHG reductions, here we have used the historical 1989 amount from the NSDEL Waste Diversion Calculations 2001.

**Table 30. Estimates of greenhouse gas emission reductions resulting from diversion of 203 kilotonnes of municipal solid waste from landfills in Nova Scotia**

| | Emission coefficient (kt $CO_2$ eq per tonne of MSW) | kt $CO_2$ eq reduction from diversion of 203 kt MSW |
|---|---|---|
| Environment Canada | 1.14 | 231.4 |
| Pratt (only lower value is used) | 1.11 | 225.3 |
| USEPA[254] | 1.29 | 261.9 |
| **Low estimate** | | **231.4** |
| **Average estimate** | | **239.5** |
| **High estimate** | | **261.9** |

Note: The values from Holbein have been omitted here as they were out of the range of other values (1.7 times the lowest value). Since Pratt's range of estimates is between 1.11-1.91, and since only the lower end of his range is used here, even the high estimate in this study may be viewed as conservative, as it remains about 20-30% lower than the high estimates of Holbein and Pratt.

[253] Bob Kenney, NSDEL. Personal communication, February 2004.
[254] USEPA 1999, op. cit.

### 8.3.1.2 Reduction of greenhouse gas emissions from reduced energy requirements

Using recycled materials in manufacture, rather than virgin materials, requires less fossil fuel energy and therefore reduces GHG emissions. A range of estimates of the additional GHG emission reductions that can be achieved in this way are shown in Table 31.

**Table 31. Additional greenhouse gas emission reductions gained from recycling**

| Source | Type of estimate | Tonnes $CO_2$ eq per tonne MSW recycled |
|---|---|---|
| Holbein[255] | $CO_2$ eq per tonne MSW recycled | 0.544 |
| Valiante[256] | $CO_2$ eq per tonne recycled | 1.79 |
| NERC[257] | $CO_2$ eq per tonne recycled | 1.87 |
| USEPA[258] | $CO_2$ eq per tonne recycled (office paper) | 1.4 |
| USEPA[259] | Corporate recycling of cardboard, paper and plastic | 0.65-0.8 |

Source: Adapted from Wendt, F. 2001, op. cit.

To estimate the size of this type of GHG emission reduction, we first need to know the volume of recyclables marketed for use in manufacture in Nova Scotia in 2000-01. Nova Scotia collected 145,602 tonnes of materials for recycling in 2000, of which 12,329 tonnes were C&D material.[260] Since C&D material is mostly used for landfill cover and very little goes into manufacture, the C&D amount is omitted from our estimate, which then totals 133,273 tonnes. This estimate is likely conservative because it is based on year 2000 surveys and the rate of recycling was likely higher in 2001.

To determine GHG emission reductions from this use of recycled materials, we again use a range of emission coefficients for GHG emission reductions per unit of materials recycled. Table 32 shows that the $CO_2$ eq reduction resulting from recycling of materials in Nova Scotia ranges from 72 to 249 kt, with an average of 188 kt.

Table 33 provides a summary of reductions in GHG emissions resulting from the Nova Scotia Solid Waste-Resource Management Strategy. Total emission reductions range from a low of 303 kt $CO_2$ eq to a high of 511 kt $CO_2$ eq.

[255] Holbein 1999, op. cit.
[256] Valiante, U. 2000. Energy to Waste? Measuring diversion by weight distracts us from more environmentally relevant criteria. *Solid Waste Magazine* April/May 2000.
[257] Northeast Recycling Council (NERC) 1999. *Recycling and the Environment*. Available at www.nerc.org/fsheets accessed Mar 2, 2000.
[258] USEPA 1999. *Pay-as-you-Throw: A Cooling Effect on Climate Change*. EPA 530-99-002a. Available at www.epa.gov/mswclimate
[259] USEPA 2002. *Success Story. Getting on the books with Waste Reduction*. Available at www.epa.gov. Accessed November 2003.
[260] Statistics Canada 2003, op. cit.

**Table 32. Estimated greenhouse gas emission reductions in 2000-01 from sending 133.3 kilotonnes of recycled materials for manufacture**

| Source | Emission coefficient (kt $CO_2$ eq saved by manufacture of goods using 1 t of recycled materials) | kt $CO_2$ eq reduction from manufacture from 133.3 kt recycled materials |
|---|---|---|
| Valiante | 1.79 | 238.61 |
| Holbein | 0.54 | 71.98 |
| NERC | 1.87 | 249.27 |
| USEPA[261] | 1.40 | 186.62 |
| USEPA (values averaged)[262] | 1.45 | 193.29 |
| **Low** | | **71.98** |
| **Average** | | **187.95** |
| **High** | | **249.27** |

**Table 33. Summary of greenhouse gas emission reductions attributable to the Nova Scotia Solid Waste-Resource Management Strategy**

| Type of Emissions Reduction | kt $CO_2$ eq reduction | | |
|---|---|---|---|
| | Low | Average | High |
| Diversion from landfill | 231.4 | 239.5 | 261.9 |
| Recycling Reduction | 71.98 | 187.95 | 249.27 |
| **Total** | **303.38** | **427.45** | **511.17** |

Wendt also estimated the reduction of GHG emissions resulting from the Solid Waste-Resource Management Strategy in HRM.[263] His calculations were based on an estimated annual rate of waste generation of 0.872 t MSW per household and landfill emissions of 1.74 t GHG per household per year. Wendt did not specifically compare pre- and post-Strategy emissions, but put a monetary value on a range of potential emission reductions of 0.9, 1.6, and 2.2 tonnes per household per year. On a province-wide basis (with 406,500 households), this would translate into reductions of 365.85 kt $CO_2$ eq (low estimate); 650.4 kt $CO_2$ eq (average) and 894.3 kt $CO_2$ eq (high). Our calculations, based on changes between 1989 and 2001, are lower but are in the range of the estimates derived by extrapolating from Wendt. Extrapolating Wendt's figures per household to the entire province likely produces an inflated estimate, since the diversion of waste in HRM is considerably higher than that of any other region in Nova Scotia.

Goodick analyzed changes in GHG emissions in Nova Scotia as a result of the Solid Waste-Resource Management Strategy by performing a life cycle emissions analysis of the 1989 case and the 2001 case.[264] Using the EPIC/CSR ISWM model, the study included changes in emissions resulting from changes in:

[261] USEPA 1999, op. cit.
[262] USEPA 2002, op. cit.
[263] Wendt, F. 2001, op. cit.
[264] Goodick, M. 2002, op. cit.

- the quantity of waste landfilled;
- the quantity of waste burned;
- the amount of waste composted;
- transportation (for collection and transfer); and
- use of recycled materials in manufacture.

For input values, Goodick used the same quantity of total waste (265,000 t) for both 1989 and 2001, based on surveys conducted in Lunenburg County in 2000 and 2001. He estimated the amount landfilled in 1989 at 203,000 t and in 2001 at 137,000 t, resulting in a decrease of 66,000 t. Goodick's total estimate of reductions in 2001, compared to 1989, was 160.6 kt $CO_2$ eq, of which approximately 44% (70.6 kt) was from using recycled materials in manufacture and the other 56% (89.9 kt) was from reductions in landfill and open burning emissions, with a simultaneous increase in emissions from composting. Emissions from collection and transportation of materials were 1% of the total in 1989 and 3% of the total in 2001.

Although Goodick presents a relatively complete analysis of GHG emissions, the numbers used for the amount of waste and recycling were from a survey that included only residential recycling data. Goodick's weight of total waste was much lower than that found in the NSDEL reports, which include C&D and ICI wastes. Our estimate of the decrease in landfilled waste between 1989 and 2001 is four times that used by Goodick. Goodick's value of 51,000 t for residential recycling is not comparable to ours because we include ICI recycling, as well as residential recycling. Thus, our estimate of the reduction in landfill GHG emissions (303-511kt) is considerably higher than Goodick's estimate of 160.6 kt (our average estimate of 427 kt is nearly three times as large), because it includes categories of waste that are excluded from Goodick's data, as well as a more simplified methodology. Also, it should be noted that the model used by Goodick did not follow Intergovernmental Panel on Climate Change standards and thus should be use with caution.

### *8.3.2 Establishing a monetary value for the reduction of greenhouse gas emissions*

To establish the monetary value of reducing GHG emissions, we must determine the dollar value of reducing GHG emissions by one tonne $CO_2$ eq. There are many different ways to calculate an economic value for the reduction of GHG emissions, depending on scientific assumptions, different modelling procedures, functional variables, and the context of the study.

Three options for setting prices on GHG emissions are (1) market trading prices; (2) the actual cost of damage from climate change; and (3) the cost to reduce GHG emissions (control costs). In this section, as throughout the report, all dollar values are $C2000.

1) Although market prices do not yet exist for GHG emission reductions, companies, governments, and international agencies are exploring the possibility of trading GHG reduction credits as commodities. If one company is emitting excess GHGs, it may be able to purchase GHG credits from another company that has put in place GHG reduction measures. Because there is no legislation for controlling GHG emissions, there is currently no such

thing as a GHG emission credit.[265] In Canada, traders are buying and selling the right to emit GHGs in the future, under the assumption that legislation may be adopted following the model of emission reduction credit trading. Because trading as a commodity is subject to the vicissitudes of market economies, the trading price of one tonne $CO_2$ eq will fluctuate widely. One recent deal saw a price of $10 per ton,[266] while BC Hydro offered to purchase reduction credits at a price of $0.50 per tonne, as part of the Greenhouse Gas Emission Reduction Trading pilot project that ran from 1998 to 2002.[267] Currently, a reasonable price for the reductions might be $1.65-$3.30 per tonne.[268] Because of the changeable nature of these prices and their still theoretical nature, they are not included as part of the pricing mechanism in this report.

2) Assessing the cost of damage caused by climate change is an enormous undertaking fraught with disagreements among scientists and politicians about the extent of damage that may reasonably be expected as a result of climate change. In the *Greenhouse Gas Accounts*, damage cost estimates are referenced, ranging from $24 to $1,090 per tonne $CO_2$ eq.[269] Damage cost estimates range from 0.6%-17% of GDP for developed countries and 25%-250% of GDP for developing countries. Based on a figure of 1.4%-2.5% reduction in GDP due to climate change damage for developed countries, and 1.8%-4% reduction in GDP for developing countries, Cline arrived at a price range of $24-$60 per tonne $CO_2$ eq.[270] Bein & Rintoul sharply revised this price, based on the precautionary principle and on an analysis of more specific costs to particular ecosystems (e.g. wetlands), to a price of $1,090 per tonne $CO_2$ eq.[271] Another estimate, based on the cost of climate change to the U.S. economy and the amount of GHG emission reduction needed to reach 1990 emission levels, is between $202 and $269 per tonne of $CO_2$ emissions.[272] Other studies, such as Winpenny, arrived at estimates of $6.28-$70.15 per tonne.[273]

3) Aside from the damages caused to society by climate change, there are costs associated with efforts to reduce GHG emissions on the part of government, business, and individuals. GPI*Atlantic* reviewed a number of studies on control costs that indicated a range of $11 to $120 per tonne $CO_2$ eq emitted.[274] On the assumption that reductions in GHG emissions might require a tax to be levied on emissions, estimates of the tax required in the U.S. to

[265] Fickes, M. 2000. Gold from Landfill Gas. *Waste Age*, pp. 68-73.
[266] Ibid.
[267] Greenhouse Gas Emission Reduction Trading 2001. First "Offer-to-Buy" Posted at GERT Website. *Trading Newsletter* Number Two. Available at www.gert.org. The Pilot was designed to learn about greenhouse gas emission reduction trading through the review of actual projects. This Canadian Pilot was a collaboration between the federal government, six provinces, industry associations, and environmental groups. The Pilot was originally intended to run from 1998 - 2000 but was extended until 2002 to enable GERT members to complete the project reviews and emission quantification guidelines and to report on the lessons learned. GERT ended in June 2002 with the publication of the *Greenhouse Gas Emission Reduction Trading (GERT) Final Report*.
[268] Fickes, M. 2000, op. cit.
[269] Walker, S. et al. 2001, op. cit.
[270] Cline, W. 1995. *Pricing Carbon Dioxide Pollution*. British Columbia Ministry of Transportation and Highways.
[271] Bein, P. & D. Rintoul 1999. Shadow Pricing Greenhouse Gases. *Proceedings of the Third Biennial Conference of the Society for Ecological Economics: Nature, Wealth and the Human Economy in the Next Millennium*.
[272] Hodge, I. 1995. *Environmental Economics*. MacMillan Press, London.
[273] Winpenny, J.T. 1991. *Values for the Environment*. HMSO, London.
[274] Walker, S. et al. 2001, op. cit.

bring emissions down to 1990 levels range from $49.50-$165/tonne.[275] Another approach to reducing emissions is to place a value on carbon sinks, which are long-term storage repositories of carbon, such as trees and soil. One U.S. estimate assessed the value of GHG emission reductions by calculating the number of trees saved by recycling paper, and thereby arrived at an estimate of $60 per tonne.[276]

Table 34 presents a very wide range of these values. Obviously, the value used depends on whether one is using the precautionary principle and looking at total environmental damages, or whether one is looking at the more immediate costs to institutions to reduce the emissions.

**Table 34. Range of estimated monetary values per tonne carbon dioxide equivalents ($C2000)**

| Source | Type of Estimate | Value of 1t $CO_2$ eq (C$2000) |
|---|---|---|
| Fickes | Carbon trading | $1.65-$3.30 |
| Hodge | Carbon sinks | $202-$269 |
| Winpenny | Damage costs | $6-$70 |
| Bein & Rintoul | Damage costs | $1,090 |
| Hodge | Cost of reduction (value of trees saved) | $55 |
| Parker | Cost of reduction (carbon tax) | $49.5-$165 |
| Walker et al. | Control costs (various methods) | $11-$120 |
| **Control costs: Low estimate** | | **$11** |
| **Control costs: Average estimate** | | **$80** |
| **Control costs: High estimate** | | **$165** |

### *8.3.3 Estimating the monetary value of reduced greenhouse gas emissions attributable to the Nova Scotia Solid Waste-Resource Management Strategy*

In deriving the low, average, and high estimates for the purposes of this report, we are following a very conservative approach that likely underestimates the value of one tonne of $CO_2$ eq emissions. Because we are concerned here with the actual cost of reducing GHG emissions, we are using the control cost estimates only. In other words, if Nova Scotia had to find means other than waste diversion to achieve the same reductions in GHG emissions, what would this cost? We have arrived at low, average, and high estimates for the cost of reducing GHG emissions by one tonne $CO_2$ eq: $11, $80 and $165, respectively. Wendt's values were $5, $126, and $247. We depart from Wendt's methodology here because we use only control costs rather than damage costs. These prices are reflected in Table 35, which summarizes the value of Nova Scotia GHG emission reductions that can be attributed to the Solid Waste-Resource Management Strategy.

[275] Parker, L. 2000. *Global Climate Change: Market Based Strategies to Reduce Greenhouse Gases*. National Council for Science and the Environment, Washington.
[276] Hodge, I. 1995. op. cit.

**Table 35. Total monetary benefits of greenhouse gas emission reductions attributable to the Nova Scotia Solid Waste-Resource Management Strategy ($C2000)**

| | Low | Medium | High |
|---|---|---|---|
| Estimated t $CO_2$ eq emission reduction | 303,380 | 427,450 | 511,170 |
| $11 (low) | **$3,337,180** | $4,701,950 | $5,622,870 |
| $80 (average) | $24,270,400 | **$34,196,000** | $40,893,600 |
| $165 (high) | $50,057,700 | $70,529,250 | **$84,343,050** |

Even if we consider the lowest possible estimates both for total GHG emission reductions and for the monetary value of those reductions, the total net savings as a result of the Strategy are at least $3.3 million. At the higher end of the estimates, savings are $84.3 million. Although the benefits of GHG emission reductions are currently realized on a global rather than a local level, in the future the benefits may be realized more locally if legislation eventually goes into effect that makes carbon trading a reality.

## 8.4 Reduction of Air Pollutant Emissions

### *8.4.1 Estimating the reduction of air pollutant emissions*

The Nova Scotia Solid Waste-Resource Management Strategy has resulted in decreased emissions of several air pollutants that have negative impacts on human health and the environment. Emission reductions come about primarily through use of recycled materials for manufacture, which requires less energy, and therefore reduced emissions from fossil fuel use. Open burning and incinerators without proper emission controls produce a number of potentially hazardous air emissions. One study in the U.S. showed that, "...a single household that burns their trash in barrels produces more pollutants than a full-scale municipal waste combustion facility."[277] The ban on open burning and improvements to incinerators required by the Strategy have resulted in improved air quality in Nova Scotia.

Goodick analyzed the net changes in emissions of air pollutants between 1989 and 2001.[278] As mentioned earlier, Goodick's recycling calculations are based only on residential recycling and are therefore low. Nevertheless, we have included these estimates here, since they are the only estimates readily available. Goodick estimated decreases in emissions of four types of air pollutants as a result of the Strategy using the EPIC/CSR ISWM model (Table 36).

[277] Lemieux, P. 1998. *Evaluation of Emissions from the Open Burning of Household Waste in Barrels*. USEPA National Risk Management Research Laboratory, Cincinnati, OH.
[278] Goodick, M. 2002, op. cit.

**Table 36. Estimated air pollutant emission reductions resulting from the Nova Scotia Solid Waste-Resource Management Strategy (tonnes)**

| Air pollutant | Net decrease in emissions between 1989 and 2001 |
|---|---|
| Nitrogen oxides | 3,685.2 |
| Sulphur oxides | 986.39 |
| Particulate matter | 297 |
| Volatile organic compounds | 1,172.9 |

Source: Goodick, M. 2002, op. cit.

### *8.4.2 Establishing a monetary value for the reduction of air pollutants*

To place a monetary value on these decreases in emissions, we have used a combination of damage costs and control costs. In the *Ambient Air Quality Accounts*, Monette & Colman present a range of damage costs attributable to different air pollutants.[279] For sulphur oxides, damage costs per tonne ranged from $850 to $14,780 ($C2000); for nitrogen oxides, from $140 to $14,426; for particulate matter, from $178 to $81,125; and for volatile organic compounds, from $9 to $12,100. The study points out that the wide variation in damage cost estimates is due to differences in study objectives, assumptions made by the researchers, and the specific costs included in the estimates. Some studies emphasize human health impacts, such as respiratory diseases, while others emphasize environmental impacts, such as acidification of lakes and rivers, which sharply increases the damage cost estimates. Monette & Colman chose values from studies that were most comparable to Nova Scotia, based on six criteria. Of the studies that met the criteria, Canadian studies were used where possible. From this process, a set of high and low values for each air pollutant were chosen (presented in the "Low" and "High" columns of Table 37).

**Table 37. Estimated cost per tonne of air pollutant emissions ($C2000)**

| Air pollutant | Cost per tonne | | |
|---|---|---|---|
| | Low | Medium | High |
| Nitrogen oxides | $1,410 | $7,700 | $12,450 |
| Sulphur oxides | $1,380 | $6,600 | $10,500 |
| Particulate matter | $2,120 | $4,400 | $5,180 |
| Volatile organic compounds | $2,000 | $5,500 | $8,240 |

Sources: Low and high estimates are damage estimates from Monette & Colman 2004. Medium costs are control costs from Walker et al. 2001.

In the *Greenhouse Gas Accounts*, Walker et al. examined damage and control costs for the same air pollutants, primarily using transportation studies.[280] The control costs used in that study fall

[279] Monette, A. & R. Colman 2004, op. cit.
[280] Walker, S. et al. 2001, op. cit.

between the low and high costs used in the *Ambient Air Quality Accounts*. Therefore, in the present study we have used the control costs from the *Greenhouse Gas Accounts* as the medium range values. Table 37 shows the per tonne values used for low, medium, and high costs based on the available literature.

### *8.4.3 Estimating the monetary value of reduced air pollutant emissions attributable to the Nova Scotia Solid Waste-Resource Management Strategy*

Table 38 presents the total estimated savings from the emission reductions of each air pollutant that can be attributed to the Nova Scotia Solid Waste-Resource Management Strategy. These savings, ranging from $9.5 million to $67.4 million, are counted as benefits in this study.

**Table 38. Total monetary benefit of air pollutant emission reductions attributable to the Nova Scotia Solid Waste-Resource Management Strategy ($C2000)**

| Air pollutant | Monetary value of emission reductions | | |
|---|---|---|---|
| | Low | Medium | High |
| Nitrogen oxides | $5,196,132 | $28,376,040 | $45,880,740 |
| Sulphur oxides | $1,361,218 | $6,510,174 | $10,357,095 |
| Particulate matter | $629,640 | $1,306,800 | $1,538,460 |
| Volatile organic compounds | $2,345,800 | $6,450,950 | $9,664,696 |
| **Total Benefit** | **$9,532,790** | **$42,643,964** | **$67,440,991** |

## 8.5 Value of Energy Savings from Use of Recycled Materials

Wendt summarized the energy savings that result from using recycled materials, rather than virgin raw materials, in manufacturing.[281] It takes 0.5 million Btu (MMBtu)[282] of energy to landfill a tonne of solid waste and 1.5 MMBtu to collect, process, and market one tonne of recyclables collected in a curbside program. This gives a net cost of 1 MMBtu to recycle a tonne of material. Since the energy recovered from manufacturing using recycled materials rather than virgin raw materials is 18.3 MMBtu per tonne, this results in a net energy savings of 17.3 MMBtu per tonne of recycled materials.

As noted in the section on GHGs, we have estimated the amount of recycled materials used in manufacture in Nova Scotia in 2000-01 at 133.3kt. To arrive at an estimate of the value of the energy saved from using this amount of recycled materials in manufacture, we first determine its value in terms of MMBtu saved, and then convert the MMBtu into kilowatt-hours (kWh). As there are 3,417 Btu in a kWh, there are 292.65 kWh in a million Btu (= one million divided by 3,417):

[281] Wendt 2001, op. cit.
[282] BTU = British Thermal Unit. This is the amount of energy required to raise the temperature of 1 pound of water 1 degree Fahrenheit when the water is near 39.2 degrees Fahrenheit.

**133.3 kt recycled materials × 17.3 MMBtu per tonne = 2,306,009 MMBtu**

**2,306,009 MMBtu × 292.65 kWh per MMBtu = 674,877,239 kWh**

To determine the monetary value of this energy saving, we multiply the kWh by the Medium Industrial Rate charged for electricity by Nova Scotia Power, which is 4.25 cents per kWh, in addition to the base charge:[283]

**674,877,239 kWh × $0.0425/kWh = $28,682,283**

Thus, the Nova Scotia Solid Waste-Resource Management Strategy has provided a benefit of $28.7 million in energy savings. By comparison, Wendt calculated a benefit value of $54 per household, which, extrapolated to the province, would be $21.9 million.[284] Since Wendt's calculation was only for residential recycling in HRM, the $28.7 million figure for the province, for residential and ICI savings, is a conservative estimate.

## 8.6 Diversion Credits & Support to Municipalities

The RRFB is mandated to "fund municipal or regional diversion programs" and to pay a minimum of 50% of net revenues to municipalities through diversion credits.[285] The RRFB provides support to municipal diversion programs in several ways: direct diversion credits based on the tonnage municipalities divert from disposal; approved funding to municipalities for diversion programs; funding for regional coordinator salaries and chair meetings; funding for derelict vehicle removal, paint swaps, and HHW depots; funding for regional education and awareness programs; and advertising assistance to promote diversion initiatives. In addition, net revenues are directed toward investment in businesses that develop products and services that divert materials from disposal.[286]

The total of these benefits for 2000-01 was $9.6 million (Table 39). These benefits are not subtracted from the overall operating costs, and are therefore considered external benefits of the Strategy.

**Table 39. Summary of Resource Recovery Fund Board diversion support ($C2000)**

| Type of Benefit | 2000-01 |
|---|---|
| Direct diversion credits | $4,979,465 |
| Approved program funding | $4,374,804 |
| Value-added manufacturing | $248,824 |
| **Total** | **$9,603,093** |

Source: RRFB Annual Reports 2000-01.

[283] Nova Scotia Power 2002. Rates and Regulations, Issued November 2002. Available at www.nspower.ca
[284] Wendt 2001, op. cit.
[285] RRFB 1999. Annual Report.
[286] M. Catherine McCarthy, RRFB. Personal communication, May 2004.

## 8.7 Extended Landfill Life

Waste diversion initiatives ultimately extend the time span over which a landfill can be used. This delays the costs and time associated with siting new landfills, extends capital investments over a greater period of time, and reduces operational costs because less waste enters the landfills.

### *8.7.1 Value of avoided siting costs*

The cost of siting a landfill depends on many factors, including real estate values, environmental assessment costs, costs borne by citizens who participate in the process, and government costs related to the public consultation process. In addition, the process is often time-consuming, labour intensive, and politically explosive. Residents typically vigorously oppose landfill developments in close proximity to their own communities due to fear of contamination, odours, and a decline in property values. Replacing a second generation landfill is much less costly than replacing a first generation landfill. When residents have witnessed a landfill site that does not cause odours or a decline in property values, resistance to siting a new landfill may be significantly mitigated, and costs reduced accordingly. Once an actual site is located, there are further costs associated with landscaping and road construction, relocating utilities, and the development of infrastructure to support a landfill.[287]

The exact price of siting a new landfill is difficult to assess, as historically there have been very few systematic attempts to document these costs. Experience from Kootenay, British Columbia, suggests that costs associated with finding a new landfill site can run as high as $4 million:

> "We (the Regional District of Kootenay Boundary) discovered in 1996 that finding a new landfill can cost between $3 and $4 million while closing an old landfill and opening a new one can cost an additional $2 million. In the past these costs were never factored into the cost of burying garbage."[288]

Researchers investigating the costs of siting a new landfill for Ontario municipalities estimated the cost of researching and siting a landfill at $2.16 per tonne of capacity ($C2000).[289] The researchers found that pre-development costs for landfills for six large Canadian municipalities ranged from $1.43 to $1.58 per tonne of capacity ($C1996). Pre-development can include the costs of preliminary screening, engineering, public consultations, environmental impact assessments, and legal fees. Smaller municipalities may face even higher costs. The Region of Halton, Ontario spent $8 million ($C1996) on hearings and consulting reports to dispose of 4 million tonnes of waste, an average of $2 per tonne of waste capacity for the landfill. Sometimes municipalities invest large amounts in pre-development costs and still end up without a landfill

[287] Alberta Environmental Protection. *Disposal Choices: Managing Waste in Alberta*. Available at www.gov.ab.ca/env/waste/.
[288] Jessen, M. 1998. *A World to Waste*. Available at www.zerowaste.ca.
[289] Apogee Research 1996. *Avoided Landfill Search Costs to Ontario Municipalities*. Available at www.railcyclenorth.com/report-econom.html.

site, as happened in Mississauga, Ontario which spent $6 million ($C1996) without getting a site.[290]

Since it appears that the per tonne costs cited above were calculated as total landfill capacity for the life-span of the proposed landfills rather than on a per year basis, they are not comparable to the per year numbers discussed below for Otter Lake. Further research efforts were unable to confirm the basis for the calculation in the above examples. The above numbers are presented here, therefore, simply to illustrate the magnitude of the cost of siting a landfill.

In the Halifax Region, replacing the Sackville landfill was an extremely long process that included site rejections; debate over disposal methods; persistent public demand for involvement; environmental assessment of incineration; rejection of incineration as an option; engagement of public processes to develop a strategy; siting a landfill and other facilities based on that strategy; and finally, introduction of the new provincial Strategy.[291] The actual siting and pre-development costs for the Otter Lake facility, excluding all the false starts for the previous fifteen years, were about $1.5 million for a landfill with a 20-year life and capacity of 135,000 tonnes per year.[292] This amounts to a cost of $0.55 per tonne per year over the lifetime of the landfill. No estimate is available for the total costs of all the siting proposals considered in the previous 15 years.

Fifteen Nova Scotia communities still have first generation landfills and will be required to upgrade to full containment (second generation) landfills by 2005. It is estimated that there will be four or five new regional second generation landfills in the province in the next five years, and that other communities will truck their wastes to these landfills.[293] The trucking costs, including environmental impacts of trucking, will need to be considered in making these choices.

Using the landfill siting cost of $0.55 per tonne per year, the costs avoided in 2000-01 by diverting municipal solid wastes from landfills were:

**$0.55 × 317,695 tonnes diverted in 2000-01 = $174,732**

Since we do not have full information on siting costs from other regions of Canada, we have used only the $0.55 per tonne per year cost and have not arrived at low, medium and high estimates. Although the $0.55 per tonne per year is an underestimate of the actual costs for siting the Otter Lake facility, it could be argued that because of improvement in landfill technologies, siting second generation landfills will not be as expensive now that one is operating successfully. Second generation landfills in the future are expected to generate less controversy and therefore the lengthy proceedings that went into the Sackville landfill replacement will likely not occur.

[290] Apogee Research 1996, op. cit.
[291] David Wimberley. Personal communication, September 2002.
[292] Barry Friesen, NSDEL. Personal communication, December 2003.
[293] Bob Kenney, NSDEL. Personal communication, December 2003.

### *8.7.2 Decreased capital investment and operational costs*

In addition to delaying costly siting expenses, extending the life of a landfill through diversion decreases the annualized capital investment costs of the landfill by extending its life span.

In Nova Scotia, there are three second generation landfills and 15 first generation landfills. A number of communities have no landfill at all and truck their garbage to other communities for disposal. Diverting solid waste from landfills by recycling and composting increases the life of these landfills and decreases their annual operating and capital costs. One incinerator is operating in Cape Breton and, although exact costs of operation have not been released, the costs are much higher than those of landfills. In addition, there is no incentive to divert waste, as the incinerator must be fed a certain level of material to keep operating. The average disposal cost for first generation landfills is $36 per tonne; for second generation landfills, $71 per tonne; and for those communities without landfills, $51 per tonne.[294] These are the gross costs to construct the cells, process materials, and close cells. They do not include additional costs such as baling or a front-end loader. While it could be argued that these costs do not take into account economies of scale and that greater amounts of waste may therefore lead to lower per tonne costs, these are the costs reported to NSDEL by the Regional Waste Management authorities, so they are regarded as the most accurate costs available.

To estimate the savings in landfill costs from waste diversion, we have multiplied the tonnes of waste diverted from each type of landfill by the disposal cost per tonne. Table 40 presents the cost per tonne of the different disposal options and the savings in landfill costs provided by diverting waste from landfills. It is clear there are substantial annual savings in the operating and capital costs of landfills alone, without consideration of the pre-development costs of a new landfill.

**Table 40. Savings in landfill costs provided by diverting solid waste from landfills**

| Type of disposal | Average disposal cost per tonne ($C2000) | Tonnes diverted in 2000-01 | Savings in landfill costs provided by diversion ($C2000) |
|---|---|---|---|
| First generation landfill | $36 | 87,620 | $3,154,320 |
| Second generation landfill | $71 | 198,001 | $14,058,071 |
| No disposal site – transferred to other facilities | $51 | 32,076 | $1,635,876 |
| Total capital and operating costs saved as result of diversion in 2000-01 | | | **$18,848,267** |

Source: NSDEL Solid Waste Diversion Calculations 2000-01 and Nova Scotia Regional Costs of Waste Management 2000-01.

[294] NSDEL 2002. *Municipal Solid Waste, Recycling and Composting Summary Tables for fiscal year 2000-01.*

### *8.7.3 Avoided liability costs*

Landfills can be a nuisance and a hazard to communities. Not only do these operations produce unwanted noise, odour, pests and an unsightly environment, but they also create significant risks of ground water contamination from leachate and other toxic releases.

One of the most serious effects of poorly sited, poorly managed, or older landfills is leachate contamination. Leachate is formed when rain falls on a landfill site and percolates throughout the waste, thereby dissolving chemicals and picking up other materials in suspension. Because this liquid is very acidic, it dissolves heavy metals such as lead and cadmium. Leachate can also carry pathogens such as bacteria and viruses. Moreover, when leachate comes into contact with decomposing organic matter and escapes into surrounding surface water, it develops high biochemical and chemical oxygen demand, which harms aquatic plants and animals by reducing their oxygen supply. For all of these reasons, leachate that escapes into surrounding ground and surface water can contaminate the environment in very serious ways.[295]

Assessments of the Sackville landfill determined that it was detrimental to that community with regard to property values, nuisance, and general quality of life. As a result, the Halifax Metropolitan Authority, which ran the landfill, compensated Sackville residents and affected individuals with $10.4 million for "loss of quality of life and property values." The general community received $6.5 million, $1.6 million went to individuals who were especially affected by the landfill, and $2.3 million went to buy out 35 homes nearest the landfill.[296]

For the second generation landfills currently being planned, a compensation cost for hosting the landfill is built into the overall costs. These costs are $4-$6 per tonne per year.[297] Diversion of solid waste from landfills results in a lower capacity requirement for the new second generation landfills and therefore avoids a portion of the compensation costs because these are based on tonnage disposed. To estimate the value of avoided compensation costs, we multiply the total tonnes of waste diverted in 2000-01 by the compensation costs per tonne that are built into future landfill costs.

| | |
|---|---|
| **Low estimate:** | **$4 per tonne × 317,695 = $1,270,780** |
| **Medium estimate:** | **$5 per tonne × 317,695 = $1,588,475** |
| **High estimate:** | **$6 per tonne × 317,695 = $1,906,170** |

## 8.8 Export Revenue from Goods & Services Related to Waste Management

The 50% diversion target set out in the Nova Scotia Solid Waste-Resource Management Strategy created a need for the development of waste-resource technologies and services. Local

[295] Tchobanoglous, G., H. Theisen & S. Vigil 1993. *Integrated Solid Waste Management*. McGraw-Hill, New York. Cited in Wendt, F. 2001, op. cit., pp. 9-10.
[296] Moar, Kim 1996. "550 Get Dump Compensation," *Halifax Daily News*, Feb. 27, 1996. Cited in Wendt, F. 2001, op. cit., p. 63.
[297] Barry Friesen, NSDEL. Personal communication, 2003.

companies that export their technologies and intellectual capital create economic benefits for the province. One example is given in Side Bar 9.

**Side Bar 9. Exporting Nova Scotian Innovation**

**Dillon Consulting Limited**

"Over the past few years the Department of the Environment has assisted Dillon Consulting with some of their exporting activities throughout the Caribbean... resulting in over $4 million of export business from offices in Nova Scotia."

"Dillon was an integral consulting firm in helping Nova Scotia establish our waste management strategy. They developed many of the municipal plans now since successfully implemented in the province. They have also demonstrated their ability to take the knowledge gained in NS and adapt it to help many of the Caribbean Islands implement their own waste management strategies."

Source: NSDEL internal memo, September 14, 2000.

Between 1996 and 2000, revenues from environmental industry goods and services in Nova Scotia rose by $68.9 million ($C2000) to a total of $310.4 million.[298] Although figures for the amount of this revenue attributable to the waste management sector by province are not available, an estimate based on the ratio of Canadian waste management industry revenue to total environmental industry revenue indicates that $14.5 million of the $68.9 million increase in Nova Scotia environmental industry revenues between 1996 and 2000 may have been in the waste management sector. This estimate may be considered conservative, as the province's Strategy likely increased the demand for waste management services during this period, and therefore their proportion of total environmental industry revenues. However, even this figure demonstrates a significant increase in waste-related business revenue in Nova Scotia during the study period.

To determine the impact of the Solid Waste-Resource Management Strategy on the provincial economy in the environmental business sector, we consider only revenues from exports of goods and services related to waste management. Statistics Canada defines these goods and services as follows:[299]

**Environmental Goods:**

- **Goods for Hazardous and Non-hazardous Waste Management**: hazardous waste storage/treatment equipment, waste collection equipment, waste disposal machinery and equipment, waste handling equipment, waste separation equipment, recycling equipment, and incineration equipment.

[298] Statistics Canada 2002. *Environment Industry Survey Business Sector 2000*. Catalogue No. 16F0008XIE. Statistics Canada, Ottawa.
[299] Statistics Canada 2000, op. cit.

- **Goods for Remediation and Treatment of Soil, Surface Water, Seawater, and Groundwater**: absorbents, bioremediation equipment, soil vapour extraction equipment, spill equipment, containment systems, chemicals and bioremediators.

**Environmental Services:**

- **Hazardous and Non-Hazardous Waste Management Services:** waste handling, collection, transport and disposal, operation of sites, ownership or management of sites, recycling (sorting, baling, cleaning), operation of materials recovery facilities, hazardous waste management services, including related consulting, engineering, and analytical services.

- **Remediation and Treatment of Soils, Surface Water, Seawater, and Groundwater:** cleaning of facilities and tanks, emergency response and spills cleanup, site reclamation and remedial action, maintenance and repair of remediation or treatment systems, including related consulting, engineering, and analytical services.

Environmental industry exports from Nova Scotia rose from $2.8 million in 1996 ($C2000) to $17.2 million in 2000, an increase of $14.4 million. Although the amount of export revenue for the waste management sector alone is not available by province, we have estimated the portion of that increase that is due to waste management-related goods and services, based on the Canadian ratio of waste management exports to total environmental export revenue (19.1%). Thus we arrive at an estimate of $2.75 million for the increase in environmental exports attributable to the waste management industry during the 1996-2000 period. In the absence of a detailed analysis of the factors responsible for this increase, we have estimated the proportion of this increase attributable to the Nova Scotia Solid Waste-Resource Management Strategy at a conservative 50%. For low and high estimates, we have calculated the benefits at 40% and 60%.

**Low estimate:** **$2.75 million × 40% = $1,100,000**
**Medium estimate:** **$2.75 million × 50% = $1,375,000**
**High estimate:** **$2.75 million × 60% = $1,650,000**

## 8.9 Tourism

By being the first Canadian province to achieve the CCME target of 50% solid waste diversion by the year 2000, Nova Scotia provided an example for other provinces and countries. As a result, solid waste managers from around the world regularly visit Nova Scotia facilities to learn about the Nova Scotia solid waste-resource system first hand. This business tourism results in a direct net benefit to the province through monies spent on accommodations, travel, meals, entertainment, and repeat tourism. Moreover, the visitors raise Nova Scotia's profile in their home markets, thereby producing spin-off benefits. Side Bar 10 lists the countries of origin of some of the delegations that have visited Nova Scotia in recent years to study the province's solid waste-resource system.

There are no precise figures for the number of visitors or delegations that have travelled to Nova Scotia to learn about its solid waste-resource management system, nor the amount they have spent in the province. However, HRM maintains a log of visitors to its Otter Lake facility, which

is a key component of the Nova Scotia solid waste-resource system. Since visits to the facility are on the itineraries of most delegations, we have used the visitor list from this log to provide an estimate of the number of outside visitors coming to Nova Scotia to study the province's waste-resource strategy.

Records from Otter Lake indicate that from June 1999 to June 2000, 117 visitors from outside the province signed the facility's logbook.[300] In addition to these visitors, over 100 visitors attend conferences in the province each year on some aspect of solid waste management.[301] Therefore we have estimated the number of visitors brought to Nova Scotia in 2000-01 specifically by the province's leading edge waste management system at a conservative 200. Considering that the names of some foreign delegates may not appear in the Otter Lake visitors' log, the true number is probably considerably higher.

**Side Bar 10. Delegations Visiting Nova Scotia from Outside Canada to Study Solid Waste-Resource Management System**

**Country of Origin**

| | | |
|---|---|---|
| Scotland | Iceland | Trinidad |
| China | Russia | United States |
| Guyana | St. Kitts | India |
| Japan | St. Lucia | South Africa |
| Northern Ireland | St. Vincent | United Kingdom |
| Dominica | Taiwan | Grenada |

An estimate of the per diem spending by each delegate to a convention is $233.98.[302] This figure includes transportation, accommodations, restaurants, retail shopping, and bars. Tourism Nova Scotia estimates the average duration of a business trip to be four days.[303]

**200 visitors × $233.98 per day × 4 days = $187,184**

## 8.10 Tax Disadvantage/Lost Opportunity

Various subsidies and taxes put recycling industries at a financial disadvantage compared to manufacturers making products from virgin materials.[304] This disadvantage results in additional costs to the recycling industry. We explain and estimate these costs, but have not added this "lost opportunity" into our cost-benefit calculation.

[300] Fred Wendt, HRM. Personal communication, November 2001.
[301] Bob Kenney, NSDEL. Personal communication, February 2004.
[302] Destination Halifax 2001. *Business Voice*, January/February 2001, Halifax.
[303] Nova Scotia Department of Tourism and Culture. Personal communication, November 2001.
[304] Heumann, J. 1997. Reaching New Heights. *Waste Age* 28:12, December 1997.

According to Wendt:

> "Recycled materials attract a higher tax rate than virgin materials because of the tax advantages in equipment write-downs, resource allowances, lower sales taxes for equipment and other subsidies for raw material extraction. This results in an additional cost to the recycling industry which, if absent, could be added to the revenue provided for recycled materials."[305]

This difference must be mentioned here, even if it is excluded from the actual cost-benefit analysis, because it represents an imbalance in the system that skews the free market away from recycling and translates into a lost opportunity for the recycling industry.

> "The effective tax rate on the cost of recycled material production costs is about 3 percentage points higher than for virgin material. If recyclers were taxed at a rate which is 3 percentage points lower than at present, their costs of production would decline by about $400 million in Canada each year."[306]

If we extrapolate this estimate to Nova Scotia based on population (the Nova Scotia share of the national population is about 3%), the cost of production to Nova Scotia recyclers would decline by approximately $12 million, thus making them more competitive.[307]

There is no evidence that the three percentage point tax subsidy to the virgin resource extraction industry comes at a net economic cost or gain to Nova Scotia, which is why this lost opportunity and tax disadvantage cannot be included in the cost-benefit analysis. It does, however, provide a net gain to the virgin resource extraction industry (which indirectly encourages manufacturers to use virgin materials), and it provides a net loss to the recycling industry by rendering the former more competitive and the latter less competitive. The virgin resource tax subsidy therefore translates into a lost market opportunity for the recycling industry. If the tax subsidy did not exist, there would be a level playing field and the economics of recycling would be more attractive to business and consumers. It is important here at least to ask the question – how much more material would be recycled if the recycling industry were not indirectly penalized through tax subsidies that promote virgin material extraction?

While this tax subsidy theoretically produces no direct net financial loss or gain to Nova Scotia, it does produce environmental costs, which in turn have long-term economic consequences. For example, products made from virgin material extraction, compared to products made from recycled material, require greater energy inputs and create more GHG emissions. They may also deplete and/or degrade scarce natural resources and produce environmental distress through

[305] Wendt, F. 2001, op. cit., pp. 72-73.

[306] Chen, D., J. Mintz, K. Scharf & S. Traviza 1995. *Taxation of Virgin and Recycled Materials: Analysis and Policy*. Cited in Wendt, F. 2001, op. cit., p. 73.

[307] As there is no statistical evidence available tracking provincial recycling rates, we have not inflated Nova Scotia's share of the $400 million tax disadvantage estimate to reflect a potentially higher rate of recycling. In fact, there is reason to believe that Nova Scotia may have an average recycling rate despite its leading accomplishments in solid waste diversion. Nova Scotia's superior level of solid waste diversion in comparison to the other provinces is attributed largely to its high level of *organics* diversion. Virtually all communities in Canada offer recycling programs. Using HRM as an example, based on the communities reporting according to GAP model (see Chapter 2), 19% of HRM's solid waste was diverted through recycling. This is the same as the GAP average. As stated earlier, however, reporting according to the GAP protocol is voluntary, and therefore the GAP average us probably higher than the overall Canadian average.

disturbing natural areas and wildlife habitat. In addition, increased recycling also reduces environmental stress by removing items from the waste stream and thus reducing the amount of material being disposed of in landfills and/or by incineration. Because these environmental stresses do have economic consequences, the tax disadvantage is described in this study as an economic impact, even though it is not included in the cost-benefit analysis.

Unfortunately, there is a lack of data to calculate the value of this lost opportunity accurately. The lost opportunity may be assessed as the estimated $12 million decline in costs of production to the recycling industry in Nova Scotia, as extrapolated above from the national figures, based on recycling industry taxation rates equivalent to those for subsidized virgin materials. However, we do not include a specific dollar amount in this cost-benefit analysis both because of the difficulty of providing a sound estimate and because it is not possible to prove a net economic gain or loss to the province. Nevertheless, the balance of evidence on potential environmental costs and the value of providing a level playing field for the recycling industry lead us to recommend strongly that the provincial and federal governments remove existing subsidies and tax advantages that promote virgin material extraction.

## 8.11 Summary: The Benefits & Economic Impacts

The benefits and economic impacts of the solid waste-resource management system are summarized in Table 41. The total estimated benefits of the Nova Scotia Solid Waste-Resource Management Strategy in 2000-01 range from $79.2 million to $221.8 million.

**Table 41. Summary of benefits and economic impacts of the Nova Scotia Solid Waste-Resource Management Strategy, 2000-01 ($C2000)**

| | Low estimate | Medium estimate | High estimate |
|---|---|---|---|
| Employment benefits (direct) | $2,830,820 | $3,262,640 | $3,910,370 |
| Employment benefits (indirect) | $3,670,470 | $4,246,230 | $5,085,880 |
| Reduction of greenhouse gas emissions | $3,337,180 | $34,196,000 | $84,343,050 |
| Reduction of air pollutant emissions | $9,532,790 | $42,643,964 | $67,440,991 |
| Extended landfill life | $18,848,267 | $18,848,267 | $18,848,267 |
| Avoided siting costs | $174,732 | $174,732 | $174,732 |
| Avoided compensation | $1,270,780 | $1,588,475 | $1,906,170 |
| Export revenue | $1,100,000 | $1,400,000 | $1,650,000 |
| Tourism | $187,184 | $187,184 | $187,184 |
| Energy savings from recycling | $28,682,283 | $28,682,283 | $28,682,283 |
| RRFB diversion credits | $4,979,465 | $4,979,465 | $4,979,465 |
| RRFB approved programs | $4,374,804 | $4,374,804 | $4,374,804 |
| RRFB investment | $248,824 | $248,824 | $248,824 |
| **Total benefits** | **$79,237,599** | **$144,832,868** | **$221,832,020** |

## 8.12 Conclusion

The operating and amortized capital cost of the solid waste-resource system in 1997 was $53.50 per person. The operating and amortized capital cost of the solid waste-resource system in 2001 was $77 per person, an increase of $23.50 per person. Conventional accounting mechanisms imply that Nova Scotia's more efficient solid waste-resource system came at a costly premium, compared to the 1997 system. Conventional accounting mechanisms, however, misleadingly count only current operating and amortized capital costs and omits a wide range of economic, social and environmental benefits created by a more efficient solid waste-resource system. When a more complete range of costs and benefits is included in the equation, the new system based on composting, recycling, and high rates of waste diversion is found to be more cost effective than the old system, which relied almost entirely on landfill disposal.

Based on a full cost-benefit accounting approach, GPI*Atlantic* estimates that the Nova Scotia Solid Waste-Resource Strategy, represented by the fiscal year 2000-01, produced net savings of $31.2-$167.7 million relative to the operating and amortized capital costs of the pre-Strategy conditions (fiscal year 1996-97) (Table 21). Based on the most conservative assumptions and assessments, this translates into annual savings of roughly $33-$178 for each Nova Scotian, rather than an increase in cost of $24 per capita, as indicated by a conventional comparison of the two systems. It should be noted that the net savings might be even higher if other benefits, e.g., those pertaining to health and environmental protection, were included in the study, and if less conservative assumptions had been employed in the analysis.

# PART IV
# RECOMMENDATIONS & AREAS FOR IMPROVEMENT

# 9. Recommendations & Areas for Improvement

## 9.1 Overall Consumption

Direct correlations can be drawn between levels of consumption and waste generation. Studies by the OECD show that increases in waste generation are tied directly to increases in GDP, which acts as a barometer of consumption:

> "Despite nearly 30 years of environmental and waste policy efforts in OECD countries, the OECD-wide increase in waste generation is in direct proportion to economic growth. A 40% increase in OECD GDP since 1980 has been accompanied by a 40% increase in municipal waste during the same period. Consumer spending also follows these trends. The delinking of effluence from affluence generally remains elusive."[308]

Evidence for this also exists locally. According to Mark Bernard, former Director of Solid Waste Management for HRM, "When you have a strong economy, you get a strong increase in waste."[309] He explains that what goes into consumers' garbage bags is related to packaging , and that the quantity of packaging is tied directly to how much consumers buy.

Nova Scotia's current waste-resource management model has dealt with waste reduction primarily through two methods:

1) *Treating waste as a resource*
   The focus is on reintegrating items that would traditionally end up being landfilled or incinerated back into the economy. For example, recycling reintegrates glass, paper, metal, tires, paint, and several types of plastic wastes back into the economy, with consequent positive environmental and economic benefits. Similarly, composted organics can enhance the physical, chemical and biological properties of soils and thereby improve crop productivity.

2) *Reducing the impacts of waste disposal on the environment*
   Second generation landfill standards and separating organics and toxic materials from the waste stream reduce the environmental stress and damage caused by waste disposal.

Although Nova Scotia has been successful both in diverting waste from final disposal and in improving disposal methods, there has been little emphasis placed on reducing the amount of waste generated. This is a difficult step because it requires challenging current high levels of consumption in order to avoid the need to recycle, compost or dispose of waste. GPI*Atlantic*'s

[308] OECD 2001. *Increasing Resource Efficiency: Waste Minimisation Policy.* Available at www1.oecd.org/env/efficiency/wastemini.htm.
[309] Simpson, J. 2000. Good Times, More Garbage. *Halifax Chronicle Herald*, September 7, 2000, p. A3.

*Nova Scotia Ecological Footprint* documents the direct link between higher levels of consumption and increased impacts on the environment.[310]

In addition, a reduction in waste generation requires greater responsibility and efforts by manufacturers to produce less packaging waste. Despite the success of the National Packaging Protocol, there is ample opportunity for further innovation and much existing packaging is unnecessary. Toothpaste, for example, usually comes in a boxboard box so that it can be more easily stacked on store shelves. This extra packaging provides more space for eye-catching advertising, something many manufacturers may be reluctant to relinquish. However, an innovative design – such as a re-usable, hard plastic, protective container which dispenses individual toothpaste tubes in stores – would cut the need for toothpaste boxes. Similar innovations have been suggested for many other products.

GPI*Atlantic* recommends that more emphasis be placed both on further reducing packaging waste and on reducing consumption as key waste management strategies. This should be done in conjunction with education and awareness initiatives that address the connection between decreased consumption and decreased waste.

GPI*Atlantic* recognizes that changing our consumer-based lifestyles is part of a larger paradigm shift. Such a shift challenges the assumption that increased consumption equates with increased wellbeing. It also challenges the notion that the fundamental foundations of our current economic and social models must be based on continuous and unlimited growth, and it points instead to the more essential non-material roots of wellbeing.

## 9.2 Household Hazardous Waste

While HHW represents a small portion of the waste stream, it poses a serious potential threat both to human health and to the health of our environment. Although some improvements have been made to handle HHW more effectively in Nova Scotia, there is still little tracking of actual quantities of HHW and no tracking of HHW material flows to ensure safe disposal. RRFB Nova Scotia has provided $105,000 in funding for HHW depots and for paint swaps. In addition, RRFB Nova Scotia is working with NSDEL to adapt RRFB's system used for tracking the beverage, tire and paint programs to tracking HHW material flows to safe disposal.[311]

GPI*Atlantic* recommends that all industries producing HHW products sign stewardship agreements either to eliminate toxic materials from their products or to ensure that they are safely and properly disposed. The recent paint industry stewardship program, which allows consumers to take leftover paint for recycling at enviro-depots, is an example of progress in this direction.

[310] Wilson, J., R. Colman & A. Monette 2001. *The Nova Scotia Ecological Footprint.* GPI*Atlantic*, Halifax; and Monette, A., R. Colman & J. Wilson 2004. *The Prince Edward Island Ecological Footprint*. GPI*Atlantic*, Halifax. Available at www.gpiatlantic.org.
[311] M. Catherine McCarthy, RRFB. Personal communication, May 2004.

The Manitoba Conservation Department has taken a proactive step to reduce HHW by releasing for public discussion a draft regulation under the province's Waste Reduction and Prevention Act. If enacted, this regulation would give companies that sell products designated as contributing to the HHW stream three months to develop plans for an alternative waste management program that keeps these wastes out of the environment.[312]

GPI*Atlantic* recommends that the Nova Scotia government examine similar legislation that requires industries to (a) eliminate hazardous content from their products or (b) undertake the responsibility to ensure the safe and proper disposal of their products. The legislation can even stipulate that companies that do not develop an adequate plan will be prevented from selling their products in Nova Scotia, thus providing an incentive and competitive advantage to more environmentally benign products and manufacturers. In the meantime, GPI*Atlantic* encourages the province, in cooperation with the municipalities, to ensure that all Nova Scotians have immediate access to HHW drop-off programs and to inform the public of these programs.

To allow effective monitoring of both the quantity and disposal of HHW, GPI*Atlantic* recommends that NSDEL begin tracking HHW with the intention of developing a production-to-disposal tracking system for toxics. Regular indicators measuring progress along these lines can themselves stimulate appropriate action and they are essential to assess the success and effectiveness of policy interventions.

## 9.3 Product Redesign

We have noted above the necessity for further reductions in packaging waste. In addition, NSDEL acknowledges that one of the biggest obstacles to higher waste diversion rates is the number of products on the market that lack the capacity to be recycled or composted.[313] Pressure needs to be placed on manufacturers and companies to take responsibility for their products and ensure that they can be recycled or composted wherever such reasonable alternatives exist.

The technology exists, for example, to manufacture compostable coffee cups. Irving Oil retails compostable coffee cups in Nova Scotia and the Sydney Olympics demonstrated the utility and cost-effectiveness of compostable cups on a mass scale. Major retailers of coffee, however, have resisted using them, opting instead for plastic-coated disposable cups that cannot be recycled or composted. For example, Tim Hortons, whose coffee cups are not recyclable or compostable in Nova Scotia, accounts for 22% of all litter in the province, and so far the company has not agreed to change its disposable cups.

New product designs should create net improvements for waste reduction and diversion. Unfortunately, however, many new product designs create increased waste and present difficulties for recycling. For example, Nova Scotia dairies recently introduced plastic twist off tops on their two litre milk containers. The new lids cannot be recycled and the new design came with a price increase to consumers.[314]

[312] Manitoba Conservation Department 2002. Available at www.gov.mb.ca/conservation/hhw/index.html.
[313] Barry Friesen, NSDEL. Personal communication, August 2002.
[314] Jeffrey, D. 2002. "Milk cartons with a twist: new tops can't be recycled," *Chronicle-Herald*, May 22, 2002.

GPI*Atlantic* recommends that Nova Scotia introduce regulations to require use of recycled, recyclable or compostable product materials where such alternatives exist. In addition, GPI*Atlantic* recommends that NSDEL work with manufacturers whose products currently lack recyclable or compostable materials to research new product designs and material content. Along with this recommendation, GPI*Atlantic* recommends that the NSDEL consider the costs and benefits of imposing a tax on each non-recyclable cup used in order to provide further incentive for manufacturers to develop recyclable materials.

## 9.4 Standardized Baseline Information, Waste-Resource Definitions & Data Tracking

The Nova Scotia Solid Waste-Resource Management Strategy requires a set of standardized, detailed, comprehensive, and publicly available data in order to assess priorities and allocate resources effectively, to make policy appropriate decisions and, ultimately, to improve the system. In addition, these data will establish a baseline set of comprehensive and consistent information against which to measure progress. While this analysis makes a first attempt to gather baseline data as a means of evaluating the solid waste-resource system, in many cases sufficient and reliable data were not available. In addition, comparisons are currently hampered by lack of consistent definitions.

1) GPI*Atlantic* recommends that NSDEL implement standardized waste-resource definitions and develop comprehensive waste-resource data tracking methods for all regions/municipalities and waste-resource facilities (landfill facilities, recycling and composting facilities, private C&D disposal sites, etc.). Standardized definitions and data tracking methods should be developed with the intent of ensuring compatibility with national standards. Where national standards do not exist, Nova Scotia can encourage and lead a process to develop such standards.

   At the municipal/regional level, GPI*Atlantic* recommends that all Nova Scotia regions/municipalities report residential waste flow and waste diversion data according to the GAP model (see Chapter 2). In Nova Scotia, as noted, only HRM currently reports according to the GAP protocol.

2) GPI*Atlantic* recommends the collection of comprehensive baseline information on all aspects of the solid waste-resource system. Immediate priorities include: HHW, C&D waste, and ICI waste – all of which currently lack such standardized and comprehensive tracking procedures. Additional areas to be addressed include the residential waste sector, apartment building waste, illegal dumping activity, and litter.

In addition, NSDEL needs a comprehensive production-to-disposal tracking system for HHW. GPI*Atlantic* recommends that the data collection process begin with detailed waste audits. These audits can then be used as a basis to prioritize areas for improvement and to identify areas where the greatest diversion potential lies.

An effective audit method is the Service Voids Analysis approach, which is one of the cornerstones of the Del Norte, California zero waste strategy.[315] Service Voids Analysis begins with a discard study, which describes materials collected for recycling, composting or disposal. This approach identifies materials for which there is little or no existing mechanism for waste reduction, recovery or marketing and it correspondingly identifies service opportunities and strategies within the region where these materials could potentially be reduced or recovered. In other words, the Service Voids Analysis is designed to show where opportunities lie for future recovery.

In Nova Scotia, such an analysis would be a valuable tool to help address the 54% of waste that is not currently being diverted. While dramatic progress was made diverting waste between 1989 and 2000 in Nova Scotia, those achievements have now reached a plateau at roughly 46% of the municipal waste stream.

Even in HRM, which has led the province in waste diversion, the rate has been slipping. According to Jim Bauld, HRM Solid Waste-Resource Manager, the residential diversion rate has dropped and the amount of garbage ending up in the Otter Lake landfill has increased. About 47% of waste was diverted in 2003/04 compared to 48% a year earlier. "Maybe complacency has set in," says Bauld.[316] The *Chronicle-Herald* reported:

> "Declining residential recycling and composting efforts mean the municipality's nationally recognized waste-diversion program has reached a plateau, regional councillors were told."[317]

On the more positive side, HRM reported increases in diversion of C&D waste, from 56,000 tonnes in 2002-03 to 74,000 tonnes in 2003-04.[318]

Further improvements that will help Nova Scotia maintain its leadership position in solid waste-resource management require analytical tools capable of identifying the best possible future diversion opportunities. The Service Voids Analysis is one such approach that has proved effective.

## 9.5 Industry Stewardship Agreements

While there has been modest success in the development of industry stewardship agreements, the full potential and development of agreements proposed in the Nova Scotia Solid Waste-Resource Strategy have not been realized.

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[315] Del Norte Solid Waste Management Authority 2000, op. cit. In 2000 Del Norte County became the first region in North America to adopt a zero waste plan to guide its solid waste management practices. See Appendix D of this report for more information on Service Voids Analysis.
[316] Lightstone, M. 2004. "Trash efforts slow down: HRM residents slip on diverting garbage from dump site," *The Chronicle Herald*, May 7, 1004, p. B2.
[317] Idem.
[318] Idem.

Some of the existing stewardship agreements (such as newsprint) result in only modest contributions by industries to managing the full cost of their sectors' materials. The remainder of these costs is borne by citizens through general tax revenues. The requirement of larger contributions from industry would stimulate waste reduction and product redesign.

A number of materials that are more costly to recycle and divert, such as some plastics and mixed material packages, have neither been included in disposal bans nor brought into producer-pay stewardship programs. Some industries have thus received a perverse incentive for the continued use of these materials, which remain virtually impossible to recycle without an industry contribution toward costs. This oversight has encouraged the continued (and even expanded) use of packaging and product materials that will end up in landfills, since the exemptions provide a competitive advantage against companies that pay for product stewardship. Many industries, including the retail dry goods, housewares, toys, home supplies and fast food sectors, are not currently partners to stewardship agreements.

GPI*Atlantic* recommends that NSDEL establish stewardship agreements with industries that are not currently partners to such agreements. Stewardship agreements should reflect the full cost of managing these materials. Needless to say, higher industry contributions to the costs of managing the wastes they produce will be passed on to consumers in the form of higher prices, thereby encouraging more environmentally benign consumption choices and product designs that require less costly waste management. In cases where agreements cannot be reached, NSDEL can use its authority to compel industries by other means (levies, mandatory bans, deposits) to bear the costs of managing the diversion or disposal of their materials.

Far from constituting government interference in industry, such actions actually contribute to the more effective functioning of the market economy, which then reflects the true (or full) cost and price of manufacturing processes and the use of materials. In the end, such actions can reduce the need for government intervention and also reduce taxpayer subsidies for waste disposal and pollution management. Instead, full cost accounting mechanisms and 'polluter pay' principles naturally provide incentives and steer consumer preferences to environmentally benign production processes and avoid taxpayer-funded cleanup efforts.

## 9.6 Construction & Demolition Waste

C&D waste makes up approximately 25-30% of the total municipal waste stream.[319] There have historically been very few provincial-level data on C&D waste diversion and no mechanism to track diversion of material before it reaches C&D disposal sites.[320] However, as noted above, at least within HRM, there has been a significant increase in C&D diversion, a clear result of the municipality's C&D waste diversion strategy and monitoring system. Although the province does have regulations delineating C&D waste disposal methods, there are currently no specific provincial regulations to encourage C&D waste diversion. The lack of tracking and regulations

[319] Bob Kenney, NSDEL. Personal communication, 2002.
[320] This includes material sold at on-site sales and material used as clean landfill by the construction industry in the province, neither of which are currently tracked or monitored.

on C&D diversion means that RRFB diversion credit funding for private facilities cannot be correctly and accurately distributed.

In fact, in the absence of diversion credit funding for privately recycled C&D materials, there is a disincentive for facility operators to re-use and recycle C&D material, since such diversion requires more capital and labour, which can in turn reduce profitability.[321] Conversely, diversion credit funding for private facilities that accounts for C&D materials could create incentives to operators that would level the playing field and encourage greater re-use and recycling of C&D materials.

GPI*Atlantic* recommends that the province work with the municipalities to develop a comprehensive C&D waste strategy based on the recommendations from the C&D Management Committee Presentation to the Nova Scotia Waste-Resource Advisory Council. The recommendations are summarized as follows:

1. Public education and awareness for builders, home renovators and developers. (HRM now has a pamphlet on this subject on its web site, but a much more detailed guide is needed.)
2. Work with the development community.
3. Leadership by example (review of HRM construction practices and improvement).
4. Tracking and accounting of C&D wastes.
5. Establishment of construction, demolition, and renovation waste guidelines.
6. Amend municipal planning strategies and land use by-laws to provide clarification and consistency with construction, demolition, and renovation facilities.
7. Recognition and registration of existing facilities.
8. Classification and regulation of disposal facilities according to types of materials that may be processed.

GPI*Atlantic* also recommends that the province find ways to encourage more voluntary reduction, re-use and recycling in the construction industry. As mentioned earlier, an Ontario study found that reduction in use is the most profitable means of reducing C&D wastes.[322] A study conducted in the U.S. by the National Home Builders Research Center and the USEPA found that efficient framing techniques can reduce the price paid for framing materials by about $1.50 per square foot while the wood-waste generation is subsequently reduced by 65%.[323]

Examples of cost savings from using recycled building materials are also abundant. These include the Whole Foods Company of Texas which saved $32,000 in renovation costs by re-using construction materials, and the City of San Diego which saved $92,000 and diverted 51% of materials from landfills.[324] In Montana, Steve Loken's Building Company and the Center for

[321] Jim Bauld, HRM. Personal communication, November 2002.
[322] Paul, T.J. et al. 1997, op. cit.
[323] Yost, P. 1998. Residential Construction Waste Management. *Southface Journal of Sustainable Building,* Volume 1. Available at www.southface.org.
[324] USEPA 2000. *Building Savings. Strategies for Waste Reduction and Demolition Debris from Buildings.* Available at www.epa.gov/osw.

Resourceful Building Technology provide home builders with actual examples of homes built using recycled materials and using fewer materials than traditional building designs.[325]

In Nova Scotia, the clients for the new Chiefs' and Petty Officers' Mess at CFB Stadacona in Halifax requested a high level of diversion of C&D waste from the project. PCL Constructors Canada Inc. (general contractor) and Solterre Design (sustainability consultant) developed a waste management work plan that encouraged as much of the waste as possible to be diverted from landfill disposal.[326]

The demolition first required that hazardous materials such as asbestos and PCB fluorescent light ballasts be removed. The first phase of demolition had one company salvage materials of higher value for re-use or resale; the second phase had another company salvage materials of lower value for resale while demolishing the remaining structures and recycling the C&D debris generated, whenever and wherever possible.

The types of C&D waste materials, the quantity generated and rates of re-use, recycling and disposal from this demolition project are summarized in Table 42. Although Table 42 shows that nearly 98% of the materials were recycled, in fact, not all of these materials could be recycled at the HRM facilities. According to Goodick, nearly 95% of the materials from this demolition were actually recycled.[327] Although this is a very positive example, it should be noted that the type of materials involved may make this an exception, since 94% of the total material weight from this project was concrete rather than traditional stick frame buildings. Nevertheless, local success stories such as this should be promoted as examples of environmentally sound management of C&D wastes.

GPI*Atlantic* recommends the introduction of legislation that requires and supports the maximization of diversion and minimization of disposal of C&D materials. This should be accompanied by a full cost accounting study that reviews which C&D materials can most profitably and cost-effectively be diverted and which diversion methods are most suitable. For example, should wood scraps be disposed of or diverted for mulch, combustion and cover at landfills? The province should follow the lead of HRM in developing and adopting both a strategy and legislation to enforce that strategy. In addition, education campaigns aimed at the construction industry could be highly effective, especially if they provide manuals that demonstrate methods of managing C&D wastes, methods of reducing the use of new materials, and the cost savings that can result from such practices.

[325] Shulman, S. 1996. Houses to Save the Earth. *Parade Magazine*, March 3, 1996. Available at www.lokenbuilders.com.
[326] Keith Robertson, Solterre Design. Personal communication, 2004.
[327] Marcus Goodick, HRM. Personal communication, May 18, 2004.

**Table 42. Materials salvaged from a Halifax demolition site**

| Material | Tonnes | % re-used | % recycled | % landfilled |
|---|---|---|---|---|
| Wood | 27.7 | 50 | 50 | 0 |
| Aggregate[(a)] | 4856.5 | 1 | 99 | 0 |
| Metal | 74.2 | 8 | 92 | 0 |
| Roofing | 27.3 | 0 | 100 | 0 |
| Insulation | 0.3 | 67 | 33 | 0 |
| Carpet | 10.9 | 0 | 0 | 100 |
| Glass | 1.1 | 100 | 0 | 0 |
| Mixed[(b)] | 137.7 | 0 | 100 | 0 |
| Landscaping | 13.1 | 100 | 0 | 0 |
| Other[(c)] | 9.1 | 100 | 0 | 0 |
| **Total** | **5,157.8** | **1.9** | **97.9** | **0.2** |

Notes: (a) These quantities include asphalt, concrete, masonry, and the volume of aggregate that is used as clean fill both on and off site.

(b) Mixed material could include any of the materials listed.

(c) "Other" includes cabinets, electrical and plumbing fixtures, doors, windows, countertops, hardware, cast iron radiators, wood moulding, mantels, and stairway components.

## 9.7 Source Separation in Apartments

Although standards vary slightly by municipality, apartment buildings in Nova Scotia are generally responsible for removal of their own waste, recyclables and organics. Landlords are required to provide proper receptacles for tenants' recycling and composting. It is the responsibility of tenants, however, to use these receptacles properly. Currently there is no monitoring or tracking system to verify levels of source separation in apartment buildings, but it is generally accepted that the level of source separation in apartment buildings is much lower than for single-family dwellings. HRM and the Clean Nova Scotia have undertaken to monitor multi-family dwellings for source separation. The project is ongoing, and the percentage of apartment buildings participating is difficult to determine. Goodick estimates that 60-70% of apartment units have recycling, and 50% have access to organics separation.[328] He emphasized that apartment buildings present a greater challenge in education about waste diversion and source separation because of the more transient population in rental units. Although there are by-laws requiring the participation of apartment buildings, enforcement has been minimal.[329] HRM has begun working with apartment building owners and tenants, to increase recycling and composting rates, starting with buildings with 100 or more units.

GPI*Atlantic* recommends that the province, in conjunction with municipalities, introduce an education and awareness program that informs apartment owners and dwellers about their responsibilities to separate and sort recyclables and organics properly. In particular, GPI*Atlantic*

[328] Marcus Goodick, HRM. Personal communication, February 2004.
[329] Robert Orr, HRM. Personal communication, February 2004.

recommends an apartment building waste audit and participation rate study so that accurate data are available as the basis for any intervention, education campaign, and measurement of progress on this front. As well, GPI*Atlantic* supports efforts to ensure that by-laws are enforced.

## 9.8 Subsidies/Incentives/Penalties

GPI*Atlantic* strongly recommends that the provincial and federal governments remove subsidies that promote virgin material extraction. In addition, GPI*Atlantic* recommends that NSDEL study incentive options, including tax rebates, to promote the re-use, recycling and composting sectors, and to ensure their competitiveness. At the very least, these measures should create a level economic playing field, so that those sectors do not suffer from the tax disadvantages and economic disincentives that currently favour virgin material extraction and hence production using virgin materials. NSDEL should also explore penalties to discourage permanent disposal.

From a full cost accounting perspective, re-use, recycling and composting produce additional social, economic and environmental benefits that remain invisible in conventional accounting measures. Government is therefore justified in doing more for waste management sectors than simply levelling the economic playing field. It is reasonable to provide those sectors with a tax advantage over virgin material extraction to the degree that re-use, recycling, and composting provide a net economic benefit to the province and save the taxpayers money. This study indicates that there is a minimum $33 (and possibly $178) per capita net economic gain realized through re-use, recycling, and composting by comparison with disposal. That specific dollar value, and full cost accounting procedures in general, provide practical and concrete guidance to government concerning the appropriate level of tax advantage that can be offered to environmentally benign industries.

Research on appropriate financial subsidies, incentives and penalties should also include a review of user-pay systems and extension of the beverage container deposit program to include other containers. Financial incentives and penalties could also be tailored to specific sectors of the solid waste-resource system that currently are not meeting waste diversion targets. (See Appendix E for further information on the User Pay Model.) These studies should incorporate full cost-benefit analyses of the potential impact of suggested subsidies, incentives and penalties to ensure that a full range of social, economic and environmental costs and benefits are considered in the equation.

## 9.9 Government Responsibility & Leadership by Example

GPI*Atlantic* recommends that the Nova Scotia government establish a policy to ensure that all government agencies promote re-use, recycling and composting and mandate the purchase of recycled products when available. This policy should be accompanied by an education and awareness program and can be designed to lead by example.

## 9.10 Citizen & Corporate Responsibility

As the provincial diversion rate continues to fall below 50% in every year since 2000, as the most recent figures indicate, the need to encourage greater citizen participation becomes apparent. The participation rate in HRM is estimated at 79% for 2000[330] but also continues to fall, as the most recent 2003-04 statistics indicate.[331] What is not known as accurately is the rate of participation in other parts of the province, or what percentage of participating households *properl*y separate and sort their waste. Do participating households separate organics and all recyclable materials, or only a portion of the items that can be removed from the waste stream? These questions could be answered through detailed waste audits and the Service Voids Analysis process. (See Recommendation 4: Standardized Baseline Information, Waste-Resource Definitions, and Data Tracking.)

Civic responsibility is clearly a critical factor in promoting higher levels of diversion. GPI*Atlantic* therefore recommends an extension of the existing education and awareness campaign to increase the level of civic responsibility and citizenship.

The biggest incentives for the ICI sector to participate in waste diversion have been the bans of recyclable and compostable materials from landfill sites, and the high costs of collecting and transporting wastes.[332] Whereas in 1998 there were no tipping fees for landfills, today there are tipping fees. The costs of disposal are now considerably higher than the costs of diversion. A decrease in cardboard disposal has been the largest component of ICI diversion to date.

Corporate responsibility has increased but still falls far short of its potential. It is in this area that the most progress can be made in increasing diversion rates.[333] Because much commercial recycling is handled by private companies, it is difficult to know the true rate of diversion for the ICI sector. HRM started with organics by working with the restaurant, grocery, and newspaper industries to increase rates of composting and by banning organics from landfills. In 1999, warnings were issued to corporations, and cancellation of disposal services was threatened. This resulted in a five-fold increase in materials received at composting facilities. Currently, 14,000 tonnes of commercial organics are being received annually,[334] but this number has not increased over the past few years.

Waste characterization studies, which have been conducted at the Otter Lake facility during the last year, indicate the types of materials being received for landfill disposal, for which a diversion or recycling program actually exists. These studies show that food waste and paper products (e.g., newspaper, corrugated cardboard, and fine paper) are the largest sources of divertible materials that are still wrongly sent for disposal by the ICI sector. New efforts are required to divert further amounts of organic commercial waste.

[330] Wendt, F. 2001, op. cit., p. 58.
[331] Lightstone, M. 2004. "Trash efforts slow down: HRM residents slip on diverting garbage from dump site." *The Chronicle Herald*, May 7, 2004, p. B2.
[332] Bob Kenney, NSDEL. Personal communication, February 2004.
[333] Robert Orr, HRM. Personal communication, 2004.
[334] Jim Bauld, HRM. Personal communication, February 2004.

Robert Orr of HRM says that working with the ICI sector involves a four-pronged approach: education; demonstration of a financial benefit; regulations and laws; and work with haulers.[335] Orr thinks the current practices in the packaging industry are a big obstacle because there is no consistency about what type of plastic can be used to package particular products. The type of plastic used for containers varies so much that recyclers cannot achieve consistent material streams. This problem requires the federal government to go further with the National Packaging Protocol and to extend its provisions, but the province could also bring greater pressure to bear on industry by legislating guidelines governing packaging consistency.

GPI*Atlantic* recommends that Nova Scotia kick-start its education campaign for both the public and private sectors by letting people know that Nova Scotia is falling behind its earlier achievements; that the 50% diversion rate has slipped; and that we need renewed and concerted efforts on the part of all residents and businesses to increase the diversion rate.

## 9.11 A Nova Scotia Zero Waste Council

GPI*Atlantic* recommends the establishment of a Nova Scotia Zero Waste Council. It is suggested that this group be a citizen led, not-for-profit, non-political stakeholders' group that will audit and review current waste management practices with the mandate to promote and encourage waste minimization, waste diversion and eventually waste elimination. The overall goal of the council should be to provide direction to municipalities and the province to move toward a zero waste society.[336] The larger context for the group's activities, written into its terms of reference, should be the basic questions: "How do we maintain a healthy economy while reducing consumption and waste generation to sustainable levels?" and "How can we re-integrate all waste resources back into the economy in order to eliminate the need for final waste disposal?" GPI*Atlantic* recommends that this Council be established through legislative action and receive core funding from the province.

This Zero Waste Council should hold public information and consultation meetings to ensure regular dialogue with the public and to promote the free exchange of ideas and information. These dialogues would build on public experience to improve current waste-resource practices and would strengthen cooperation and working relationships between government and citizen groups. There are several existing groups that can be used as models to help develop this new organization, three of which are described below.

**The Zero Waste New Zealand Trust**[337] is a non-profit organization dedicated to waste minimization that could be used as a prototype for a Nova Scotia Zero Waste Council. The long-term objective of the Zero Waste New Zealand Trust is to achieve a national goal of zero waste.

[335] Robert Orr, HRM. Personal communication, 2004.
[336] This recommendation is based on a similar recommendation put forward in the Citizen Stakeholder Committee document *An Integrated Waste Resource Strategy*, which proposed the formation of a citizen-led, independent stakeholders' Audit Review Group.
[337] For more information about the Zero Waste New Zealand Trust, visit the organization's web site at www.zerowaste.co.nz/ or contact Lucy White at lucy@zerowaste.co.nz.

Under the umbrella of the Zero Waste New Zealand Trust, the Zero Waste Community Enterprise Network has been established to provide a common voice and communication tool for community groups involved in waste minimization and recycling in New Zealand. The Network advises and consults with the New Zealand Ministry for the Environment and other government agencies on waste reduction and related issues.

Based in Portland, Oregon, the **Zero Waste Alliance**,[338] a program of the International Sustainable Development Foundation, is a non-profit partnership between universities, government, business, and other organizations, most of which are in the north-western U.S., working to develop and promote zero waste strategies. The objective of the Alliance is to improve the profitability, competitiveness, and environmental performance of the re-use, recycling, and composting sectors through the development and implementation of practices that lead to the reduction and elimination of waste and toxics.

**The Recycling Council of Alberta**[339] is a non-profit, charitable organization whose mission is to promote and facilitate waste reduction, recycling, and resource conservation in the Province of Alberta. The Council acts as an interface for information and dialogue among industries, municipal and provincial governments, environmental groups, and consumers. The organization also plays a role in education and conducts research to advise the Alberta government on waste minimization policies.

## 9.12 Future Research on Best Practices

GPI*Atlantic* recommends that NSDEL fund an independent analysis of successful waste-resource initiatives and best case waste-resource practices throughout the world as a basis to continue improving Nova Scotia's solid waste resource system. This will help ensure that Nova Scotia remains a leader in solid waste resource management.

[338] More information about the Zero Waste Alliance can be obtained at www.zerowaste.org/about.htm or by phone at (503) 279-9383.
[339] More information about the Recycling Council of Alberta can be obtained at www.recycle.ab.ca or by phone at (403) 843-6563.

# Appendix A – Assessing Environmental Improvements Resulting from Changes in Waste Management Practices in Nova Scotia from 1990-2000

**By Marcus Goodick, 2002**

## Executive Summary

In 1989 Nova Scotia adopted the Canadian Council of Ministers of the Environment target of 50% diversion of waste from landfill by the year 2000. This set in motion a transformation from an uncontrolled "burn or bury" waste disposal system to a provincially regulated integrated solid waste-resource management system that recognized the value of waste as a resource. The Solid Waste Resource Management (SWRM) Strategy adopted by Nova Scotia in 1995, required municipalities to implement a comprehensive waste management program involving recycling, composting and landfilling. In addition, stricter environmental controls were required for disposal options such as landfilling and incineration. In 2000, Nova Scotia became the first and only province to date to meet the 50% diversion of waste goal.

Nova Scotia's waste management practices changed markedly between 1989 and 2001. One example of this is shown in Table 43 which highlights the waste flow quantities for 1989 and 2001. However, questions are often asked about how the changes resulting from the province's SWRM strategy and the province's high level of waste diversion have affected environmental parameters such as energy consumption, greenhouse gas emissions and other emissions to land, air and water. In other words, has adopting the strategy and implementing environmental regulations in the province reduced the environmental burdens associated with the management of the solid waste stream in Nova Scotia?

**Table 43. Residential waste flow quantities (tonnes)**

| Waste Flow (tonnes) | 1989 | 2001 |
|---|---|---|
| Recycling | 3,000 | 51,000 |
| Composting | 0 | 53,000 |
| Land application | 3,000 | 2,000 |
| Energy from waste | 56,000 | 22,000 |
| Landfill | 203,000 | 137,000 |

This study compared the waste management system in place in calendar year 1989, before significant changes were made, to the waste management system in operation in fiscal year 2001, after Nova Scotia met its 50% diversion target. The comparison reflects the differences in environmental performance of the "before" and "after" infrastructure and material handling practices based on 2001 waste quantities and composition. The study boundaries included all

residential material picked up from the curb through municipal collection, residential material delivered to transfer stations and landfills by residents and recyclables delivered to provincial enviro-depots by residents.

The "before" and "after" scenarios were modeled using the Environment and Plastics Industry Council and Corporations Supporting Recycling (EPIC/CSR) Integrated Solid Waste Management (ISWM) tool. Results of the modeling exercise showed the life cycle burdens of select environmental parameters, in relation to specific waste management practices. Life cycle analysis attempts to encompass all the relevant associated impacts including the upstream and downstream impacts of a particular undertaking from raw-materials acquisition to final disposal.

The results of the modeling exercise showed that the environmental burdens of Nova Scotia's new solid waste-resource management system have decreased for each of the parameters measured. These improvements in environmental performance will be realized not only in Nova Scotia but also beyond the boundaries of the province. The actions which the EPIC/CSR ISWM model showed to be responsible for the greatest reductions in environmental burdens were:

- increased collection of recyclable materials;
- a ban on open burning of wastes and reduced emissions from the Sydney incinerator;
- improved leachate collection efficiency at landfills;
- increased composting of organic materials;

A literature review indicated that other waste-resource management activities, which were outside the scope of the modeling exercise, also decreased the province's environmental burdens. These activities included the encouragement and promotion of backyard composting, the establishment of household hazardous waste depots and the implementation of stewardship programs for paint, oil, antifreeze, car batteries and tires.

The EPIC/CSR ISWM tool was designed "to give municipalities a broad indication of the environmental effects of waste management decisions," not to determine absolute quantities of specific emissions. Therefore, while some issues with the model were identified, particularly with regard to greenhouse gas emissions, qualitative judgements regarding which changes affected environmental burdens could still be made from the results as intended.

The study resulted in a number of recommendations pertaining to both the Nova Scotia Solid Waste-Resource Management System and the EPIC/CSR Integrated Solid Waste Management Tool. While many of the recommendations for the province are not new, the study provided more evidence that good progress is being made at lowering environmental burdens and that more can be achieved. Further study needs to be done to try to quantify the reductions in greenhouse gas burdens for Nova Scotia's Waste-Resource Management System based on internationally accepted protocols. Model results do show, however, that reductions achieved so far would help the province meet its Kyoto target.

As Nova Scotia continues to move forward with the implementation of its provincial Waste-Resource Management Strategy, further reductions in environmental emission burdens should result. Modeling indicates that continuing to increase leachate collection efficiency through the

implementation of second generation landfills can decrease discharges to water. Increased composting, which has already occurred since 2001, should lower the emissions of greenhouse gases further. In addition, an improvement in recycling recovery rates would also help to lower the environmental emission burdens.

Unfortunately there are no guarantees. Nova Scotia has had a problem developing markets for some recycled materials. Unless the materials are actually recycled, then the reduction in environmental burdens will not be realized. Therefore, it is important to remember that managing waste once it reaches the curb is not the final step.

**Table 44. A comparison of the 1989 and 2001 net life cycle environmental burdens**

| | 1989 "Before" Case | 2001 "After" Case | Change in Burden | Net Change | Annual Burden Equivalents |
|---|---|---|---|---|---|
| Energy Consumed (GJ) | 65,549 | -928,451 | ↓ | 994,000 | Electricity for 22,900 homes |
| Greenhouse Gases | | | | | |
| $CO_2$ (t) | 98,231 | 16,956 | | | |
| $CH_4$ (t) | 15,367 | 11,593 | | | |
| $CO_2$ Equivalents (t) | 420,947 | 260,414 | ↓ | 160,533 | Emissions from 42,800 cars |
| Acid Gases | | | | | |
| $NO_x$ (t) | 3800.6 | -48.30 | ↓ | 3,848.9 | Emissions from 179,000 cars |
| $SO_x$ (t) | 1032.56 | -182.15 | ↓ | 1,214.7 | Electricity for 153,800 homes |
| HCl (t) | 530.54 | -135.53 | ↓ | 666.1 | Electricity for 1,549,000 homes |
| Smog Precursors | | | | | |
| $NO_x$ (t) | 3800.6 | -48.30 | ↓ | 3,848.9 | Emissions from 179,000 cars |
| PM (t) | 372.5 | -74.7 | ↓ | 447.2 | Electricity for 97,200 homes |
| VOCs (t) | 1279.0 | -16.19 | ↓ | 1,295.2 | Emissions from 40,500 cars |
| Heavy Metals & Organics | | | | | |
| Air - Pb (kg) | 2590.9 | -4.53 | ↓ | 2,595.43 | Electricity for 6,488,600 homes |
| - Hg (kg) | 986.0 | 0.94 | ↓ | 985.11 | Electricity for 16,418,600 homes |
| - Cd (kg) | 256.77 | 0.29 | ↓ | 256.48 | Electricity for 12,823,800 homes |
| - PCDD/F (TEQ) g | 179.54 | 0.02 | ↓ | 179.52 | |
| Water - Pb (kg) | 54.05 | 45.27 | ↓ | 8.8 | Electricity for 800 homes |
| - Hg (kg) | 0.6563 | 0.416 | ↓ | 0.240 | Electricity for 92,400 homes |
| - Cd (kg) | 63.79 | 33.08 | ↓ | 30.70 | Electricity for 341,200 homes |
| - BOD (kg) | 778,808 | 381,511 | ↓ | 397,297 | Sewage from 14,500 homes |
| - PCDD/F (TEQ) g | 8.25E-03 | 3.9E-03 | ↓ | 0.004366 | |
| Total Residual Waste (t) | 215,421 | 150,256 | ↓ | 65165 | |

# Appendix B – The National Packaging Protocol[340]

The National Packaging Protocol was developed by the CCME to reduce packaging waste by 50% from 1989 levels by the year 2000. The protocol was a voluntary process with the intention of giving industry the flexibility to determine how best to reach waste reduction targets.

It resulted in the elimination or reduction of some packaging, the expansion or introduction of re-useable packaging or packaging systems and the expansion of recycling infrastructure.

Canada achieved the 50% reduction target in 1996, four years ahead of schedule (Table 45). Canada achieved a 56% per capita reduction in disposal of packaging despite an 11% increase in national population since the inception of the program.

**Table 45. Packaging reduction targets vs. actual targets**

| Year | Goal | Actual reduction |
|---|---|---|
| 1992 | 20% | 21% |
| 1996 | 35% | 56% |
| 2000 | 50% | Unknown –Task Force dissolved |

The greatest contributions made by the National Packaging Protocol were the introduction of reusable packaging or packaging systems, and the expansion of recycling infrastructures. In 1996, 47% of all packaging materials were being re-used, and between 1988 and 1996 the recycling rate of packaging material increased by 273%.

Despite achieving its stated targets four years ahead of schedule, the Protocol has been criticized on several grounds. First, the Protocol was unable to create a harmonized approach to packaging policy throughout Canada. Second, very little progress was made in reducing household consumer packaging. And third, waste diversion from packaging (in shipping, manufacturing, and distribution) was measured by *weight* and, therefore, major gains in the reduction of heavy packaging – such as wooden pallets – misrepresented overall package waste reduction in volume terms.

[340] Based on highlights from the CCME National Task Force on Packaging Final Report 2000. Available at www.ccme.ca.

# Appendix C – Only In Our Backyard: Annapolis Royal and Zero Waste 2005[341]

## Background

In 1996, as part of the Nova Scotia Department of the Environment's strategy to create seven waste regions in the province, Annapolis County and Kings County were joined to form Region Five, the Valley Waste Region. The eight municipalities that comprise the two counties participated in a process to develop a waste management plan for the new region and part of the plan called for the creation of a regional waste authority. In the meantime, an attempt to site a "second generation" landfill in Annapolis County to serve the new region was thwarted by local activists who would later form the Annapolis County Environmental Protection Association (ACEPA).

Late in 1997, after carefully studying the waste management plan for the region, Annapolis Royal opted not to join the newly formed Valley Waste Resource Management Authority and chose instead to develop, with the help of ACEPA, its own locally managed waste management strategy. In 1998, Annapolis Royal and ACEPA entered into a partnership for the design and implementation of its own initiative.

## Annapolis Royal: Vital Statistics

Around 600 individuals reside in Annapolis Royal, in approximately 350 households. There are a dozen restaurants, half of them seasonal; two schools: the Annapolis Royal Regional Academy, with 227 students in Grades 6-8 and Annapolis West Education Centre, with 391 students in grades 9-12; two grocery stores; two hardware stores; a dozen or so retail stores; two doctors' offices; a Health Centre; one Legion; a theatre; one auto repair garage; a community arts centre; a library; a number of professional offices; four churches; the county municipal building; a post office; the town hall; a court house; a fire hall; a Liquor Commission store; a motel and numerous inns and bed & breakfasts; a public garden; and, on Saturday mornings from May to October, a popular outdoor Farmers' and Traders' Market.

## Zero Waste 2005

In February of 1998, the council of the Town of Annapolis Royal set a goal of zero waste by the year 2005 and adopted the name "Zero Waste 2005." The idea behind Zero Waste 2005 was to develop a waste management system that would be as low-tech, low-cost and locally managed as possible, while maximizing diversion from the landfill. The long-term goal of Zero Waste 2005 was to have such waste reduction programs in place and such an array of consumer options available that would allow residents, businesses and visitors to conduct their lives and businesses

[341] This paper is by Mark Dittrick, Chair, Atlantic Canada Chapter of Sierra Club of Canada and former chair of the Annapolis County Environmental Protection Association. The Annapolis Royal example is included here to demonstrate one option that can be explored as an innovative, local way to deal with solid waste.

without creating residual waste and to do so with a minimal amount of effort. Annapolis Royal is the oldest permanent European settlement in Canada and the goal of 2005 coincides with its 400th anniversary.

The Annapolis Royal system may be the best model for other small Nova Scotia communities – particularly more rural communities – as an alternative to participating in larger centralized schemes. Some of the components of the Annapolis Royal system might also be applied within larger systems to reduce costs to taxpayers and municipalities and to yield more local and environmental benefits.

**"Only In My Backyard"**

Organic waste constitutes roughly 30% of the municipal waste stream. The centerpiece of the Annapolis Royal strategy is its unique method of dealing with organic waste. This initiative, called "Only in Our Backyard," provides equipment and facilities for the composting of all organic waste, both commercial and residential, within town limits. No other town in Canada currently has such a system or can claim to successfully contend with all its organic waste so locally. In contrast, the other municipalities within the Valley Waste Region jointly collect organic waste at the curbside and transport it to a large centralized facility for composting. Curbside collection of organic waste and the trucking involved are not part of the Annapolis Royal strategy.

"Only In My Backyard" involves three levels of composting: (1) backyard residential composting; (2) neighbourhood composting; and (3) Earth Tub composting.

***Residential on-site (backyard) composting***. A majority of households now are able, using food waste digesters (Green Cones) along with traditional backyard composting units, to deal with all food and yard/garden wastes on site. By the end of 2001, approximately 140 Green Cones were in use. A site adjacent to the town's public works yard is available to residents for depositing sorted leaves, grass, brush and other so-called yard waste. Such materials are not collected curbside and composting on site is encouraged.

It should be noted that even properly maintained Green Cones may still experience problems with capacity. A Green Cone's ability to reduce the volume of organics though digestion is only so fast. If more material is added than the unit can handle, it will fill up. The simple solution is a second Green Cone. When one cone is fairly full, it is taken out of use and only the second cone is filled, giving the first cone time to "digest" its contents.

***Neighborhood composting***. Low-tech and locally constructed wood and metal mesh-lined multi-household composting units are located conveniently throughout town as a backyard composting alternative and for backyard overflow. Neighbourhood composters have three compartments. New organic material is introduced into only the first compartment. The third compartment contains finished compost. When the finished compost is removed from the third compartment, composting material from the middle compartment is moved to it and the relatively new material in the first compartment is moved into the middle. This work is done by the public works staff. Compost removed from neighborhood composters goes into Earth Tubs as bulking agent and as

starter and also as an extra safeguard to ensure total pathogen kill in accordance with Nova Scotia provincial guidelines. By the middle of 2002, five neighbourhood composters were in place.

***Earth Tub composting***. An Earth Tub is a rugged insulated tub with a capacity of 3.5 cubic yards that is able to rapidly compost larger quantities of organics generated by restaurants, grocery stores and institutions. The tub is equipped with a maneuverable motorized auger for easy turning of the organic contents. Earth Tubs are operated by the town's public works staff and organic wastes are delivered to the Earth Tub facility, which is located within the public works yard, by those using it. The town currently operates three Earth Tubs, which handle all of the town's commercial organic wastes. Annapolis Royal was the first municipality in Canada to put Earth Tubs to use.

"Only In My Backyard" minimizes waste management costs because organic waste is not trucked to distant composting facilities. Additionally, the negative environmental impact of trucking, from associated production of greenhouse gases and pollution, is avoided.

**Other Zero Waste 2005 Initiatives**

By the summer of 2002, six four-stream separation stations were in place along downtown streets for collecting recyclable paper, beverage containers, separated organics and residual waste generated by visitors and residents.

**Residuals Management and Flow Control**

Annapolis Royal still ships residuals to a landfill. The budget for Annapolis Royal's waste management program for the year 2001-02 is in the vicinity of $26,000. This figure includes all hauling, tip fees, recycling contract, and all organics expenses. Early in 2001, Annapolis Royal's contract with the Queens County landfill came up for renewal. When the town attempted to initiate negotiations, Queens County informed Annapolis Royal that it would prefer that Annapolis Royal send its residual waste through the Valley Waste Resource Management Authority (VWRMA)'s transfer station in Lawrencetown, so that it would only receive residuals from the authority. This would have meant opting into the authority's waste-management system – which includes waste and organics pickup.

In renegotiating its own much larger residuals contract with the Queens County landfill, the Valley Waste Resource Management Authority demanded that the Queens landfill accept residual waste from within Region Five only from the authority. This feature of the renewed VWRMA-Queens contract, a practice referred to as "flow control," effectively barred Annapolis Royal from using the Queens County facility. Consequently, Annapolis Royal now sends its residual waste at greater cost and over a greater distance to a landfill in the district of Clare.

Residual waste is collected every other week by the town's public works staff and placed in a container. A local hauler then transports the container to the Clare landfill.

By 2005, all landfills in Nova Scotia are required to measure up to second generation standards. Clare plans no upgrade and the Western Region is considering trucking all of its residuals to the upgraded Queens landfill. If the Queens County landfill refuses to deal with Annapolis Royal directly, the town may be forced to send its residuals through VWRMA.

**Recyclables**

Blue-bagged commingled recyclables are collected curbside by the public works staff, also bi-weekly. A local recycler is contracted to take all recyclables, which he then markets independently. Recyclables include: all plastics except #6 and #7; boxboard; corrugated cardboard; milk cartons; bond paper; newspaper; glass bottles; steel and aluminium cans; clean foil; paint cans; and empty aerosol cans.

**Recognition**

In 1998, Annapolis Royal's Zero Waste 2005 plan was placed on the United Nations' prestigious list of *100 Global Best Practices for Human Settlements*.[342]

In 2001, Annapolis Royal was designated a Sustainable Community by the Federation of Canadian Municipalities (FCM) and received its FCM-CH2M Hill Sustainable Community Award to "recognize and celebrate the leadership of Annapolis Royal for its Zero Waste 2005 initiative. CH2M Hill, of Greenwood Village, Colorado, is a global project delivery firm that teamed up with FCM to provide this award.

**The Partnership Ends**

The cooperative management of Zero Waste 2005 ended in the spring of 2001 when citizen volunteers, mostly members of ACEPA, withdrew their services in protest over the Annapolis Royal Council's decision to accept funding for the program from Shell Canada's Shell Environmental Fund. Deputy mayor Trish Fry and councillor Wayne Morgan now manage the Annapolis Royal program. The town has not replaced the resigned volunteers and the program has suffered as a result. Monitoring and assisting backyard composting and education are areas of notable decline and no new initiatives aimed at achieving the 2005 goal of zero waste are in any stage of development or implementation. When the ACEPA volunteers left the Zero Waste 2005 program, many initiatives in the planning stage went with them. These initiatives represented the "next steps" on the road to zero waste and mainly involved providing the consumer options needed to reach the previously stated goal "to have such waste reduction programs in place and such an array of consumer options available that would allow residents, businesses and visitors to conduct their lives and businesses without creating residual waste and to do so with a minimal amount of effort." Consequently, little progress has been made in reducing waste in Annapolis Royal since early 2001 and reaching the 2005 goal is now very doubtful.

[342] Maich, S. 1998. "Waste busters mean business: UN award boosts resolve to nix trash in Valley town," *The Chronicle-Herald*, Halifax, September 1, 1998.

**Costs: Participating in the Regional Authority vs. "Going it alone"**

Measured against what it would have cost Annapolis Royal to participate in the programs of the VWRMA, the town has realized significant savings by opting to manage its waste on its own. For example, Annapolis Royal's waste management program budget for the year 2001-02 is roughly $26,000. By comparison, it would have cost the town approximately $45,000 for its share of the regional authority's budget had it been a member. Based on what it cost Hantsport to join the VWRMA in 2001, it can be calculated that it would cost Annapolis Royal up to $85,000 in initial capital costs to join the Waste Authority.[343]

Population and uniform property assessments are used to determine a VWRMA member's share of operating and capital costs. Annapolis Royal's percentage share would therefore be 0.86%, based on costs charged to Hantsport when it joined the authority in 2001.

Annapolis Royal's $26,000 annual waste management budget includes capital costs. These capital costs are not amortized. But a fairer comparison would be to amortize the cost. For example, if a capital cost such as an Earth Tub (at approximately $10,000 each for three tubs) were amortized over 10 years, it would bring down the yearly costs considerably.

Earth Tubs cost US$5,600 to US$6,500, or C$10,000 to C$12,000. A 10-year amortization of the cost of each Earth Tub would be appropriate. Although Annapolis Royal paid for the Earth Tubs in one budget year, their actual yearly costs amortized over ten years will be less than indicated by the current budget. The first Earth Tub, installed in 2000, cost approximately C$10,000. The second Earth Tub was acquired as a long-term open-ended "loan" from the manufacturer as a result of negotiations undertaken by a representative of ACEPA. The third Earth Tub, which cost approximately C$13,000, was partly paid for by a grant of $5,000 from the Shell Environmental Fund.

The cost of the biofilter for the three Earth Tubs involves materials and the labour to build it. The town public works staff provided the labour. The materials—basically $600 worth of 6x6s—were donated by a local lumber dealer. The cost of the organic materials, wood bark mulch and wood shavings, was not significant and some of this material was donated.

Electric power costs less than $5 per month for all three Earth Tubs. A single unit can handle approximately 150 lbs (70 kg) of biomass per day. When multiple units are used in conjunction, however, higher volumes can be added to a single tub. By using three Earth Tubs in rotation for example, up to 450 lbs (200kg) of biomass could be added to a single tub. Each unit has a total of 3,200 lbs (1,500 kg) biomass capacity when full.

Green Cones cost approximately $70 each. Residents paid $40 for a Green Cone. One hundred were bought at first. The town stored 100 more for the distributor and paid for new ones as they were needed. The first 100 Green Cones therefore cost the town $30 each, after the resident's contribution.

[343] Wayne Morgan, Councillor, Annapolis Royal. Personal communication, 2003.

The first Green Cones were installed by volunteers who knew the proper procedure. They were occasionally helped by members of the town's public works staff. The proper installation of Green Cones and monitoring of their use by knowledgeable volunteers accounted for the early success of the Only In My Backyard program. (By contrast, in Lockeport, Nova Scotia, which was the first community to implement a Green Cone project in which every homeowner and business was provided with a Green Cone, Green Cone recipients were expected to do their own installation. As a result, many cones were improperly installed and failed to work well.) With the exit of volunteer installers and monitors, public works staff now does all installing and monitoring, at an obvious added cost to the town.

Neighborhood composters cost between $400 and $500 each when construction and installation are contracted out.

**Volunteer Contribution**

Volunteer time on program is conservatively estimated at 10 hours a week: 10 hours x 52 weeks x 3 years x ($13.20 an hour[344]) = $20,592 for three years, or $6,864 per year. This is a very conservative estimate. It does not include the time each resident spends on his or her own composting.

**Diversion Credit Funding**

Nova Scotia's provincial goal for waste reduction was 50% diversion from landfill by the end of the year 2000. By its own calculations, Annapolis Royal exceeded this goal by achieving 53% diversion by the beginning of the year 2000. Annapolis Royal's waste management plan has enjoyed wide community participation. As a result, the town achieved a conservatively estimated diversion rate of 53% early in the year 2000.

All diversion credit funding, which is distributed by RRFB from its share of deposits on recyclable beverage containers, is channelled through the regional waste management authorities. Municipalities that do not belong to their regional authorities (Yarmouth, Barrington, Clarke's Harbour, Lunenburg and Annapolis Royal are examples) must obtain their share of diversion credit funds by petitioning the authority to which they would normally belong. Diversion credit funds are based on the percentage of waste diverted from landfill (based on a 1989 benchmark for the amount landfilled) achieved.

While Annapolis Royal calculated a diversion rate of 53%, the VWRMA disagreed. A number of member municipalities in the authority felt that Annapolis Royal should not receive any diversion funds as long as it was not a member of the authority. In order to receive diversion credit funding, Annapolis Royal came to a compromise with VWRMA on a lower level of diversion.

[344] This calculation was made using the value assigned to voluntary work in Colman, R. 1998. *The Economic Value of Civic and Voluntary Work in Nova Scotia.* Available at www.gpiatlantic.org.

*Note:* Diversion levels are calculated according to reductions from amounts landfilled in 1989. In some locations, such calculations may be based on fairly reliable information regarding amounts landfilled in the benchmark year. It is generally assumed that diversion from HRM is based on reliable figures. An interesting observation, however, should be made regarding HRM's 1989-era waste management practices in light of a presentation made before a regional waste management conference in Halifax in 1999. Jim Bauld, speaking for HRM, stressed how far HRM had come from earlier years, citing practices at the now-closed Lower Sackville landfill: "Why we even put school buses in the landfill back then," said Bauld. By comparison, Annapolis Royal's 1989 benchmark numbers do not include the landfilling of items such as school buses, for the simple reason that the town never landfilled schoolbuses or any other type of vehicle.

Sources:
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# Appendix D – Service Voids Analysis[345]

In 2000, Del Norte County, California, became the first region in the U.S. to adopt a zero waste plan as a basis to guide its solid waste management practices. Del Norte County's zero waste plan is especially relevant to Nova Scotians because of the geographic and economic similarities between the two jurisdictions. Located on the Pacific coast, Del Norte has a resource-based economy, which includes fishing, fish processing and logging. Its population is mixed rural and urban and geographically widespread.

Del Norte's Zero Waste Plan concentrates on policies and market incentives to encourage waste reduction and ensure maximum participation from residents and businesses. The plan evaluates ways to encourage and expand on-site waste management. It promotes waste prevention and advocates life-cycle product design.

One of the cornerstones of the Del Norte Zero Waste Strategy is "Service Voids Analysis." This analysis determines where opportunities lie for further waste diversion through recycling, re-using, or preventing waste generation at the outset. Such an analysis could help Nova Scotia begin to divert the portion of waste currently not being recycled or composted.

The Service Voids Analysis process begins with a waste study, which describes all waste collected for recycling, composting, or final disposal at a landfill or incinerator. It identifies problem materials for which there is currently little or no mechanism for waste reduction, recovery or marketing. It then identifies "service opportunities" – opportunities to capitalize on waste – and local ways that these materials could be reduced or recovered. The Service Voids Analysis is based on the simple principle that planners should be able to identify "service voids" (in this case, materials currently being landfilled) in order to evaluate the potential for expanded waste recovery, with an end goal of zero waste.

### Step by Step: The Service Voids Analysis[346]

1. Conduct a Waste Generation Study (a study of the content of materials that make up the waste stream).

2. List all material types as well as the waste reduction and collection programs that target those materials. Materials for which there is no waste reduction or collection program are labelled "service void." Materials that have existing collection programs – yet still comprise more than 1% of the disposal stream – are labelled "service opportunities." Del Norte totalled all the percentages and found that over 91% of materials were either "service voids" or "service opportunities."

[345] Del Norte Solid Waste Management Authority 2000, op. cit.; and Liss, G. 2001. "Del Norte County, On The Road to Zero Waste." *The Journal for Municipal Solid Waste Professionals*.
[346] Summarized from Del Norte Solid Waste Management Authority 2000. *The Del Norte Zero Waste Plan*. Available at www.grrn.org/order/order.html#del_norte.

3. List materials according to the percentage they comprise of the total waste stream. This method helps reveal the greatest opportunities to make the largest strides toward zero waste.

4. Identify programs that target the materials listed.

5. List target programs designed to reduce, re-use, recycle, or compost each identified material type. Programs are identified based on knowledge of locally available or readily developed markets for recovered materials.

6. Conduct market research into recovery programs, in situations where the market for particular recovered waste products is uncertain.

7. Prioritize target programs through an assessment of the relative urgency and/or ease of implementing the program.

8. Determine the total percentage of the disposal stream to be targeted by each program, by using data gathered in Step #3.

Materials that fall into the category "materials without markets" require action to:

a. engage manufacturers to take back their non-recyclable materials, or
b. collect the disposal costs for these items as close as possible to the point of purchase (i.e., through fees or deposits).

Repeat the Service Voids Analysis process after implementing target programs to determine which additional programs may most quickly and efficiently reduce waste.

# Appendix E – The User Pay Model

A user pay program is a creative taxation policy that moves the costs of waste pick-up from the property tax base to those generating the waste. This tax shift rewards households and businesses that minimize waste and it maximizes participation in recycling and composting programs through direct financial incentives and penalties.

A study by the Sound Resource Management Group concluded that residential user fees, which increase at least in proportion to the volume of waste generated, improve recycling rates by about four percentage points over less sharply graduated user fees.[347] That same study also estimated that bundling curbside recycling costs into residential garbage collection fees, while offering recycling for free, improved recycling rates by over ten percentage points.

This study also references the *Nationwide Diversion Rate Study – Quantitative Effects of Program Choices on Recycling and Green Waste Diversion: Beyond Case Studies*, which cites numerous studies that conclude that volume-based residential garbage collection fees result in significant increases in recycling.

[347] Morris, J. 2000. "Incentives to recycle – an end to the Seattle Stomp!" *Warmer Bulletin*, No. 70.

# Appendix F – A Citizen's Agenda for Zero Waste

**A UNITED STATES / CANADIAN PERSPECTIVE.[1] A strategy that avoids incinerators and eventually eliminates landfills**

**By Paul Connett and Bill Sheehan**

## 1. INTRODUCTION

This essay is an updated and expanded version of one Paul Connett wrote in 1998, entitled Alternatives to Trash Incineration. That paper was based on Paul's 14-year experience of helping communities in over 40 countries fighting unwanted incinerators and landfills and on his co-producing videotapes of alternative solutions mostly initiated by citizens. Several key events and developments have triggered this update.

First and foremost, Paul Connett met Bill Sheehan, director of the GrassRoots Recycling Network.[2] Bill is as avidly opposed to landfills as Paul is to incinerators. It was Bill who encouraged Paul to attend the meeting of the California Resource Recovery Association (one of the oldest and largest recycling organizations in the U.S.) in June 1999. It was there that we - Paul and Bill - met with some of the key theorists and practitioners of zero waste and captured many of their ideas and activities in the videotape, *Zero Waste: Idealistic Dream or Realistic Goal?* (see Resources section at end).

Unfortunately, community groups with single-minded determination to stop an incinerator at all costs have frequently ended up supporting a landfill (often somewhere else!) and similarly, those single-mindedly resisting a landfill have often ended up with an incinerator (also somewhere else!). It was with the strategy of Zero Waste that Bill and Paul have found common ground. We believe it can offer common ground to community groups as well. Zero Waste offers a solution to trash that neither involves incineration nor a large reliance on landfill and certainly not the huge mega-raw-waste landfills so popular with the solid waste industry. Zero Waste also allows citizens a positive agenda rather than simply opposing something. Hopefully, it will encourage citizen activists, such as those who have helped to stop the building of over 300 trash incinerators in the United States and many others in other countries, to integrate their efforts in the larger goal of moving towards a sustainable economy. A message that the Washington DC-based Institute for Local Self-Reliance has been delivering for over 25 years is that stopping incinerators makes recycling possible and recycling makes economic development possible. As they argued in the 1989 report, *Salvaging the Future: Waste-Based Production,*[3] the most important economic benefit occurs when the recovered materials are manufactured into finished products within the local economy.

In short, the movement for zero waste has grown out of decades of grassroots efforts to promote community-based recycling and defeat incinerators and landfills.[4] Zero Waste is a guiding principle that says that waste is not natural and can be eliminated with the proper design, policy and advocacy efforts.

The second key development is that as of 2001, 40% of the municipal authorities in New Zealand have adopted Zero Waste goals.[5] Most are shooting for Zero Waste by the year 2015 and some by 2020. They have thus shattered the notion that Zero Waste is a hopelessly 'idealistic' cause. Their adoption of a Zero Waste strategy confirms that it is a very practical approach for both local authorities and local activists. A third important event occurred in 1999 with the publication of the book *Creating Wealth from Waste* by Dr. Robin Murray, an economist from the London School of Economics.[6] About a third of this book is devoted to the concept of Zero Waste. Murray's analysis underlines the sound economic basis for a Zero Waste approach.

A fourth event was Paul's participation in a press conference in Toronto in November 2000, at which Earth Day Canada launched the Target Zero Canada campaign.[7] At this conference Paul met several exciting people including Lucio Di Clemente, chief executive officer of the Beer Store in Ontario, which captures and re-uses 97% of its glass beer bottles; Trish Johnson, who has masterminded the successful Take it Back to Retail program in Ottawa, which involves over 300 retailers; Rahumathulla Marikkar from Interface Canada, the multinational carpet manufacturer that is pledged to become a truly sustainable corporation; and Barry Friesen, solid waste-resource director for the Ministry of Environment and Labor in Nova Scotia (see Resources section), a province that under his leadership has achieved a 50% diversion of municipal solid waste in just five years. All of them are making significant strides on the Road to Zero Waste. Paul and his son Michael have since visited and videotaped each program.

The fifth key development was a trip organized by Arne Schoevers, director of the Dutch environmental group, Waste & Environment,[8] to the European headquarters of the Xerox Corporation in Venray, Netherlands. Xerox is one of a number of leading corporations that have announced a commitment to Zero Waste. Using a massive 'reverse distribution' system, the Xerox Corporation is recovering its old copying machines from throughout Europe, repairing them, reusing parts, or recycling their constituent materials. Ninety-five percent of the returned material is either being re-used or recycled. In the process they have saved $76 million in production and avoided waste disposal costs. Xerox candidly admits that they went into this program for economic rather than environmental reasons, which clearly underlines the fact that Zero Waste is a win-win solution for both the environment and the economy.

All five events for us have reinforced the fact that the move towards Zero Waste is not pie-in-the-sky. That does not mean, however, that it is going to happen without a tremendous effort from citizens, more vision in industry and enlightened leadership from government officials.
To aid this effort, Grass Roots and Global Video,[9] with the help of the GrassRoots Recycling Network and Waste & Environment, is producing a series of videotapes with the running title, *On the Road to Zero Waste*. We completed Part 1, *Nova Scotia, Community Responsibility in Action* in October 2001. This Guide is designed to accompany this series. In it we will look more closely at three key elements of a Zero Waste strategy: Community Responsibility, Industrial Responsibility and Political Leadership. But first we will look more closely at the Zero Waste vision.

## 2. ZERO WASTE VISION:

### Ending the Age of Wasting

The grassroots recycling movement has been tremendously successful over the past 30 years in encouraging communities to handle their discarded materials responsibly. Recycling advocates realized that dealing with waste at the back end is not enough to stem the vast over-exploitation of virgin resources (including fossil fuels) that is the fundamental cause of global environmental degradation. Thus, while the Zero Waste vision recognizes the importance of recycling, it also recognizes its limitations. Communities cannot solve the trash problem alone and should not be forced to clean up after irresponsible industries.

Zero Waste requires a mind shift. We have to change the task from getting rid of waste, to one of ensuring sustainable material practices at the front end of the manufacturing process. Communities faced with discarded materials and objects they cannot re-use, recycle or compost have to demand that industry stops producing them. Total recycling is not approachable without industry's help.

*Thus, Zero Waste consciously links 'community responsibility' to 'industrial responsibility.'*

Zero Waste combines community practices such as re-use, repair, recycling, toxic removal and composting, with industrial practices such as eliminating toxics and re-designing packaging and products for the key demands of the twenty first century: the need to develop sustainable communities and sustainable companies.

Zero Waste combines ethical practice with a solid economic vision, both for local communities and major corporations. On the one hand, it creates local jobs and businesses, which collect and process secondary materials into new products and on the other, it offers major corporations a way of increasing their efficiency, thereby reducing their demands on virgin materials as well as their waste disposal costs.

Our current industrial system and throwaway society is based on the one-way flow of virgin resources to polluting dumps and incinerators. Extracting, processing, transporting and wasting resources is a primary cause of environmental destruction and global warming. We need to reconfigure our one-way industrial system into a circular, closed-loop system, recycling discarded resources from communities back to industries, both new and old.

Zero Waste recognizes the larger bookkeeping of nature. We never actually 'own' anything: we are simply borrowing its constituent materials for a short time. We are breaking this 'contract' when we simply throw things away. Nature makes no waste; waste is a human invention. Our task - both in the community and in industry - is to cycle these materials for future use. To do this, more than anything else, we need strong leadership at the community, industrial and political levels.

## 3. COMMUNITY RESPONSIBILITY

### 3.1 Zero Waste Policy and Legislation

Several communities have already introduced Zero Waste legislation or goals and they are listed at the end of this section. We have pulled out a number of policy steps that we believe are important for communities to take in order to a launch a Zero Waste program.

1) **Designate a target year.** When adopting a Zero Waste goal, it is important for communities to designate a year by which no waste will be delivered to the 'interim' landfill. Most communities have chosen a year some 15 or 20 years ahead. Doing this allows communities to approach an 'idealistic goal' in a realistic time frame. It allows the mind shift from managing waste to eliminating waste and managing resources time to develop.
2) **Design program with whole community.** During this first step and all subsequent ones it is critical, in our view, that the whole process be overseen and designed by a group of committed people drawn from the community, including people in local government, businesses and private citizens. Without this cooperative effort neither strong laws nor good intentions will go very far.
3) **Ban key items from the landfill.** These should include ALL organic material (that is, compostables, or things that can be composted and safely returned to the Earth), any material that can be currently recycled and any toxic material that can be dropped off at collection centers or retailers.
4) **Place a surcharge on material that is landfilled.** This is important for two reasons: a) to provide a disincentive for the generation of this fraction and b) to provide finance for other critical parts of the Zero Waste program.
5) **Provide incentives for recycling.** It is important to stimulate development of businesses, small or large, that can collect, process and re-use, repair or recycle materials in the community discard stream. Ideally, such businesses will provide jobs for the local community.
6) **Encourage waste audits.** It is critical to provide financial help or professional advice to businesses and institutions to embark on waste audits. Such audits identify where waste is being generated in both industrial processes and office operations, so that it can then be reduced or eliminated. The good news here is that almost invariably when such steps are taken they result in saving money.
7) **Stimulate take-back programs.** Provide incentives to local retailers and manufacturers to take back their products and packaging after use. Such incentives can range from deposits on such things as beverage and food containers; batteries and automobile tires, to the free publicity that surrounds a community sponsored 'Take It Back' program for hazardous materials like paint, fluorescent bulbs and electronic goods.
8) **Convert old landfill into industrial or ecopark.** Set in motion plans to convert the old landfill site into a completely different operation. As conceived and described by Dan Knapp and others, this site will look more like an industrial park. The local government can own and maintain the infrastructure but franchise out different parts of the site to local businesses involved with collecting, processing, recycling, reusing, repairing and remanufacturing source separated materials and objects in the community discard stream.

It is clear that many these policy changes impact community economics. Instead of paying waste companies to get rid of discards, we are suggesting that tax payers' money is better spent recovering resources. Thus the role of local government changes when discarded materials are treated as community enhancing assets rather than as liabilities (waste). Instead of managing liabilities, local government policies instead promote entrepreneurial innovation by maximizing delivery of clean resource streams to local enterprises.

As materials once considered waste gain value, Zero Waste principles will help local economies become more self-sufficient and create opportunities for increased civic participation and sustainable employment.

To the extent that communities and citizens can pressure industry to reduce the extraction and processing of virgin resources, they not only reduce the demands on local services but they also contribute to solving larger global problems.

Following are examples of communities that have passed Zero Waste legislation, plans or resolutions:

- **Canberra, Australia** (population 300,000).[10] Australia's capital adopted a No Waste by 2010 goal and plan in 1996. The plan envisions a waste-free city by 2010, with its two landfills replaced by 'Resource Recovery Estates.' Since 1995, recycling has increased 80%. This landfill design looks more like an industrial park than the typical landfill disposal site.
- **Del Norte County, California, USA** (population 32,000).[11] Del Norte County is the first county in the United States to guide its solid waste strategy with a comprehensive Zero Waste plan, which it adopted in 2000. Officials expect the plan to ease the conversion from a timber-oriented economy to a new, sustainable economy using local resources currently being wasted.
- **New Zealand Councils.**[12] As of 2001, 40% of New Zealand's 74 local governments have adopted goals of Zero Waste to landfills by 2015 and an effort is underway to get the goal adopted nationally. Zero Waste New Zealand Trust provides a small amount of grant money to help councils get started but does not supply a blueprint -- that is being developed by local officials, managers and engineers. The trust predicts the creation of 40,000 jobs over 10 years through converting local transfer stations to resource recovery centers and through the resulting proliferation of re-use and recycling businesses.
- **Seattle, Washington, USA** (population 534,700).[13] Seattle adopted Zero Waste as a 'guiding principle' in 1998. The plan emphasizes managing resources instead of waste and conserving natural resources through waste prevention and recycling.
- **Santa Cruz County CA, USA** (population 230,000). Adopted Zero Waste as a long-term goal in 1999.

### 3.2 Practical Steps

The importance of passing legislation in support of a Zero Waste plan is that it puts a large conceptual umbrella over a whole series of practical steps, many of which are familiar to people who have already been involved in discard management. We will now consider those practical steps.

### 3.2.1 There are no magic machines.

Frequently, after giving a blistering attack on the idea of burning trash or dumping it into a mega landfill, we are asked, "Well, if we can't burn it and we can't bury it, what can we do with it?" Such questioners are usually seeking an alternative technology, because they have become accustomed to salesmen that offer them 'turnkey' solutions. "Give us this much money and we will solve your trash problem with our state-of-the-art technology," is what they are used to hearing. At the outset, we have to stress that there are no magic machines that can solve the trash problem. Trash is a not a high tech problem. Technology has a role to play but only when judiciously applied to carefully selected components of the discard stream. Zero Waste is not a technology; it is a strategy and that strategy begins with better industrial design and ends with source separation of discarded products.

### 3.2.2 Trash is made by mixing.

From the citizens' perspective, trash is made by the ten things at the end of our hands and if we want a solution that we and the planet can live with, it is those ten things that have to be co-opted from the very beginning. In short, trash is made by mixing and it is prevented by keeping discards separated at source.

### 3.2.3 Source separation.

Avoiding expensive and potentially dangerous incinerators and huge regional landfills requires keeping our discarded items in several well defined categories (both mentally and physically). These are:

- avoidables
- reusables
- compostables
- recyclables
- toxic materials and
- residuals (re-designables)

These separated materials will be discussed under the following headings:
3.2.4 Collection systems.
3.2.5 Avoidables and waste reduction strategies.
3.2.6 Reusables and re-use & repair centers.
3.2.7 Compostables and composting facilities.
3.2.8 Recyclables and recycling economics.
3.2.9 Resource recovery parks and ecoparks.
3.2.10 Toxics, household hazardous waste collection and take-back programs.
3.2.11 Residuals screening facilities.
3.2.12 Better industrial design.

### 3.2.4 Collection systems.

In our view the most successful public collection scheme for the urban setting is a three container curbside system. This has been used in pilot projects in San Francisco and throughout Nova Scotia.

There are many variations on such scenarios. A key point to remember when a community is embarking on a source separation system is to organize separation around the existing collection system. If the community is used to curbside collection of trash, then it is best to organize the collection of recyclables and compostables at curbside. If, on the other hand, the community is used to taking discards to the landfill (this is often the case in small rural communities) or a transfer station (sometimes the case in suburbia), then it is best to organize collection at these facilities.

As far as the number of containers used at curbside is concerned, if communities opt for only two, then it is critical to put the emphasis on collecting source-separated organic discards. This is critical for two reasons: a) it is the organic material that causes so many of the problems at landfills and b) it is very difficult, if not impossible, to pick out clean compostables from the residual fraction. Unfortunately, most communities that use a blue box system put the emphasis on collecting recyclables and thus dramatically reduce the amount of material that they can divert from landfill and eliminate the chance of getting good clean organic material for composting.

With these problems in mind, Guelph, Ontario, departed from the blue box approach (containers and paper in one bin and everything else in another) and developed a two-container system that put the emphasis on getting clean organics. They use a green bag for source separated organics and the residuals and recyclables go into a blue bag. This is called a wet/dry system. The green and blue bags go into two different sections of light weight trucks and are delivered to a facility that has two sections: a separation line for recyclables and a screening line for compostables. The recyclables are further processed (crushed or baled) to meet market specifications and the compostables are put through a composting operation enclosed in a large building. This two-way division is very simple for the citizen and they have a 98% participation rate. Within a few years the city was achieving a 58% diversion rate from landfill. The city also operates a household hazardous collection depot and a separate collection for bulky yard trimmings.[14]

If communities are able to increase the number of containers to four, then its best to have two containers for the recyclables, allowing the separate collection of paper products. This minimizes the contamination of paper with glass shards from the other recyclable fraction (bottles, cans, etc).

Garbage lottery. Some communities have come up with novel ideas to encourage people to separate their discards carefully. Rockford, Illinois, increased its recycling rate fourfold by introducing a garbage lottery. Each week one household is selected at random to have its garbage picked up and examined. If no designated recyclables are found in the trash, they win $1,000! If that is not the case, a householder the following week stands to win $2,000 and so on. The participation rate in this community increased by 400% in a few months. This system is illustrated on two videotapes produced by Videoactive Productions entitled Joe Garbario and the Marin Resource Recovery Plant and Millie Zantow: Recycling Pioneer (see Resources section).

### 3.2.5 Avoidables and waste reduction strategies.

In recent years two key activities have produced astonishing results with respect to waste reduction.

Waste audits. When local manufacturers and businesses are required to find out at what points in their processes that they generate waste, they typically find many places where they can make less waste

and save money in the process. For example, Quaker Oats of Canada, after a waste audit, was able to reduce its waste stream by over 90% and save an enormous amount of money in the process. That's truly, a win- win solution.

Volume-based trash charging systems for households and institutions. Simply put, the more waste you generate, the more you have pay. There are a number of different ways of applying this kind of system. The city of Seattle has a monthly garbage fee that is based upon the size of container used for the residual fraction of the discard stream. Households that opt for a large container for their residuals pay a larger monthly fee than household that opts for a small one. Other communities require a pre-paid coupon to be used on every bag of residuals put out at the curb. These are often referred to as 'Pay-by-bag' or 'Pay-as-You Throw' systems. In some communities in the Netherlands there is an electronic microchip in the residuals container and when the can is picked up it is weighed and the household is automatically charged according to how much residual material they have put out.

### 3.2.6 Reusables and re-use & repair centers.

Many householders and communities around the world have developed both formal and informal means of getting reusable objects moving from one owner to the next. These include garage sales, yard sales, jumble sales, flea markets and thrift shops run by charities like the Salvation Army and Goodwill Industries. Some of these are run for profit and others as a community service.

While reusables represent a small fraction of the discard stream, it is the most valuable one. Some re-use and repair programs not only recover materials but they also recover people (through job training etc). A municipal official given the responsibility of diverting material from the local landfill needs to investigate how comprehensive the existing services are in his or her community. Such an official should support them in any way possible, including finding ways to bring different re-use and repair functions together in a Community Re-use and Repair Center (the last thing you want to happen is to introduce a facility that puts existing operations out of business). Many models exist.

*WasteWise, Georgetown, Ontario.* One early example of a community non-profit center is the WasteWise operation. This facility came about because local activists were tired of defending themselves from 'back-end' solutions proposed for their community. They had fought to prevent a large quarry from being used to accept 40 million tons of Toronto's trash and then a 1,500 ton-per-day trash incinerator, again for part of Toronto's waste (Georgetown is about 30 miles from Toronto). They set up WasteWise to show that an alternative approach was possible. With the help of a grant from the Ontario government, they rented a large warehouse and set it up (1) to repair many items like furniture, appliances and bicycles (2) sell these and other ready-to-use items (3) collect, process and sell recyclables not covered by the local blue box (recycling) program and (4) provide educational services for waste and toxics use reduction. Largely run by volunteers, the operation became self-sufficient after five years and now has two full time staff. A videotape of this operation is available (see Resources section).

The important thing about the re-use and repair center is that it can be the springboard for many other community activities. It can be used for education, especially youngsters, who can be taught how to repair things at an early age. It can provide a venue for senior citizens, many of whom have

important repair skills that they are eager to share with the community. It can act as an incubator for small repair businesses by providing affordable overhead. It can be used to teach people how to compost in their backyards and even to build their own composting units out of materials collected at the center. It can also be used to collect potentially hazardous materials like paints, varnishes and cleaners. Paint can either be used in renovation of items for resale or be made available to the public in a 'paint exchange.' The center may also become a meeting place for the community.

*Recycle North, Burlington, Vermont.* One of the best examples we have seen of a community non-profit operation that includes extensive repair and job training is Recycle North. In addition to a large area devoted to the resale of reusable items, there are four areas devoted to repair. The items that are repaired are (1) large household appliances like stoves and refrigerators, (2) small electrical appliances, (3) electronic equipment and (4) computers. In each section people are trained. After six months they receive a training certificate as well as training in skills needed to get a job (e.g. writing application letters and practicing job interviews). They also attempt to service the local community in other ways. In addition to offering the reusable items at very reasonable prices, they provide these goods in exchange for vouchers provided by the local department of Social Services. In 2000 they generated a gross income of $750,000 and employed over 20 full time staff. They have since added a building deconstruction and salvage service to their operation. A videotape of Recycle North is in preparation (2001).

*Urban Ore, Inc. Berkeley, California.* Urban Ore is another excellent example of a re-use and repair center run for profit. It is owned and directed by Dan Knapp[15]. This operation grosses over $1.5 million and has created many permanent and well paid jobs. Urban Ore, Inc. has pioneered the resource recovery park concept (see Resource Recovery Parks section below)

*Hobo Hardware, Guelph, Ontario.* This large warehouse handles only re-used building materials, fittings and do-it-yourself items. Even though the products are all second-hand, it is run as if the items were new, with tidy arrangements and things easy to find. Paul has visited the store and videotaped the operation and hopes to include in a forthcoming video which examines the business opportunities in the community discard stream.

### 3.2.7 Compostables and composting facilities.

Composting can be run on almost any scale. It can be done in the backyard, in the basement with worm bins (vermiculture), in the community or in a centralized facility. However, a key principle is to maintain tight control over what materials enter the composting operation, because the ability to use the material can easily be compromised if unsuitable materials are composted.

In our view, after source separation, composting is the most important step in the community part of the Zero Waste strategy, because it is the organic material in landfills that cause so many problems. When organic material rots underground it generates (1) methane, which contributes to global warming (molecule for molecule methane traps over 20 times more heat than carbon dioxide), (2) organic acids, which are capable of dissolving the metals in the waste load and getting them into surface and ground water and (3) awful odors, which make landfills so unpopular with the public. Thus a key objective of composting is to keep organic materials out of the landfill.

The key step in Nova Scotia's program was the passing of legislation banning organic material from landfill. Such a regulation forced both source separation at the household and institutional levels, as well as creation of a back-up screening facility at the landfill (see Section 3.2.8).

Backyard composting is the single most cost effective treatment of a large fraction of the domestic discard stream. Seattle has subsidized backyard composting kits and a Master Composters' program, in which citizens are taught all the ins and outs of composting and are then make themselves available to help other citizens troubleshoot their backyard composting problems. The program is run by the Seattle Tilth Association. A video, Zoo Doo and You Can Too! (see Resources section), was made at the association's demonstration site and illustrates many home made and commercially available composting units. In our view, the composting of yard trimmings and food scraps in one's backyard is one of the biggest contributions a citizen can make to solving the trash problem.

*Community composting.* Composting conducted at the community level is well illustrated by the program in Zurich, Switzerland. A 1991 videotape of this program, Community Composting in Zurich (see Resources section), describes the city's 480 community composting plots involving 3 to 200 households. In August of 2001, Paul revisited the program. The number of community composting operations has risen to about 1,000 and approximately half the householders of Zurich are now served. Paul also videotaped this and it, too, will be included in a forthcoming video focussing on the full range of methods of handling organic discards.

*Mulching lawnmowers.* A simple and cost effective way of reducing one type of organic waste is to encourage both householders and institutions to use mulching lawnmowers. This one step saved the New York City's Parks Department over $1 million in avoided disposal costs.

*Community gardens.* Many citizens who might not be interested in community composting may become excited about a community garden. The latter would be ideally supported with a community composting operation. It makes economic sense for municipalities to support such operations, because every pound of organic material composted means one pound of waste that does not have to be picked up, transported and disposed. It is also a very positive way of integrating discard management with the local community. Such gardens have become havens of delight in New York City and other large cities.

*Centralized composting facilities.* In the United States there are now over 3,000 yard trimmings composting operations.[16] When handling leaves and brush, the technology does not need to be very sophisticated. Composting yard trimmings usually involves a static pile or windrow system. Such windrows are long rows that have a triangular cross section. They need to be turned regularly to make sure that they get a plentiful supply of air and thus maintain aerobic conditions. They can be turned in one long sweep using mobile turning devices like the Wildcat system manufactured in North Dakota and the Scarab in Texas.

In Nova Scotia centralized composting facilities handle all source separated organic material. Seventy-two percent of the citizens in the province are currently provided with curbside collection of organics (see Nova Scotia video listed in Resources section).

Around the world, many facilities are composting special organic materials, such as food scraps, agricultural waste, fishery waste, sewage sludge and mixtures of these products. To serve these ends, a variety of in-vessel and indoor systems are designed to speed up the composting process and minimize odors. Such systems are either aerobic (plentiful supply of air) or anaerobic (starved of air). The latter are used to generate methane to be used as a fuel or chemical feedstock. Many of these systems are described in articles that appear in the bible for composting: the monthly journal, BioCycle.[17] This journal is an essential resource for any official who wants to include an aggressive composting component in a Zero Waste program.

Vermiculture is the use of worms to degrade organic material. These remarkable creatures provide yeoman service for those prepared to put them to work. One woman, who has worked with worms practically her whole life, is Mary Appelhof, who lives near Kalmazoo, Michigan. Her book, *Worms Eat My Garbage*,[18] is a delight. Her enthusiasm for these industrious worms has no bounds!

The place where vermiculture has received its largest municipal support is in the area around Bombay, India. There they have a variety of vermiculture sites located in backyards, hospital grounds and near local food markets.

### 3.2.8 Recyclables and recycling economics.

According to professional recyclers, the three golden rules to secure markets for recyclables are 'quantity, quality and regularity.' The industries that will use these materials must be confident that they will get a regular supply of material free from contaminants that can ruin their process, e.g. ceramics in glass, plastics in paper, PVC plastic co-mingled with polyethylene or PET. Source separation schemes have helped to meet some of these demands. The materials recovery facility with human picking lines and along with some mechanical equipment, which can separate steel (magnets), aluminum cans (eddy currents) and plastic cans, helps to complete the process. Hundreds of such facilities are operating around the world. A facility operated by the Miller Corporation in Halifax, Nova Scotia is illustrated in the video, On the Road to Zero Waste, Part I. Nova Scotia, Community Responsibility in Action (see Resources section).

*The economics of recycling.* Today, the driving force underpinning the economics of recycling is 'avoided disposal costs.' It costs money to recycle, but it is economically viable when the overall cost of collecting and recycling a ton of recyclables is less than disposing a ton of waste. Yard trimmings composting is particularly favorable when making this comparison.

*The enemy of recycling is cheap landfills.* Those in favor of recycling need to argue that cheap landfilling is artificially cheap because the long term costs of future damage to the environment, both locally (toxic emissions to air and ground water) and globally (waste of finite resources), are being ignored. The web page of the GrassRoots Recycling Network provides more details of the artificial economics of landfilling.[19]

Shortage of markets for recyclables is often offered as a reason to limit recycling. However, the markets for certain recyclables are a highly cyclic phenomenon and certainly should not be used as an argument for building a trash incinerator or mega landfill, which represent a long term (at least a 20-years for an incinerator) capital investment. Communities can insulate themselves from the

vagaries of commodities markets by developing local markets for their recyclables. For example, when Arcata, California, lost their market for glass they developed Fire and Light, an upscale tableware company that uses exclusively recycled glass from the Arcata Community Recycling Center. Similar business opportunities exist with wood, tires, plastics and other materials. Communities are well served if they invest in and/or support business opportunities that use the materials they generate but for which markets are poor. This creates other economic benefits too, like jobs and sales taxes.

We argue that if we are forced to bury stuff, then this stuff shouldn't have been manufactured in the first place. Some activists advocate a 'return to sender' approach as a way of drawing attention to bad examples of industrial design such as the silly squeezable ketchup bottle. Paul has provided a great deal of amusement at the expense of this particularly bad form of packaging. A little thought would suggest that a simple spoon could deliver ketchup just as precisely from a recyclable or reusable jar, with a wider opening, as a non-recyclable plastic ketchup bottle.

A net profit. The way for recycling to generate a net income for the community is to find ways of utilizing the salvaged materials locally. Examples include: newspaper to make cattle bedding, or insulation material; glass to make fiber glass; tires to make crumb rubber; crab shell waste to make surgical sutures and dietary products; post consumer wood to make fiber board, furniture or flooring, old building materials used to make furniture and old carpets used to make new ones.

Dr. Robin Murray, in his book Creating Wealth from Waste (see Resources section), provides a very persuasive strategy to encourage companies to move to cities in order to capture the flow of separated resources generated there. Such an approach means that local, rather than distant, economies can capture the 'value added' of local manufacture.

### 3.2.9 Resource recovery parks and ecoparks.

Looking to the future, visionaries like Dr. Dan Knapp of Urban Ore, Inc. envisage Resource Recovery Parks and Ecoparks as the community replacement facilities for landfills and incinerators.[20] These facilities locate re-use, recycling and composting businesses close together and can be the core of a comprehensive strategy for local resource management. Local collection entrepreneurs and the public can deposit all recoverable materials at one processing facility, get paid for some of them and buy other items at bargain prices. Some designs place the recovery park together with a waste facility or transfer station, arranged so that traffic passes recovery businesses before coming to the waste facility. When combined with incentives for recycling, disincentives for wasting and a commitment to gradually phase out the waste facility, such an arrangement can be the centerpiece of a Zero Waste community.

Resource recovery parks can be privately financed, or local government can create an authority whose role is to secure the land, build the core facility and lease space to private entrepreneurs, as is frequently done for airports. When located close to appropriate industries, resource recovery parks can provide feedstocks for Eco- industrial parks, where the byproducts of one industry become inputs for the next[21]. Serial resource recovery systems, are a variation of resource recovery parks where a critical mass of resource conservation businesses are located in a neighborhood, but not necessarily on the same property. Repair shops and secondhand shops are good examples of existing

businesses that need only to bring their services into greater synergy and prominence in a Zero Waste system.

*Urban Ore Ecopark, Berkeley, California, USA.* Urban Ore, Inc. has pioneered the resource recovery park concept. In 2001, Urban Ore moved to a 2.2-acre former steel pipe manufacturing facility and established a building materials exchange, a hardware exchange, an arts and media exchange, a general store and salvage and recycling activities. Two major lumberyards, a hardware store and two other re-use facilities, all in a three-block area, provide a stream of potential customers. Urban Ore Development Associates (UODA), a spin-off of Urban Ore, designs, builds and operate resource recovery parks.[22]

**Other Resource Recovery Parks are in development:**

*San Leandro Resource Recovery Park, San Leandro, Calif., USA.* Waste Management, Inc. is developing a resource recovery park that recycles wood, greenwaste, curbside and other recyclables, operates a buy-back center and sells recycled-content soil and landscape products. Tenants include a tire recycling and crumb rubber facility and a building materials exchange. The park is at a waste transfer site.

*Monterey Regional Environmental Park, Marina, Calif., USA.* This park includes public drop-off and commercial waste recycling stations, a Last Chance Mercantile re-used goods resale operation, a landfill gas power project, a household hazardous waste collection facility, construction and demolition recycling operations, composting facilities and a soils blending facility, at an existing regional landfill.

### 3.2.10 Toxics, household hazardous waste collection and take-back programs.

While toxics only make up 1-2% of the household waste stream, if ignored, they threaten other aspects of the Zero Waste strategy. It is important to get these materials identified and made visible.

*Curbside collection.* Some communities have organized separate curbside collection of certain toxics like automobile oil (Hamburg, NY) and batteries (Neunkirken, Austria).

*Household hazardous waste collection sites.* Some communities have organized household hazardous waste collection days, on which citizens are requested to bring their hazardous materials to a central collection point. In Halifax, Nova Scotia, there is a very well organized and efficient drop-off facility operating most Saturdays from 9- 4 p.m. This facility is illustrated in the video, *On the Road to Zero Waste, Part I. Nova Scotia, Community Responsibility in Action* (see *Resources* section). Some communities have set aside buildings at the landfill to collect, store and even exchange potentially hazardous materials, like paint, with the community.

*Use it up.* Some paint manufacturers have offered to reblend recollected paint and donate it for community projects. In New Brunswick, Canada, there is a company specializing in collecting used paint and recycling it into new paint.

In the absence of a commercial operation we would advocate the use of a Community Re-use and Repair Centers (see above) to collect paint and use it for community projects. The principle is a simple one: if it is safe enough to use (and it may not be, but this is a different issue) then it is safe enough to use up. If the individual cannot use it up, the community should.

*Producer Take-Back.* Some toxic substances, like mercury, are so intractable that we should question their use altogether. If industries insist on mercury's continued use and governments allow them, then legislation should be introduced that would require these industries to take back the mercury-containing objects, such as household batteries, thermometers and fluorescent lights. A citizen who has devoted more than a decade to getting governments and industries to eliminate the mercury problem, is Michael Bender in Vermont USA.[23]

In a similar fashion to mercury, we should require the oil industry to take back used motor oil and tire manufacturers (where communities don't have access to modern tire recycling facilities like the one in Nova Scotia) to take back used tires. These manufacturers should be challenged to find chemical ways of recovering these valuable feedstocks and put them back into their manufacturing process. They need to 'close the loop.' This is called *Extended Producer Responsibility* for waste or EPR (see Section 4.2).

*Retailer Take Back.* Ottawa, Canada, has a successful 'Take It Back!' (to retail) program in which over 350 retailers take back from customers 65 different toxic and difficult-to-recycle products that do not belong in curbside recycling bins[24]. These items include used motor oil, batteries, consumer electronics and prescription drug containers, among others. Retailers are anxious to get involved because of the free publicity and the way being on the program attracts customers into their stores. Trish Johnson, who directs this award-winning program, described some of the details in the video *Target Zero Canada* (see *Resources* section). Inspired by the Ottawa example, Washington County MN, USA, has introduced a similar program.

While Retailer Take Back programs put the emphasis on retailer responsibility for waste, the ultimate goal is to build a community coalition to increase pressure on the manufacturers, or Brand Owners, who profit from making products that become waste and, more importantly, who make the design decisions on toxicity, durability and recyclability of products and packaging. And in the meantime, such programs educate citizens that there is no *a priori* reason that taxpayers have to continue to clean up after industry. We anticipate that as the program evolves and retailers question the expense of disposing brand name products, retailers will begin to put pressure on manufacturers to take financial or physical responsibility for their products at end-of-life.

### 3.2.11 Residuals screening facilities.

After source separation has kicked in and materials like reusables, recyclables, compostables and hazardous materials have been sent to different facilities for processing, there will still be a fraction left over: *the residuals.* This fraction consists largely of the items that are deemed to be currently non-reusable, non-recyclable or non-compostable. To this we have to add materials that individuals or institutions have not bothered to put into the correct container.

Ultimately, in the Zero Waste strategy we have to develop creative and forceful ways of telling manufacturers that if the community cannot re-use, repair, recycle or compost these objects or this material, they should not be making them (see *Industrial Responsibility*, below).
In typical communities in North America, once the community has done what it can with recycling and composting, the residue is shipped off to landfills. Often these landfills are very distant and very large. The rationale for their development has been the need for expensive and complicated engineering systems to contain, collect and treat the leachate (garbage juice!) that emerges from them. This equipment, along with the lining systems, is so expensive that it is usually cost-prohibitive for the community to use this back end approach on a small scale for local needs; hence, the drive for regional facilities.

We have argued that, despite this equipment and these lining systems, all landfills eventually leak toxic materials into the ground water and emit other polluting gases and particulates into the air. We have further argued that if engineers cannot control what comes out of a landfill, the community's only rational choice is to control what goes in.

**Controlling what goes into a landfill.** There are two stages at which control can be exerted over what goes into the landfill. The first stage comes from source separation prior to curbside pick up, leading to all the measures discussed in the activities described above (e.g., re-use, repair, composting, recycling and toxic removal). The second level of control can be exerted immediately prior to landfill in a residual screening facility.

We further argue that, if the residual screening facility is properly overseen by the community, there will be little or no need to build huge regional landfills. With community controlled screening facilities we can return to the small, locally operated landfill.

One of the first such screening facilities is operating in Halifax, Nova Scotia and is illustrated in the videotape, *On the Road to Zero Waste, Part I. Nova Scotia, Community Responsibility in Action* (see *Resources* section). This screening facility, locally called a 'front-end processing facility,' starts with conveyor belts manned by well-protected workers. These workers separate out more recyclables (which escaped the source separation net), bulky items and toxic materials like batteries and paint cans (which escaped household hazardous waste drop off centers). They leave on the conveyor belts (i.e., using a negative sort) a dirty organic fraction as well as a variety of non- recyclable plastic items. This material is shredded and put through another composting process. The purpose of this operation is to stabilize the dirty organic fraction biologically for 21 days prior to landfilling. With more effective source separation and longer curing times this material might (after the plastics are removed) eventually be used for landfill cover. When Paul visited the landfill at the end of this operation he was struck by how odor-free the landfill was and the almost total absence of seagulls or other birds.

We would argue that, if the screening facility is properly overseen by the community, there will be less, or no, need to build huge regional landfills with elaborate lining systems. With community controlled screening facilities we can return to the small, locally operated landfill. In Halifax, however, they have backed up their 'residual screening facility' with a double lined, leachate collecting system at the landfill. While, it may be a good idea to have a back up, the danger is that this back end support might eventually undermine the care with which toxics are removed and organics are stabilized.

### 3.2.12 Better industrial design.

This is not the end of the road to Zero Waste. Even though the material exiting a 'residual screening facility' may be biologically stable and safe to bury, it still represents a waste of resources, some of them in finite supply. We believe that the objects and materials that end up in this interim landfill should be studied, possibly by research students destined to work in manufacturing industries. They should be challenged to recommend design changes in manufacturing to avoid this fraction in the future. In short, we need *better industrial design* for the 21st Century. In our view, this is where community responsibility can help drive industrial responsibility.

## 3.3 Community Success Stories

In the late 1980's, Dr. Barry Commoner and co-workers performed an experiment in East Hampton, Long Island in the state of New York.[25] With the help of 100 volunteer families they measured how much diversion from landfill could be achieved with a four-container system and existing commercial recycling and composting facilities. They used one container for bottles, cans and other hard recyclables, a second container for all paper products, a third for the compostable fraction (they used a multiply kraft paper bag for this fraction) and a fourth container for the residuals. In this experiment they achieved a remarkable 84% diversion from landfill.

Critics have argued that this sample is not a representative of the American people and that the 100 families were highly committed to the success of the project. We would argue that this is precisely the point. This experiment showed how much diversion was physically possible when you had a very strong commitment from householders. From our point of view, it clearly underlines the need to spend sufficient money from the waste budget on the kind of education programs that might generate this kind of commitment.

*USA recycling rate.* Despite the pessimistic projections of waste experts in the early 80's, who suggested that the maximum recycling rate you could expect from a typical American community would be about 15%, Americans have done far better than this. A survey financed by the US Environmental Protection Agency indicates that over the whole country, in 1996, Americans were recycling 27.3% of the municipal discard stream,[26] with nearly 9,000 curbside recycling programs in operation.[27] But that is for the whole country. This includes states that are recycling a lot and others that are doing very little.

*NJ recycling rate.* Without including junked automobiles and construction and demolition debris (C& D), the state of New Jersey is diverting over 45% of its municipal discards from landfills. If we include the autos and C & D, they are diverting over 60%.

*California recycling rate.* California has a recycling law that required communities to divert 50% of their discards from landfill by the year 2000. Over 60 communities had reached that target by 1996 and as many as half of all communities may have actually reached the target on time (reports are not due until the end of 2001).[28]

*Nova Scotia recycling rate.* In 2000, the province of Nova Scotia became the first province in Canada to achieve a 50% diversion from landfills.

*Recycling in Communities.* While states and countries can stimulate recycling with appropriate legislation, incentives and government purchasing, it is not states or countries but communities that recycle. National statistics that combine data from both excellent programs with very poor ones give a misleading impression of what an individual community can achieve. Thus officials from a village, town or city who are wondering how much they can divert from a landfill should comb the world and the Internet, to see how much a community of their size and demography has actually achieved and consider whether they can copy their example or improve upon it.

*Nova Scotia communities.* A good place to start would be the Canadian province of Nova Scotia. In the sections above many of the details of this program have been described. Their program includes: backyard composting, curbside collection of all other separated organic material, curbside collection of recyclables, drop off facilities for all beverage containers except milk cartons (there are 95 eco-centers scattered throughout the province that collect these deposit containers), deposits on tires and recycling of tires to crumb rubber, household toxic waste collection sites and a 'residual screening facility' to handle and process the residuals prior to landfilling. Only non- toxic , non-recyclable and non-biodegradable materials are accepted at the landfill. Remarkably in just five years, the program has achieved over 50% diversion from landfills and in the process has generated over 3000 jobs. If we exclude construction and demolition ('C&D') debris, the city of Halifax in the year 2000 had reduced the amount of discards (calculated per capita to allow for population growth) going to landfill by nearly 60% over 1989 figures.

*Citizen driven.* A very exciting element in the Nova Scotia program is that it has been largely driven and designed by citizens, particularly the 'It's Not Garbage Coalition.' It was the citizens who produced a report in which the word 'waste' was struck out every time it appeared and replaced with the word 'resources.' To their credit, the Nova Scotia authorities, after initially proposing a trash incinerator to get them out of their landfill woes, have worked with citizens to make this program possible. Indeed, following the citizens' cue, Barry Friesen's title at the Ministry of Environment and Labor is 'Solid Waste Resource Director.'

*United States communities.* From 1996 to 1998, the Institute for Local Self-Reliance identified 100 communities and nearly 200 businesses, institutions and other organizations reporting waste reduction rates at 50 percent or higher. The results of that survey are summarized in a report, Cutting the Waste Stream In Half: Community Record-Setters Show How, much of which is posted on ILSR's website[29]. The next two communities are from that study.

*San Jose, California, USA* (population 849,363). 60% of materials from single-family households are recycled or re-used; 47% of overall municipal solid waste is diverted from landfill; businesses receive financial incentives to reduce waste.

*Loveland, Colorado, USA* (population 37,352). This rural community recovers 56% of residential materials for re-use and recycling using dual-collection vehicles that pick up both recyclables and trash.

*Guelph, Ontario, Canada* (population, 100,000) 58% of materials diverted from landfill. Uses wet/dry collection system. 98% participation rate. No waste goes direct to landfill. 67% diversion of wet waste. 51% diversion of dry waste. Overall: 58% diversion.[30]

*Belleville, Ontario* (population 37,000) 63% reduction to landfill.

*Sidney, Ontario* (population, 17,000) 69% reduction to landfill.

*Trenton Ontario* (population, 15,000) 75% reduction to landfill.

These three towns are part of a 15-municipality, blue box-2000 program. 20 materials are collected at curbside. They use a 'pay-by-bag' system and provide incentives to residents to compost in their backyard (65% participation rate).[31]

*Canberra, Australia* (population 273,300). 51% diversion from landfill in 1996, 12% of this was construction and demolition debris.[32]

*Bellusco, Italy* (population 6,000). This small town is in the Milan area. 73% of municipal discard stream is diverted from landfill. Curbside collection of paper and green waste. Drop-off containers plus a very smart drop-off center run by volunteers.[33]

*Gazzo, Italy* (population 3,220). Community near Padua. 81% diversion from landfill. No details.[34]

## 4. INDUSTRIAL RESPONSIBILITY[35]

### 4.1 Introduction

The two major reasons we have become a toxic, throwaway society are that (1) taxpayers subsidize the extraction of virgin materials that compete with recovered (or secondary) materials and (2) taxpayers assume the burden of disposing whatever products and packaging industry chooses to market. Hitherto, however, taxpayers and local government have had little say in the production of things that become waste. The Zero Waste strategy requires that this connection be made.

### 4.2 Producer Take Back

Producer Take Back, or Extended Producer Responsibility (EPR) for waste, holds manufacturers and specifically brand owners, responsible for managing their products and packaging at the end of their useful life. When brand owners have physical or financial responsibility for their products and packaging at end of life, they have a built-in incentive to use less toxics, make more durable and recyclable products and reduce excessive packaging.

EPR was first mandated in Germany for packaging in 1991 and is now being applied to packaging and other product sectors in most of the world's industrialized countries. A notable exception is the United States.[3] EPR policies in Europe have led to company recycling rates close to 90% and high recycled content, as well as an emphasis on reusable and returnable packaging. The policy has spread to other countries as well, including Canada and nations in Asia and Latin America. Often, U.S.-based companies follow EPR requirements in other countries but do not replicate the programs in the United States.

**Examples of EPR programs in the United States and Canada include:**

*Deposit Systems for Beverage Containers.* Deposit systems transfer the costs of recycling from taxpayers to consumers and beverage manufacturers. Deposits are not only fair; they work. In the ten U.S. states with container deposits, recycling rates average 80% for containers covered by deposits, compared with far less in non-bottle bill states (for example, around 10% for plastic soda bottles in non bottle bill states). In Canada, where the beer industry invested in refillable glass bottles, 97% of bottles are returned to the producer for refilling.[37]

*Take-Back Programs for Toxics.* British Columbia's Product Stewardship laws require producers to take back household chemicals such as paint, thinners, pesticides, fuels and medicines for recycling or safe disposal. Millions of gallons of these toxic chemicals are collected at industry-funded depots at no cost to local communities. The costs create incentives for producers to keep toxic leftovers to a minimum.

*Local Take Back to Retail.* Ottawa, Canada and Washington County, Minnesota USA, have implemented successful programs targeting problematic wastes not covered by curbside programs, as an alternative to taxpayer funded Household Hazardous Waste programs. Retailers like the program for its free publicity and opportunity to get return customers. These are examples of voluntary Retailer Responsibility programs that can complement other Producer Responsibility programs.

### 4.3 Environmentally Preferable Purchasing

Any organization, business or individual can promote Zero Waste by altering buying habits. Many government agencies and companies have already adopted preferences for recycled content products. Many are now moving to broader, environmentally preferable purchasing programs seeking to reduce resource use, cut air and water emissions, or achieve other environmental goals. Purchasing practices can target:

- materials purchased for manufacturing products and packaging;
- products purchased for use within the organization;
- packaging for products and materials delivered to the organization; or
- products specified through contractors, such as direct mailers, billing agents, printers, copier companies, office products retailers, architecture and construction companies.

**Examples:**

*a) U.S. Federal Agencies.* As a result of Executive Orders in the 1990s, federal agencies are taking the lead in buying recycled paper and other recycled products, as well as products that include features such as reduced toxics and reduced energy needs.[38]

*b) King County, Washington USA* is a national leader in buying environmentally preferable products and has an excellent website. Likewise, the Pacific Northwest Pollution Prevention Resource Center has excellent resources on its website.[40]

### 4.4 Product and Packaging Design

Many companies have been innovative in redesigning products, whether to reduce costs or to meet government incentives or requirements. Some have redesigned packaging to minimize materials. Others have redesigned products for ease of re-use and recycling. Still more have transformed the concept of their products to eliminate waste. Extended Producer Responsibility encourages manufacturers to design products for easy disassembly, to minimize the cost of manufacturer responsibility for recycling. A few examples include:

*Interface, Inc. (Dalton GA, USA)* This maker of commercial carpets is changing its focus from providing a product to providing a service, leasing carpets to customers and taking back old carpet and tiles for refurbishing or recycling. Interface also pioneered the practice of installing carpet in tiles, so that only high wear places need to be replaced when worn out.

*Herman Miller (Zeeland MI, USA)* In manufacturing office furniture, Herman Miller used to receive molded plastic chair seats in single-use cartons containing shells in bags, separated by chipboard sheets, placed 56 to a double-sided corrugated box. After unpacking the seats and assembling the chairs, Herman Miller was left with 30 pounds of packaging for every 56 chairs. The company developed, with its vendor, a protective rack that stores 90 seats in the space that previously housed 56 and can be re-used 80 to 100 times or more.

### 4.5 Comprehensive Zero Waste Business Approaches

Businesses pursue Zero Waste, in addition to redesigning products, by:

- Re-evaluating products and services to create the greatest consumer and environmental value, within economic feasibility;
- Minimizing excess materials and maximizing recycled content in products and packaging;
- Finding productive uses for, re-use, recycling or composting over 90% of their solid waste;
- Reducing procurement needs, then specifying products that meet Zero Waste criteria;
- Establishing easily accessible repair systems, as well as recovery processes for packaging and products.

**Examples:**

*Collins & Aikman, Dalton, Georgia, USA.*[41] These makers of automotive fabric and trim sent zero manufacturing waste to landfill in 1998. Waste-minimization and energy-efficiency programs boosted production 300% and lowered corporate waste 80%.

*Xerox Corporation, Rochester, NY, USA.*[42] Xerox instituted an Asset Recycling Management program in 1990 as a cost saving rather than an environmental initiative. It is an example of a win-win voluntary EPR initiative. In 1997, it saved the company $40 to $50 million and resulted in the remanufacture of 30,000 tons of returned machines. According to Bette Fishbein of INFORM, Inc.,[43] it is an approach that can serve as a model for many companies, though it may only be profitable for high- value products. Even Xerox has found that for lower-value equipment such as fax machines, the ARM program generates net costs rather than savings.

*Xerox corporation, Venray, Netherlands.* Venray is the manufacturing headquarters of the Xerox corporation in Europe. There, Xerox operates a massive 'reverse distribution service' to recover old copying machines from 16 European countries. They re-use these machines or re-use their parts, or recycle their materials. They are only sending 5% of the returned materials for waste disposal. In 2000, this operation saved the company $76 million in reduced production costs and avoided disposal costs. This operation will be the subject of a future video: On the Road to Zero Waste. Models of Industrial Responsibility.

*ZERI Breweries, Africa, Sweden, Canada and Japan.*[44] The Zero Emissions Research and Initiative (ZERI) Foundation has helped design breweries that utilize 40 different biochemical processes to re-use everything, including heat, water and wastes. A digester transforms organic wastes into methane gas for steam for fermentation. Spent grain is used to grow mushrooms. Alkaline water supports a fish and algae farm.

*Fetzer Vineyards, Hopland, California, USA.*[45] Fetzer recycles paper, cardboard, cans, glass, metals, antifreeze, pallets and wine barrels; composts corks and grape seeds. Garbage was reduced by 93% in the past several years, with a goal of no waste by 2009.

## 5. THE NEED FOR GOOD LEADERSHIP

When we examine successful cases of Zero Waste, it is clear that leadership has come from all the areas of business, government and non-governmental organizations. We can anticipate even more leadership from the business community because reduction in waste here is indelibly linked to economic benefit.

When we look at communities that have achieved major breakthroughs, we find the key to their success is the fact that the government was prepared to work with community activists to design their programs. This was the case in Canberra, Australia, which first introduced the 'No Waste to Landfill' concept in the mid-nineties and the province of Nova Scotia, in Canada, which has diverted 50% from landfill in just five years. The message is a simple one. As far as a genuine sustainable solutions are concerned, the future belongs to those in local government who put their faith in people, not 'magic machines'.

## 6. CONCLUSION

We would not wish to imply that achieving Zero Waste, or even getting close, is going to be easy. While simple in principle, the execution of these systems requires a lot of hard work, perseverance and creativity from the organizers in the community and in industry. We believe that adopting the Zero Waste goal as a local government or industry policy is the best way to get started. It forces the paradigm shift. It transforms the task from getting rid of waste to saving resources.

We should recognize that currently there is a considerable amount of tension between long-term goals and interim solutions. While the long term goal is to have no landfills, in the interim we need some kind of landfill to handle the non-toxic and non-biodegradable residuals. The worry is that these 'interim' landfills may get fossilized unless citizens keep the pressure on local officials to live up to their Zero Waste commitment. Similarly, there are some commentators who are uneasy about how

much money communities are putting into curbside collection of recyclables, when they believe that ultimately the collection (and re-design) of their packaging should be industry's responsibility.

For industrial officials, in addition to reducing toxic use and resource conservation, it means searching for ways of getting back objects and materials from their customers so that they can be used again. If the huge Xerox corporation can take on the daunting task of recovering its used copying machines (which contain over a 1,000 parts) from all over Europe and clean, repair their parts or recycle their material components, any manufacturer *should be able to do it*. Moreover, when manufacturers hear that Xerox is saving $76 million a year doing this, they *should want to do it!* Moreover, once companies take on such a recovery task, it then feeds into the need to design new products with this ultimate goal in mind i.e. to make them easier to disassemble and re-use their constituent parts.

For the local official, the new Zero Waste paradigm, transforms the old 'waste disposal' task from the distressing one of looking for new landfill or incinerator sites, to a much more exciting one of searching for entrepreneurs who can create viable businesses that utilize discarded objects and materials. This task is better both for the planet and the bureaucratic 'psyche' than attempting to locate a hole in the ground or a non-existent 'magic machine' that will make the problem disappear.

The Zero Waste paradigm also offers another challenge and reward and that is working constructively with citizen activists rather than dreading their appearance at public meetings!

Our experience has convinced us of several things:

a) However daunting the task may appear, the Zero Waste approach is moving our society in the right direction.
b) It is certainly far superior to a reliance on raw waste landfilling or incineration.
c) It will improve as more and more manufacturers learn to combine selling to the present with sharing our limited resources with the future.
d) As far as community responsibility is concerned. People are not the problem. Once they recognize that source separation is easy, that it is in the best interests of their children and those in charge have organized effective systems to handle the materials they separate, they readily cooperate to make the system work.
e) As far as the local economy is concerned the pay off is far greater than the dead end of landfills and incinerators. With the latter a huge amount of money is put into complicated machinery and most of it leaves the community and probably the country, in the pockets of multinational corporations. Whereas, with the low-tech components of the Zero Waste program most of the money stays in the community creating local businesses and local jobs.
f) Finally, we believe that the Zero Waste approach is the one that is most likely to lead to questions on how we should be living on a finite planet.

Today, with so much that we do, we are living on this planet as if we had another one to go to! The average person's most concrete connection to this important realization is our trash. The way we handle our discarded material is a microcosm of the way we handle our planet. If we care about the planet we have to care about the way we treat our discarded materials.

While the economic and environmental benefits of a Zero Waste goal are very clear, ultimately the issue is an ethical one. Alan Durning brilliantly outlines the ethics in his book *How Much is Enough?*[46] He shows how a combination of slick advertising and too much time in front of the TV has trapped so many of us in a mindless binge of consumption. But the good news is that it is not making us very happy. Durning points out that while Americans are consuming in 2000 about five times more per capita than our ancestors in 1900, we are not five times happier. Meanwhile, the gap between our consumption patterns and the poorest fifth of the world's population steadily increases. As Mahatma Gandhi so succinctly and wisely put it, "The world has enough for everyone's need, but not for everyone's greed."

In short we have been seduced into believing that happiness lies in the series of objects we buy, rather than the relationships we nurture with our friends, our loved ones and our community. Thus in our view the antidote to over-consumption is community building.

If we are to succeed, the task of achieving, or moving towards, a Zero Waste society must be seen to be exciting, challenging and fun. If we approach it only with a sense of moral duty and not with a sense of business opportunity, we will probably fail. If we approach reduced consumption with a sense of loss, rather than the opportunity to regain our 'sense of community' we will certainly fail. As far as having fun is concerned, We cannot think of anything quite as challenging and as exciting, as having people in our communities, from businesses, from government and from activist circles, working together to create a community that is determined to share as much of their resources with the future as it can. Especially if we remember to celebrate often.

## 7. ZERO WASTE RESOURCES VIDEOS

- Zero Waste: Idealistic Dream or Realistic Goal? (1999, 58 minutes; 2000, 28 minute version). This video was produced by Paul Connett, of Grass Roots and Global Video (GGvideo) with the help of the GrassRoots Recycling Network. The video conveys a sense of excitement, immediacy and practicality about recycling, re-use, deconstruction, sustainability and zero waste. It has been translated into two languages and distributed, by Essential Action, to activists in 20 countries.
- Target Zero Canada (2001, 51 minutes) covers the launch of a Zero Waste strategy for Canada and elaborates on principles and practicalities of the Zero Waste concept in both Canadian communities and industries. (See description in Section 1, above.)
- On the Road to Zero Waste. This new series of videotapes will spotlight successful initiatives in communities and businesses that illustrate community responsibility, industrial responsibility and political leadership needed to get to Zero Waste. The series is being produced by GG Video and co-sponsored by Waste and Environment (Netherlands) and the GrassRoots Recycling Network (USA).
- Part 1. Nova Scotia: Community Responsibility in Action (32 minutes, 2001). This videotape covers many aspects of a Zero Waste program as described in this paper.

Videos by Paul Connett and GG Video can be purchased from the GrassRoots Recycling Network, by check to GRRN, P.O. Box 49283, Athens GA 30604-9283 (Tel: 706-613-7121), also described at www.grrn.org. All videos are $12 (postage included) for grassroots activists (add $6.00 to cover

international postage) and $25 for libraries, local governments and all others. Check the status of new videos on www.grrn.org/order.

Earlier videos by Paul Connett referred to in the text were produced by Video- Active Productions and are available from GG Video, 82 Judson Street, Canton, NY 13617. Phone 315-379-9200. Fax: 315-379-0448. Email ggvideo@northnet. All videos are $12.00 (postage included. Add $6.00 for international postage).

- WasteWise: A Community Resource Center (1991)
- Community Composting in Zurich (1991)
- Zoo Doo and You Can Too (1988)
- Joe Garbarino and the Marin Resource Recovery Plant (1987)
- Millie Zantow: Recycling Pioneer and the Trashman (1987)

## RECENT BOOKS & REPORTS

- Creating Wealth from Waste, by Robin Murray (London: Demos, 1999).
- Zero Waste Briefing Kit, by GrassRoots Recycling Network (2001).
- Wasting and Recycling in the United States 2000, by Institute for Local
- Self-Reliance for GrassRoots Recycling Network (2000).
- Welfare for Waste: How Federal Taxpayer Subsidies Waste Resources and Discourage Recycling, by GrassRoots Recycling Network, Taxpayers for Common Sense, Friends of the Earth, Materials Efficiency Project (1999).
- Materials Matter: Toward a Sustainable Materials Policy, by Ken Geiser (Cambridge: MIT Press, 2001).

Most items listed above can be previewed and purchased on the GrassRoots Recycling Network website at www.grrn.org/order/order/html.

## ZERO WASTE WEB SITES

- GrassRoots Recycling Network www.grrn.org
- Zero Waste New Zealand www.zerowaste.co.nz
- Target Zero Canada www.targetzerocanada.org

## APPENDIX F ENDNOTES

1 This guide may be downloaded from the internet at www.grrn.org/zerowaste/community

2 The GrassRoots Recycling Network (GRRN) is a North American network of waste reduction activists and professionals dedicated to achieving sustainable production and consumption based on the principle of Zero Waste. Founded in 1995 by members of the Sierra Club Solid Waste Committee, the Institute for Local Self-Reliance and the California Resource Recovery Association, GRRN uses grassroots advocacy, organizing and activism to advance policies and practices based on government, corporate and individual accountability for waste.

3 Renine, C. and A. MacLean (1989). Salvaging the Future, Institute for Local Self-Reliance, ISBN: 0917582373.

4 Platt, B. and N. Seldman (2000). Wasting and Recycling in the United States 2000, Prepared by Institute for Local Self-Reliance for the GrassRoots Recycling Network, 64 pages. Seldman, N. (1995). 'History of Recycling in the U.S.,' Encyclopedia of Energy, Technology and Environment (New York, Wiley Brothers).
5 See Zero Waste New Zealand Trust website: www.zerowaste.co.nz. Contact: Warren Snow, email: wsnow@envision-nz.com
6 Murray, Robin, Creating Wealth from Waste, (London: Demos, 1999). Email: postmaster@ecologika.demon.co.uk (see Resources section).
7 Target Zero Canada, Website: www.targetzerocanada.org
8 Arne Schovers, Waste and Environment; Email waste.and.environment@hetnet.nl
9 The mission of Grass Roots and Global Video is to: (1) expose environmental injustice; (2) communicate scientific controversy with integrity and clarity; and (3) spotlight communities, institutions and companies that are pursuing sustainable solutions to environmental problems (see footnote on page 1 for contact information).
10 See website: www.act.gov.au/nowaste
11 Contact: Del Norte County Solid Waste Management Authority at 707-465-1100 or email: recycle@cc.northcoast.com . The Del Norte County Waste Management Authority Zero Waste Plan (February 2000) can be viewed at ww.grrn.org/order/order.html#del_norte
12 See website: www.zerowaste.co.nz. Contact: Warren Snow, Email: wsnow@envision-nz.com
13 See website: www.ci.seattle.wa.us/util/solidwaste/SWPlan/default.htm
14 Roumpf, J. (1998). 'Wet- and dry -all over,' Resource Recycling, April 1998, 29-34; Kelleher, M. (1998). 'Guelph's Wet-Dry System. Up-to-date costs are now available,' Solid Waste and Recycling, Feb/ March 1998, 34-35.
15 Contact: Dr. Dan Knapp, Urban Ore, Inc., 6082 Ralston Avenue, Richmond, CA 94805. Phone: 510-235-0172, Fax: 510-235-0198; Website: urbanore.citysearch.com/1.html
16 Glen, J. (1998). 'The State of Garbage in America,' BioCycle, April 1998, 32-43.
17 BioCycle, Journal of Composting and Organics Recycling, published monthly by the JG Press, Inc. ISSN 0276-5055. Subscription offices: 419 State Avenue, Emmaus, PA 18049; Tel: 215-967-4135; Website: www.biocycle.net
18 Contact: Mary Appelhof, Flowerfield Enterprises, Inc., 10332 Shaver Rd., Kalamazoo, MI 49024; Tel: 616-327-0108; Fax: 616-327-7009; Website: www.wormwoman.com
19 See website: www.grrn.org/landfills.html#resources
20 Urban Ore, Inc. (1995). Generic Designs and Projected Performance for Two Sizes of Integrated Resource Recovery Facilities, for the West Virginia Solid Waste Management Board, January 1995 (order at www.grrn.org/order/order.html )
21 See Resource Recovery Parks: A Model for Local Government Recycling and Waste Reduction, by Gary Liss for the California Integrated Waste Management Board, 2000 (www.ciwmb.ca.gov/LGLibrary/Innovations/RecoveryPark). Contact: Gary Liss; Tel: 916-652-7850; Email: gary@garyliss.com; Website: www.garyliss.com
22 Contact: John Moore, UODA, 1970 Broadway, Suite 950, Oakland, CA 94612, 510-893-6300 or jmoore@recyclelaw.com
23 Contact: Michael Bender; Tel: 802-223-9000; Email: MTBenderVT@aol.com; Website: www.mercurypolicy.org
24 Ottawa Take It Back! website: city.ottawa.on.ca/gc/takeitback/index_en.shtml . See also www.grrn.org/resources/ottawa_take_it_back.html
25 Commoner, Barry, et al (1988). 'Intensive Recycling: Preliminary Results from East Hampton and Buffalo,' presented at the Fourth Annual Conference on Solid Waste Management and Materials Policy, Jan 27-30, New York City. Copies available from CBNS, Queens College, Flushing, NY 11367. Phone: 718-670-4192.
26 US EPA (1998), Characterization of Municipal Solid Waste in the US: 1997 Update (EPA 530-R-98-007).
27 Glen, J. (1998). 'The State of Garbage in America,' BioCycle, April 1998, 32-43.
28 California Integrated Waste Management Board, Hitting the Goal Year: 2000 Annual Report www.ciwmb.ca.gov/boardinfo/annualreport/2000/default.htm
29 Institute for Local Self-Reliance (1999), Cutting the Waste Stream In Half: Community Record- Setters Show How, for U.S. Environmental Protection Agency, Document EPA-530-R-99-013. See www.ilsr.org/recycling/wrrs.html
30 Roumpf, J. (1998). 'Wet- and dry -all over,' Resource Recycling, April 1998, 29-34; Kelleher, M. (1998). 'Guelph's Wet-Dry System. Up-to-date costs are now available,' Solid Waste and Recycling, Feb/ March 1998, 34-35. Annual reports available from Wet-Dry Recycling Center, 333 Watson Road, Guelph, Ontario, Canada. Tel: 1-519-767-0598; Web: www.recycling.org/guelph/

31 Argue, B. (1998). 'Sustaining 65 percent waste diversion,' Resource Recycling, May 1998, 14-21. Centre & South Hastings Recycling Board, 270 West Street, Trenton, Ontario, Canada K8V 2N3, Tel: 1-613-394-6266; Fax: 1-613-394-6850.
32 Australian Capital Territory, Canberra (1996). 'A Waste Management Strategy for Canberra. No Waste by 2010', ACT Waste, PO Box 788, Civic Square ACT 2068, Australia. Phone: Website: www.act.gov.au/nowaste Contact: Graham Mannall, Waste Reduction Manager, Email: graham.mannall@act.gov.au
33 Personal visit by Paul Connett. Videotape in progress.
34 Provincia di Padua (1996). 'La Raccolta Differenziata Port a Porta. L'esperienza del Conzorzio di Bacino Padova Uno.'
35 Parts of this section have been adapted from the GrassRoots Recycling Network's Zero Waste Briefing Kit (see Resources section).
36 Fishbein, B., J. Ehrenfeld and J. Young (2000). Extended Producer Responsibility: A Materials Policy for the 21st Century, INFORM, Inc. http://www.informinc.org/eprbook.htm
37 See website: www.thebeerstore.ca
38 See website: www.epa.gov/oppt/epp/gentt/resource/total5.html
39 See website: www.metrokc.gov/procure/green
40 See website: www.pprc.org/pprc/pubs/topics/envpurch.html
41 See website: www.collinsaikman.com
42 See website: www.xerox.com
43 Fishbein, B., J. Ehrenfeld and J. Young (2000). Extended Producer Responsibility: A Materials Policy for the 21st Century, INFORM, Inc., page 84. http://www.informinc.org/eprbook.htm
44 See website: www.zeri.org/systems/brew.htm
45 See website: www.fetzer.com, then see 'Fetzer Story' then 'Environmental Philosophy.'
46 Durning, A. (1992). How Much is Enough? The Consumer Society and the Future of the Earth. Worldwatch Environmental Alert Series, W.W. Norton, NY.