Prepared for the Government of the Northwest Territories

Inventory and Feasibility Assessment of Electronic Waste Recovery in the Northwest Territories

Final Report

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Inventory and Feasibility Assessment of Electronic Waste Recovery in the Northwest Territories

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LIST OF ABBREVIATIONS

ACES	Atlantic Canada Electronics Stewardship
ARMA	Alberta Recycling Management Authority
BCUOMA	British Columbia Used Oil Management Association
CAP	Canada-wide Action Plan
CCME	Canadian Council of Ministers of the Environment
EE	Electronic Equipment
EHC/EHF	Environmental Handling Charge / Environmental Handling Fee
ENR	Northwest Territories Department of Environment and Natural Resources
EPR	Extended Producer Responsibility
EPRA	Electronic Products Recycling Association
EPSC	Electronic Product Stewardship Canada
ESABC	Electronic Stewardship Association British Columbia (now EPRA BC)
GDP	Gross Domestic Product
GEEP	Global Electric Electronic Processing
GNWT	Government of the Northwest Territories
IFO	Industry Funding Organization
NWT	Northwest Territories
OES	Ontario Electronic Stewardship
OTS	Ontario Tire Stewardship
PEI	Prince Edward Island
PRO	Producer Responsibility Organization
PWS	Northwest Territories Department Public Works and Services
SAO	Senior Administrative Officer
SARC	Saskatchewan Association of Rehabilitation Centres
SWEEP	Saskatchewan Waste Electronic Equipment Program
USEPA	United States Environmental Protection Agency
WEEE	Waste Electrical and Electronic Equipment

DISCLAIMER

Dessau has prepared this report at the request of the Government of the Northwest Territories. The recommendations, views, opinions and findings in this report are those of the consultant and do not necessarily reflect the official policy or position of the Government of the Northwest Territories and its employees. The recommendations, views, opinions or findings stated in this report are based on circumstances and facts as they existed at the time Dessau performed the work. Changes in these circumstances or facts may affect the recommendations, views, opinions and findings contained in this report.

EXECUTIVE SUMMARY

Since 2005 the Department of Environment and Natural Resources (ENR) has aggressively pursued the development and expansion of waste reduction and recovery programs in the Northwest Territories (NWT). The design development and implementation of an electronic waste (e-waste) program is the last item in the five year plan to be addressed.

The current study intends to investigate the feasibility of addressing e-waste recovery in the NWT and to investigate whether and how an Extended Producer Responsibility (EPR) program for e-waste could fit into a northern context and/or what other options may exist for program structure and cost recovery. This undertaking is consistent with Waste Reduction and Recovery Program commitments and with the commitments in-principle made to the Canadian Council of Ministers of the Environment (CCME) Canada-wide Action Plan (CAP) for EPR in 2009.

There are two primary objectives for this study:

- To identify the amount of e-waste in various categories and prepare an inventory of existing and future waste electronics which could be managed by an e-waste program.
- To undertake a feasibility assessment to determine the best approach to developing and delivering an effective, efficient, transparent, accountable, and self-sustaining e-waste management system for residents of the NWT that also accrues social and/or economic benefits within the NWT and to assess and recommend whether an EPR framework could work.

Estimation of the quantity of historic and future e-waste in NWT

The study was initiated by an intensive literature review to identify information on quantities of electronics equipment and product categories handled in other programs. The categories of electronic equipment (EE) covered by the study are:

- Desktop and portable computers and peripherals;
- Desktop printers;
- TVs and Display devices;
- Personal or portable audio/video systems;
- Vehicle audio/video systems (aftermarket);
- Home theatre in a box systems;
- Home audio/video systems;
- Non-cellular phones;
- Cellular phones and wireless devices.

The data collection was supplemented by direct contact with managers of other recovery programs in Canada, US and Europe, including all e-waste recovery programs in Canada. Market research firms with expertise in media and communication technologies were also contacted. Based on theses sources of data:

- It is estimated that 36,696 units of electronic equipment (EE) were sold to NWT residents in 2011 (not including cell phones and other wireless devices).
- Based on available standard unit/kg data this represents approximately 236 tonnes of equipment.

In addition to the annual sales figures in NWT, the total functional and non-functional EE currently in NWT were estimated. This estimation is primarily based on three calculation methods based on different assumptions. Considering their limitations, the analysis of the three estimations did not allow selection of one method. However, it is possible to estimate that the total number of selected categories of EE in NWT range from a minimum of 176,358 to a maximum of 323,959 items.

Historic and future e-waste in the NWT which will need to be managed as part of any e-waste program are based on 2012 estimated numbers of EE items, collected historic sales figures and calculations using the Ontario Electronic Stewardship (OES) discard model.

Table ES-1 displays the estimation of the quantity of historic and future e-waste in NWT. It is possible that a large number of historic items (2009-2011) has been managed through existing practices in NWT, such as discarded in garbage or returned to existing e-waste recovery initiatives. Storage of end-of-life units is another consideration. These stored quantities and tonnages are expected to be a factor at the beginning of any e-waste collection program but will be less of an issue over time as units which have been stored in anticipation of a program are collected for recycling.

Table ES-1: Estimated historic generation of e-waste

CATEGORY	2009-2011		2012		2016		2020	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Desktop computers	3,991	6,506	1,336	2,178	1,469	2,395	1,615	2,633
Portable computers	16,952	39,622	5,676	13,267	6,241	14,587	6,862	16,038
Printers/Fax Machines/Peripherals	12,309	16,488	4,121	5,521	4,531	6,070	4,982	6,674
Display devices	9,239	16,485	3,093	5,520	3,401	6,069	3,740	6,673
Personal or portable audio/video systems	27,044	32,123	9,055	10,756	9,956	11,826	10,947	13,003
Vehicle audio/video systems (aftermarket)	2,335	3,053	782	1,022	860	1,124	945	1,236
Home theatre in a box systems	1,460	2,006	489	672	537	739	591	812
Home audio/video systems	7,380	18,542	2,471	6,208	2,717	6,826	2,987	7,505
Non-cellular phones	9,402	22,435	3,148	7,512	3,461	8,259	3,806	9,081
Cellular phones and wireless devices	8,687	34,267	2,909	11,474	3,198	12,615	3,516	13,871
TOTAL Estimated e-waste generation (units)	98,799	191,527	33,081	64,128	36,372	70,510	39,992	77,526
TOTAL Estimated e-waste generation (kg)	514,882	950,661	172,396	318,307	189,552	349,982	208,415	384,810
TOTAL - Estimated e-waste generation (kg/capita)	12	23	4.2	7.7	4.6	8.4	5.0	9.3

Description of program options

Five basic options for structuring an e-waste program were identified and evaluated. Four options include an EPR component. The fifth option, which is product stewardship, public sector operated program, involves a publicly managed and operated program similar to the existing beverage container program.

The primary options which were reviewed are as follows:

- EPR with full producer responsibility for funding and operation

Producers would be given a legal obligation to collect and recycle designated end of life electronics in the NWT and meet program performance targets and reporting obligations. Final decisions on program design, funding, including any fees and how they are collected, and program operation would be a responsibility of producers themselves.

- Directed EPR

Producers would have the primary operational and funding responsibility for the EPR program, but the GNWT would prescribe key program elements such as possibly using the existing beverage processing and depot network for e-waste collection.

- Shared responsibility: Public Sector Operation with Full Producer Funding

The public sector would have full responsibility for the establishment, operation and direct costs of the e-waste program including the delivery of collected e-waste to a final processor and payment for recycling. Producers would be responsible to fund the program and would pay the public sector operators for their net program costs based on an agreed upon funding formula.

- Shared responsibility: Divided Operational Responsibilities/Collection and Recycling Split

Operational responsibilities for a program and the associated funding for operations would be divided between the public sector and producers. Producers would be given responsibilities for designated e-waste under an EPR regulation but with only a partial share of responsibility for overall operations and financing. The GNWT would determine the degree of shared operational responsibilities with each partner responsible to fund their own operational program element.

- Product Stewardship program: Public sector operation

The e-waste program would be operated as a stewardship program by government or an independent agency with no direct producer involvement in either program funding or operations. Funding would likely be achieved through the placement of visible fees charged to consumers at point of sale.

Costs and benefits of an e-waste recovery program

Costs of an e-waste recovery program

Operating and overhead costs are estimated based on Electronic Stewardship Association British Columbia (ESABC), Saskatchewan Waste Electronic Equipment Program (SWEEP), OES and

Atlantic Canada Electronics Stewardship (ACES) programs' reported costs per tonne[1]. The dollar values found in the programs' 2011 annual reports were used to get a minimum-maximum cost range. This enables the lowest and highest program costs to be taken into account when estimating potential program costs for the NWT.

Since the cost of living in the NWT is substantially higher than the Canadian average, the 2009 Cost of Living Statistics provided by the NWT Bureau of Statistics were used to determine how costs should be adjusted to the NWT specific context.

Overall program costs, including overhead and operating costs are estimated to range between $357,000 and $579,000 per year. Table ES-2 provides a summary of the estimated program costs.

Table ES-2 Estimated NWT Program Costs Summary

COSTS CATEGORY	COST ESTIMATE FOR NWT	
	MIN. ESTIMATE	MAX. ESTIMATE
Total Operating Costs	$1,323 / T	$1,720 / T
Collection	$251 / T	$308 / T
	$59,000 / yr	$73,000 / yr
Transportation	$382 / T	$605 / T
	$90,000	$143,000
Processing/Recycling	$690/ T	$807/ T
	$163,000 / yr	$191,000 / yr
Total Overhead Costs	$186 / T	$630 / T[2]
Administration	$115 / T	$280 / T
	$27,000/ yr	$66,000/ yr
Communication & Education	$67 / T	$288 / T
	$16,000/ yr	$68,000/ yr
Other expenses	$4 / T	$62 / T
	$1,000/ yr	$15,000/ yr
Total Program Costs ($)	$357,000	$555,000
Total Program Costs (Per Tonne)	$1,509 / T	$2,349 / T
Total Program Costs (Per Capita)	$8.60	$13.40

As an example for Year 1 of a program, when start-up costs are added to these figures, estimated program costs range from $371,000 to $594,000 for Year 1 of the program or $1,570 to $2,514 per tonne. Another way to express these costs is between $8.95 and $14.34 for each resident of the NWT.

[1] Those four programs were selected because cost breakdown was made available in their annual reports.

[2] Minimum and maximum overhead cost estimates correspond to the sum of minimum and the sum of maximum costs estimates for administration, communications and other expenses for the NWT as show on the lines below.

Benefits of an e-waste recovery program

The benefits of a collection and recycling program for NWT e-waste are described on the basis of benefits to the environment, overall economic activity and community awareness. Benefits are described in qualitative terms and not financial terms.

In terms of environmental benefits, recycling e-waste enables an overall lifecycle reduction in GHG emissions, reduces the need for extraction of new raw materials, extends the lifetime of landfills and reduces environmental and human health liabilities through the reduction of global e-waste loadings. Moreover, as demonstrated by the successful beverage container recovery program, e-waste recovery would provide additional social benefits by enabling local full and part-time employment which in turn builds local economies, promotes the environmental education and awareness of citizens as well as promotes a sustainable lifestyle.

Feasibility assessment of options

To facilitate a comprehensive and thorough analysis of the options previously described, the following methodology and steps were undertaken resulting in a quantitative ranking of the five options. It is upon this ranking and a subsequent discussion of program implementation issues that recommendations for the GNWT are built. The steps are described as follows:

Establishment of principles, goals and objectives

A set of core principles and goals and objectives for an e-waste program in the NWT were first identified in consultation with GNWT Environment and Natural Resources (ENR). The principles reflect existing GNWT environmental and waste management policy as set out the Waste Reduction and Recovery Act (WRRA) adopted in October 2003, policies expressed through operational waste diversion programs and further reflect the GNWT's adoption of the CCME's Canada-wide Action Plan for EPR in October 2009. The principles, goals, and objectives are:

Principles

- The natural environment continues to be protected and enhanced;
- The collection, recycling and environmentally sound management of electronic waste is a responsibility of producers with roles to be played by distributors, retailers and consumers;
- Adaptability and innovation are the foundations of waste electronic equipment best management practices.

Goals and objectives

- Maximize the recovery and recycling of electronic waste and reduce the overall volume of waste disposed to landfills;
- Implementation and operation of an electronic waste recovery and recycling program are revenue-neutral for the GNWT;

- All residents of the NWT have reasonable access to local electronic waste collection systems. The collection and recycling of electronic waste results in minimal impact to existing electronic equipment sales and existing recycling infrastructure;
- Increase the public awareness and understanding of multi-material waste recovery and recycling and encourage environmentally responsible and ethical purchasing;
- The recovery and recycling of electronic waste results in new local employment and economic development opportunities for residents;
- The NWT electronic waste recovery and recycling system is integrated to the extent practicable with electronic waste recovery and recycling programs in Alberta and British Columbia;
- Program design implementation and administration is simple and efficient, and can be effectively managed;
- E-waste collection and recycling operates transparently and meets established program performance measurement and reporting requirements.

Identification and weighting of evaluation criteria

Drawing on the principles, goals and objectives, a number of evaluation criteria were identified, grouped by program effectiveness, program efficiency, legality and program implementation. These criteria were also weighted with 15, 10 or 5 points out of a possible 100 to indicate their relative importance.

The evaluation criteria and the point weightings are set out in the table ES-3 below.

Table ES-3 Evaluation criteria and point weighting

CRITERIA CATEGORY	CRITERIA	POINTS
Program effectiveness 50	Ability to reduce and divert electronics from landfills, responsibly recycle e-waste, and meet targets	15
	Service to residents	15
	Ability to measure performance	10
	Program transparency and accountability	10
Program Efficiency 30	Least cost and risk for GNWT	10
	Impact on existing retail market and consumers	10
	Ease of administration and flexibility	5
	Respect for existing infrastructure	5
Legality 10	Regulatory authority	5
	Clarity of roles and responsibilities	5
Program implementation 10	Addresses municipal and community concerns	5
	Program communication	5
Summary score		100

Evaluation of program options

In a final step, the five program options were evaluated using the Holmes Ordinal Evaluation Method. The Holmes methodology has been used since 1971 and was developed and first used by the Jack Holmes Planning Group under contract to the UK Secretary of State for Scotland as a process for evaluating a number of proposed new road alignments. The process has been widely used, particularly in urban planning and development studies, to evaluate and rank various proposals and options. It is based on grouping criteria based on greater and lesser importance as and ranking options as 1st, 2nd 3rd place etc, against the criteria.

Once rankings are given for each evaluation criterion, each option is granted a number of points depending on the criterion's weight. The sum of the points equals a mark out of 100.

Summary Score

Table ES-4 provides a summary of the rankings obtained by each option for the evaluation criteria.

According to the evaluation of the five different program options, the directed EPR model ranks first, followed by the Product Stewardship/ Public Sector Operation, while the full EPR model places third. The Shared Responsibility options come in fourth and fifth places.

Table ES-4 Summary score of the evaluated program options

CRITERIA CATEGORY	CRITERIA	PRODUCT STEWARDSHIP: PUBLIC SECTOR OPERATION	SHARED RESPONSIBILITY : DIVIDED OPERATIONAL RESPONSIBILITIES/ COLLECTION AND RECYCLING SPLIT	SHARED RESPONSIBILITY : PUBLIC SECTOR OPERATION WITH FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Most important	Ability to reduce and divert electronics from landfills, and responsibly recycle e-waste	3	3	1	1	3
	Service to residents	1	1	4	1	4
Important	Least cost and risk for GNWT	3	3	3	1	1
	Impact on existing retail market and consumers	4	1	1	4	1
	Ability to measure performance	2	4	4	1	2
	Program transparency and accountability	1	3	3	1	3
Somewhat important	Ease of administration and flexibility	1	5	4	3	1
	Addresses municipal and community concerns	3	3	1	1	5
	Respect for existing infrastructure	1	3	3	1	5
	Regulatory authority	1	2	2	2	2
	Clarity of roles and responsibilities	1	5	4	3	1
	Program communication	3	5	4	1	1
Summary score	Out of 100	78	63	65	89	70

Option implementation issues

Regardless of the option chosen for the end-of-life management of electronics waste in the NWT there are a number of issues which cut across and are common to all of the options evaluated. These are issues largely related to option implementation and they will need to be considered as the GNWT determines the next steps that it wishes to take towards the development and implementation of an electronics waste program. In the case of each issue a set of key actions are identified as next steps.

Issue: Electronics Purchased Outside the NWT

Key actions:

- Initiate further study to determine the extent of NWT resident purchases in Alberta and secondarily in other jurisdictions;
- Approach Alberta Environment and Alberta Recycling Management Authority (ARMA) for discussion on fees collected from NWT residents;
- Initiate discussions with the Electronics Products Recycling Association (EPRA) and ESABC on the possible partnership of a NWT program with existing provincial extended producer responsibility programs.

Issue: Levels of service and public access to collection system

Key actions:

- Set a goal for the overall territorial level of public access (percentage of population to be served by a program);
- Develop standards for the provision of service to the various sizes of community in the NWT (type and frequency of service to different size communities).

Issue: Building on existing recycling infrastructure

Key actions:

- Undertake a detailed review of the capacity and possibilities of the existing beverage depot and processing network being used as a basis for an e-waste collection system;
- Develop depot standards and operational and management terms and conditions to operate a depot.

Issue: Transportation Logistics

Key action:

- Identify companies available and qualified to provide transportation services by barge, air and road (year round and winter).

Issue: Cost internalization or visible point of purchase fees

Key action:

- Review the legal authority necessary to mandate cost internalization of fees along similar lines to the approach taken by Quebec.

Issue: Return to retail

Key actions:

- Recommend in the guidance for stewardship plans that return to retail be considered;
- Review any applicable regulations which might have a bearing on the operation of a return to retail depot.

Issue: Phasing in program options

Key action:

- Develop the listings of designated products and their phasing based on comparable implementation steps taken in British Columbia.

Issue: E-waste processors and end markets

Key action:

- A standard for e-waste processing should be established or referenced and used as the benchmark for selecting e-waste processors for all materials collected in the NWT.

Issue: Historic and orphan products

Key actions:

- Work with public institutions, businesses, government departments and communities which may have significant stockpiles of waste electronic equipment in order to reduce the quantities of waste EE prior to implementation of any recovery program.
- Ensure that provision is made for handling extra volumes at the beginning of a program and make addressing this issue a requirement of any stewardship plan.

Issue: Program Development and Oversight

Key action:

- The GNWT should review its existing resource and staff capacity to develop, implement and oversee an e-waste program and determine what capacity is required if current resources are not sufficient.

Issue: Performance Measurement and Reporting

Key action:

- Existing key performance indicators and auditing protocols are available from other e-waste programs to adopt as the performance measures and reporting protocols for an e-waste program in the NWT.

Issue: Reduction, Reuse and Refurbishment

Key action:

- That stewardship plans required by the GNWT must address reuse and refurbishment and that an e-waste program includes support and encouragement, as is done in Ontario.

Conclusion

The two main objectives of this report were to conduct an inventory of existing and future electronic equipment in the NWT and to assess the feasibility and options for addressing electronic waste. In summary the report first focuses on defining the main issue parameters and the development of an e-waste inventory and a methodology, including sales estimates, historic and future e-waste quantities per product category. This allows a determination of the quantities available for collection and recycling, now and in the future. The current state of e-waste management and the other available recycling infrastructure in place in NWT is also portrayed.

The review of different e-waste and comparable initiatives in other jurisdictions and in remote communities confirmed that there was only limited directly applicable or comparable program experience elsewhere that could be applied to the NWT's situation. This review also made possible the drafting of product designation phase-in and timeline setting for program implementation. The authority provided under the *Waste Reduction and Recovery Act* as well as other Canadian regulatory frameworks regarding stewardship and EPR programs were also reviewed.

Five e-waste program options were then fully described and assessed using 12 evaluation criteria and a series of issues to be considered in the specific NWT context were presented.

The primary conclusion of the study and the analysis presented is that the GNWT should consider the establishment of a regulated EPR program for e-waste in the NWT following the Directed EPR model. This option offers the financial advantages to the GNWT of full EPR while allowing public control on the way the program is implemented.

The following concluding sections draw together the key findings of the feasibility assessment, list some final recommendations for implementing an e-waste collection and recovery program in NWT and suggest priority next steps to be followed to facilitate program implementation.

Key Findings

Legislative and regulatory framework/ Cost internalization

The ability of the GNWT to mandate the establishment of an EPR program needs to be confirmed with NWT legal services. A regulatory framework to allow an establishment of a Directed EPR program will need to be developed by GNWT and it would need to include the service requirements acceptable to the GNWT that will ensure communities across the NWT's five regions are provided with an appropriate level of e-waste recycling service and an appropriate level of public access.

Visible point of purchase fees to support the operations of an e-waste collection program applied only on purchases made in the NWT through internet sales and from NWT retailers may not be sufficient to cover the entire cost of such program in the NWT given the significance of electronic equipment purchased outside the NWT. It is recommended that a cost internalization approach, as adopted in Quebec and in New Brunswick for paint and for electronics in Quebec be considered for a waste electronics program in NWT..

Product category phase in

It is recommended that a new end-of-life electronics program be implemented in at least two phases. The ESABC experience suggests two phases and two groupings of product categories:

- Phase 1: Display devices, Desktop computers, Laptop computers, Printers/Fax machines/Peripherals;
- Phase 2:. Portable Audio/Video and Recording, Home Audio/Video Systems, Home Theatre in a Box, Cellular phones, Non-cellular phones, After-market vehicle audio/video systems.

It is recommended that discussions be initiated with public institutions, businesses and communities who may have significant stockpiles of waste electronic equipment in order to reduce and schedule the quantities of end-of-life electronics prior to implementation of any recovery program. It is recommended as well that a Directed EPR e-waste program make provisions to handle extra volumes at the beginning of the program.

Collection, transportation and processing of materials

Collection

Managing e-waste in all NWT communities appears feasible. However, because of wide variations in community size, facilities and local resources variations in the level of collection service will need to be developed and offered. Depending on the program model chosen or mandates required by the GNWT, existing infrastructure, such as Beverage Containers Depots, and return to retail may be used in an e-waste collection program. It is recommended that goals or mandates be set in the regulations and/or stewardship plan requirements for the overall level of public access.

It is suggested as well that depot standards, operational and management terms, and conditions to operate a depot be developed based on EPRA's Collection Site Approval Program (CSAP).

Transportation and processing

Transportation will be an important part of program expenditure. Means to mitigate transportation costs include preferred backhaul rates, which exists with some shipping companies, sufficient volumes, proper materials handling and careful shipment planning. Under the Directed EPR model producers would be entirely responsible for transportation costs and logistics. It is recommended that companies qualified to provide transportation services and that options to combine shipment of waste electronic equipment with collected beverage containers be investigated.

Standards for reuse, refurbishing and processing

Any stewardship plan required by the GNWT should address reuse, refurbishment, and recycling in a similar way as the current approach in Ontario, and using a similar facility approval approach as the EPSC standards for processors. It is recommended that such standards be used as the benchmark for selecting e-waste processors for all materials collected in the NWT.

Roles and responsibilities

In a Directed EPR program the following are the core elements and requirements that must be addressed by producers in a producer responsibility program:

- Full producer responsibility for program management and operation costs so that costs are not borne by government or taxpayers;
- Follows the 3R hierarchy, i.e. reuse the material before it is recycled;
- Respects environmental objectives and requirements;
- Consumers are offered equitable opportunities to participate in the program regardless of their location with service and access standards set by the GNWT;
- Orphan and historic products are managed by the program in the same fashion as all waste electronics;
- Reporting based on CCME's CAP for EPR performance indicators;
- Communication initiatives to ensure public awareness and support participation.

Under a Directed EPR program the following are the key responsibilities for GNWT:

- Develop a clear regulatory framework and requirements for stewardship plans;
- Provide staff resources to support the program's development and implementation and, subsequently provide for the continuing program oversight;
- Ensure NWT communities have reasonable access to collection without charge;
- Ensure environmental objectives and program performance measures and targets are met;
- Provide guidance on stewardship plans and EPR program elements as set out in the CCME Canada-wide Action Plan for EPR.

Recommendation for Priority next steps

In conclusion the following priority next steps for program implementation are presented for consideration:

- Verify legal authority and initiate any of the changes that might be necessary;
- Review GNWT's existing resource and staff capacity to develop, implement and oversee an e-waste program and determine if any additional capacity is required;
- Undertake a detailed review of the existing capacity and potential for the beverage container depot and processing network to be used as the foundation for an e-waste collection program;
- Investigate companies for transportation and haulage opportunities and prices;
- Initiate discussions with Electronics Product Recycling Association (EPRA) regarding possible development of an NWT EPR e-waste program;
- Investigate and set service and public access standards for collection;
- Initiate discussions with Alberta Environment and ARMA regarding fees paid on products sold in Alberta but used and recycled in the NWT.

1 INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

Since 2005 the Department of Environment and Natural Resources (ENR) has aggressively pursued the development and expansion of waste reduction and recovery programs in the Northwest Territories (NWT). The first program, the Beverage Container Recovery Program, was implemented in November 2005. Then in 2008, the Department sought public input on potential areas of program expansion, the result of which has formed the basis of ENR's five-year *Waste Reduction and Recovery Program* plan for development from 2008 to 2013. As part of the five-year plan, the Beverage Container Regulations were amended in 2010 to include milk and milk substitutes. Also, in 2010 the NWT became the first provincial or territorial jurisdiction in Canada to adopt regulations specifically targeting the reduction of single-use retail bags. The design development and implementation of an electronic waste (e-waste) program is the last item in the five year plan to be addressed.

The current study intends to investigate the feasibility of addressing e-waste recovery in the NWT and to investigate whether and how an Extended Producer Responsibility (EPR) program for e-waste could fit into a northern context and/or what other options may exist for program structure and cost recovery. This undertaking is consistent with Waste Reduction and Recovery Program commitments and with the commitments in-principle made to the Canadian Council of Ministers of the Environment (CCME) Canada-wide Action Plan (CAP) for EPR in 2009. The CCME commitments relate to development of legislation and/or regulations and the implementation of EPR for a number of identified priority products including e-waste. The CAP recognizes the unique situations and issues faced by the northern territories and that EPR may not be the best approach for all products or product categories.

The initiative is the first time that EPR has been formally investigated as an option for the management of e-waste in the Canadian North, although a response to the challenge of e-waste is also being considered in the Yukon. The project will guide thinking about the collection and diversion of the priority wastes identified in the CAP and the possible use of EPR and set benchmarks not only for e-waste management but also for other products which could also be managed through a stewardship approach or an EPR regulation. The project results will be of interest to the other territorial governments, the electronics industry and to prospective industry stewards in other product categories.

There are two primary objectives for this study:

- To identify the amount of e-waste in various categories and prepare an inventory of existing and future waste electronics which could be managed by an e-waste program.
- To undertake a feasibility assessment to determine the best approach to developing and delivering an effective, efficient, transparent, accountable, and self-sustaining e-waste management system for residents of the NWT that also accrues social and/or economic benefits within the NWT and to assess and recommend whether an EPR framework could work.

1.2 DEFINITION OF E-WASTE AND ELECTRONICS PRODUCERS

1.2.1 E-waste Definition

Definitions of used electronic items, or e-waste, vary from place to place. Therefore, it is important to clearly define the scope of items included in the current study. ENR identifies the Atlantic Canada Electronics Stewardship (ACES) accepted product list as a reference for the quantification and qualification of electronic equipment (EE) in NWT. This list is presented in Table 1. Cell phones are also included in the e-waste targeted by ENR. Cell phones are not included in ACES list because they are managed separately by the Canadian Wireless Telecommunications Association.

Table 1 NWT Proposed E-Waste Product List (ACES accepted items + cell phones)

E-WASTE CATEGORY	ITEMS INCLUDES
Desktop computers	Includes Central Processing Units (CPUs), cables and other components within the computer. This includes desktop computers, desktop computers acting as servers, and all cabling.
Computer peripherals	Includes both wired and wireless manual input devices such as keyboards and/or pointing devices such as mice and trackballs.
Portable computers	Includes portable computers such as notebook, laptop, notebook and tablets.
Desktop printers	This includes printing devices that are designed to reside on a work surface, and includes various printing technologies, including Laser & LED (electrophotographic), ink jet, dot matrix, thermal, dye sublimation and "multifunction" devices that may copy, scan, fax, or print. Stand-alone desktop scanners and fax machines are also included in this category.
Display devices	Any display device for displaying images from computers and/or televisions, including professional displays. This includes various display technologies, such as traditional Cathode Ray Tube (CRT), flat panel (LCD and plasma) or rear projection.
Personal or portable audio/video systems	Includes mobile or portable devices primarily for personal use including computer/docking speakers; portable stereos/tape players/radios; clock radios; personal CD players, portable audio recorders/portable tape/radio players; headphones; MP3 players; solid state voice recorders; digital cameras; digital picture frames and video cameras/camcorders.
Vehicle audio/video systems (aftermarket)	Includes car stereo amplifiers, equalizers, speakers and in-dash audio/video components.
Home theatre in a box systems	Includes pre-packaged speaker/amplifier systems for use with any manner of video or television display to create a home theatre experience.
Home audio/video systems	Includes VCRs and DVD players; mini/mid/full size package systems; single/multi CD players; digital cable equipment; satellite cable equipment; speakers (home speakers; home theatre speakers and multi-media speakers), amplifiers, receivers, data projectors and similar audio/video systems.
Non-cellular phones	Includes wired telephones; cordless telephones and telephone answering machines.
Cellular phones and wireless devices	Cell Phones, “smart phones”, pagers, and beepers, including Includes batteries, headsets, and walkie-talkies.

While some other e-waste management programs in Canada and elsewhere have included other kinds of electrical equipment and appliances in the scope of their programs, these materials are not the focus of the current study.

1.2.2 Electronics producer definition

All jurisdictions with electronics EPR programs have addressed the issue of identifying who is the producer. In a situation where an electronics program is operated on the stewardship model by the GNWT or by a public authority (see Section 6.5) the definition of producer is somewhat less relevant because the focus is instead on anyone who sells or supplies in or into the jurisdiction. In a product stewardship model sellers and suppliers would be required to register (as they are in the Alberta Recycling Management Authority (ARMA) program) and fees would be applied at the point of purchase[3]. While it is important to define who is selling and supplying into the jurisdiction, the more important issue in the case of a product stewardship program is a clear definition of what products are covered by the program.

The producer definition is however of critical importance in EPR programs for identifying the responsible party and for determining where in the supply chain program and what financial obligations are to be met. There are a number of precedents, which could be followed by the GNWT, for how regulations can describe producers. The definitions shown in this section were selected because their phrasing was clear and comprehensive. One provincial definition was not selected over the other. Moreover, Dessau does not intend to select one definition as the most appropriate. In this report's rationale, the definitions below complement one another. ENR will need to review the specific language used with legal services. Examples could be drawn from the following definitions, including the one contained in the British Columbia Recycling Regulation (Regulation 449/2004, as amended) in Part 1, Section 1. A "producer" is:

> *(i) a person who manufactures the product and sells, offers for sale, distributes or uses in a commercial enterprise the product in British Columbia under the manufacturer's own brand,*
>
> *(ii) if subparagraph (i) does not apply, a person who is not the manufacturer of the product but is the owner or licensee of a trademark under which a product is sold, distributed or used in a commercial enterprise in British Columbia, whether or not the trademark is registered, or*
>
> *(iii) if subparagraphs (i) and (ii) do not apply, a person who imports the product into British Columbia for sale, distribution or use in a commercial enterprise;"*

Under this regulation the emphasis is on the manufacturer who brands a product or the manufacturer who licences or trademarks a product (sections i) and ii)) which is sold or imported into British Columbia. Under this definition it is possible for a retailer to be an obligated producer if that retailer brands their own products and sells them in their own retail stores. This would likely be the case with a larger national retailer such as Sony, The Source or Future Shop. Small independent retailers generally do not brand their own products and are therefore not an obligated party. In any case, an increase in the quantity of leased products (modems, cell phones, satellite systems, etc.) would not affect the definition of producer. The producer is still the producer regardless of whether the item is sold, leased or rented. The producer is the first one who

[3] A more detailed discussion of the product stewardship model and the distinction between producer and seller and supplier is contained in Section 6.5.

introduces a product on the market. This is different than the situation with a public policy product stewardship model where a retailer could be an obligated party, required to register as a seller or supplier, and required to remit an environmental handling fee applied at the point of purchase to the government or government agency.

A similar approach with an emphasis on brand owners is used in Nova Scotia. In its simplified guide (September 2009) to the designation of electronics for EPR under the province's waste management regulations (Nova Scotia regulation 61/2007, as amended) brand owners are identified as follows:

> *"Brand owners are persons or businesses that make and/or distribute electronic products in Nova Scotia, including those that assemble new electronic products (e.g. computers) from component parts and sell them. All brand owners, small and large, including those located out of province, will have to comply with the regulations"*

In this case the retailer who brands their own product by assembling components is covered by the EPR obligation. While retailers are not identified as obligated parties, Nova Scotia has explicitly provided guidance on the role of electronics retailers. Retailers are not directly responsible for the designated products but they do have a critical role to play in the program as follows:

> *". . . . .retailers will be required to :*
>
> *1) ensure that brand owners of affected products they sell are covered under an approved stewardship program. If the brand owner does not have an approved program the retailer will not be able to sell their products;*
>
> *2) provide information at the point of sale on where customers can take their old products for recycling. This information will be provided by brand owner/third parties operating the program"*

In Prince Edward Island a producer is defined as one of the following:

> *1) Manufacturer;*
>
> *2) First importer;*
>
> *3) Distributor;*
>
> *4) Multi-provincial retailer;*
>
> *5) PEI-only retailer;*
>
> *6) Internet and/or catalogue seller;*
>
> *7) Computer assembler;*
>
> *8) Value-added reseller; or*
>
> *9) Licensee or owner of a regulated electronic product brand name*

The PEI program takes a similar approach to Nova Scotia and does not allow the retailer to sell electronics belonging to a brand owner who is not part of the approved stewardship plan and a participant in the Atlantic Canada Electronics Stewardship (ACES) program which services both PEI and Nova Scotia (see Section 7.5). Retailers under the ACES program are obligated to apply the program's environmental handling fee as a separate charge on the invoice or to include it in the price provided they inform the customer that such a fee is being applied.

The British Columbia, Nova Scotia and Prince Edward Island approaches to identifying producers with their focus on brand owner manufacturers could be used as models in the NWT if an EPR approach is taken. In all the examples retailers operating within the jurisdiction are not identified as the primary party responsible for the designated electronics. The only exception to this is the retailer who brands their own product. Retailers do have an important role to play in both helping to enforce the regulations, by not selling products of a brand owner who does not meet regulatory obligations, by acting as an important point of contact with consumers to help promote the program and by collecting the environmental handling fee that is commonly charged.

1.3 METHODOLOGY

1.3.1 Data Collection

The study was initiated by an intensive literature review to identify information on quantities of electronics equipment and product categories handled in other programs. A complete list of the documents reviewed is provided in Appendix 1. Electronic copies of all the documents obtained during the literature search will be provided to ENR.

The data collection was supplemented by direct contact with managers of other recovery programs in Canada, US and Europe, including all e-waste recovery programs in Canada. Market research firms with expertise in media and communication technologies were also contacted.

1.3.2 Estimation of Quantities

1.3.2.1 Sources of data and limitations

The data collection process has underlined the fact that data on the sales of electronics and the availability of end-of-life electronics for collection and recycling are not specifically available for the NWT. In addition sales figures are very difficult to obtain from retailers or retailers' associations. Costs of the available sales data held by market research firms was considered beyond the scope of the project's budget, especially for computers and cell phones. In addition, the available collected sales data do not provide any figures for Canada's three territories and if purchased would have to be prorated to the NWT from national numbers.

The challenge of finding good data is not unique to this study. All of the electronics waste programs in Canada operate under some similar constraints. While data on product sales is tracked in the operating e-waste programs, particularly as sales are commonly subject to a fee to fund the program, data on the availability of end-of-life products for collection and recycling is challenging. This challenge currently complicates the ability to properly measure program performance against diversion targets. The electronics industry correctly argues that the life cycle of electronic products is much more complex and lengthy than a short lived product such as a beverage container. In the case of a beverage container, collection and recycling can easily be quantified against beverage sales and recovery rates can thus be easily calculated. Beverages tend to be consumed shortly after purchase, hence the amount purchased is roughly the amount discarded. In the case of durable goods such as electronics, they are discarded years after they are purchased. Electronics may be passed on for second-hand use, for refurbishment or stored pending an accessible

recycling program. The challenge of lifespan modelling is to determine how many years later such items are discarded.

As a result of these challenges none of the existing e-waste programs currently operating in Canada can describe with any confidence or accuracy whether they are achieving high, medium or low rates of end-of-life electronics collection and recycling because none operate with a clear quantifiable understanding of what the baseline availability for recycling actually is.

Despite these recognized challenges the following sources and procedures have been used to estimate the amount of electronic equipment sold in NWT through all origins:

- Statistics Canada's 2011 Census;
- Statistics Canada Survey of Household Spending 2009;
- Electro-Federation of Canada (ElectroFed) 2005 to 2011 National Annual Sales Reports which include sales to residential, commercial, industrial and public sectors from 2005 to 2011 were used as database for home and personal audio-visual systems, home theatre-in-a-box systems, vehicle audio/video systems, and cordless phones. It is important to note that equipment purchased in the USA is not taken into account in this database;
- Units sold in Saskatchewan as shown in the Saskatchewan Waste Electronic Equipment Program (SWEEP) 2011-2012 Annual Report along with Statistics Canada, 2010, Gross domestic product (GDP) were used to estimate the national sales figures for computers, computer peripherals, printers (desktop) and display devices (including TVs and monitors);
- Data on average market share figures for laptops and desktops and average price per unit in Canada for 2008 and 2011;
- Ontario Electronics Stewardship (OES) discard model for the weight, age at first life and at end of life of each categories of EE.

In addition to these sources of data, the results of the survey performed by ENR in May 2012[4] were used as a point of comparison for some data. Although the survey is not representative of NWT's population, the results were used as an indicator to compare existing data and complete some data gaps.

Appendix 1 presents in more details the methodology, assumptions, sources of data and limitations to estimate the National sales figures for EE.

1.3.2.2 Data extrapolation for NWT

Since most of the EE sales data available are national Canadian data, ratios were calculated in order to estimate NWT sales data. Given the limited specific data available for NWT, three ratios based on available figures were identified as possibly useful for this calculation: NWT's population as a proportion of Canada's population; the number of NWT households (2011) as a proportion of

[4] E-waste: A survey of household Electronic Products in the Northwest Territories. Northwest Territories. Environment and Natural Resource. July 2012.

the Canadian total; and the proportion of EE household expenditures (2009).[5] The results of the three ratios are presented in Table 2.

Table 2 Shares of NWT population, households and total household expenditures

	POPULATION (2011)	HOUSEHOLDS (2011)[6]	TOTAL EE HOUSEHOLD EXPENDITURES $CA (2009)
Canada	33,476,688	13,320,614	$10,643,170,586
NWT	41,462	14,700	$16,317,000
Ratio NWT/Canada	0.124%	0.110%	0.153%

Using these ratios, estimations of the share of NWT sales of EE are presented in Table 3

Table 3 Estimated number and weight of EE units sold in the NWT according to population, households and average total EE expenditures ratios.

	CANADA	NORTHWEST TERRITORIES		
		BASED ON POPULATION RATIO	BASED ON HOUSEHOLDS RATIO	BASED ON AVERAGE TOTAL EE HOUSEHOLD EXPENDITURES RATIO
EE units sold 2011	33,252,984	41,185	36,696	50,980
Weight equivalent	214,245,394 kg	265,350 kg	236,431 kg	328,459 kg
Weight per capita	6.40 kg	6.40 kg	5.70 kg	7.92 kg

The estimations according to the population and household ratios are similar but the estimation based on the expenditure ratio is clearly higher. The difference is likely caused by the fact that average annual household spending in the NWT ($82,966) is 16.7% higher than the Canadian average ($71,117). It is worth mentioning that there are very acute regional differences in annual household income and expenditures within the NWT. Those disparities may likely influence purchasing patterns of EE. As for the household spending for categories of EE in Statistics Canada survey, average household EE spending in NWT is $1,303, significantly above the Canadian average of $838 per household.

This variation may be explained by the cost of living differential between NWT communities and the rest of Canada. According to Northwest Territories Bureau of Statistics, the cost of living in different

[5] Statistics Canada. Survey of Household Spending 2009. Summation of the following categories :*Computer Hardware; Computer equipment and material; Computer software; Computer supplies and other equipment; Digital cameras and accessories; Audio equipment; Other home entertainment equipment; Televisions; VCRs, DVD players, DVD writers; digital video camera; Other video and television components.*

[6] Based on Statistics Canada 2011 Census figures for Private Dwellings occupied by usual residents

communities in NWT is higher than Edmonton (15-20% higher in Yellowknife, up to 75-80% higher in isolated communities)[7].

Furthermore, the results of *Survey of Household Spending - Household Equipment*[8] shows that NWT households own less EE than the average Canadian household, i.e. 8.9 items in NWT compared to 9.8 items for an average Canadian household.

The lack of correspondence between the different sources of data suggests that the household expenditures may not be an accurate method to estimate EE sales in NWT.

Since the population ratio does not show the regional particularities put forward in Statistics Canada reports where NWT EE units per household in NWT were found systematically lower when compared to the Canadian average, it was decided to utilize the total household ratio to estimate the number of units sold in NWT.

1.3.3 Ontario Electronics Stewardship (OES) discard model

The discard rate model presented by the Ontario Electronic Stewardship (OES) in its Final Revised WEEE Program Plan (July 10, 2009) was also used as a reference in the quantity estimation process. OES defines discard rate as ''the estimated rate at which individual designated EE will be made available by generators for potential collection through the Program''.

The OES discard model provided the basis for setting the average weight equivalence per EE material category. The average weight per unit as shown in the discard model is presented in Table 4. The weights shown in the discard model may not reflect the actual number of units sold in 2011, as research and development innovation have progressively reduced weight per unit over the years. Unfortunately, no updated discard data was made available since OES Program Plan published in 2009. For some EE categories, average weight of multiple categories was used to reflect the needs of the current study. OES Discard model rationale may be explained as followed:

- *Products were assumed to last a specific "first life" in years.*
- *At the end of the "first life", products are stored, reused, or discarded.*
- *Where products are stored or reused, a "second life" of an additional number of years is assumed which may be different for storage vs reuse.*
- *It is assumed that all products are discarded at the end of their "second life."*
- *Products discarded in any given year are therefore made up of those units which were discarded at the end of their first life plus those units which were stored and reused for a number of years and are now being discarded at the end of their second life*[9]

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7 Northwest Territories Bureau of Statistics. Federal Isolated Post Living Cost Differentials, by Community : http://www.stats.gov.nt.ca/prices-expenditures/living_cost_differentials/

8 Statistics Canada. Survey of household spending 2009. Table 203-0020, Equipments only.

9 Ontario Electronic Stewardship, 2009. Final Revised (Phase 1 and 2) Waste Electrical and Electronic Equipment (WEEE) Program Plan, p.25

The discard model estimations of age at first and second life were also applied on the EE historic sales based on ElectroFed and SWEEP data in order to estimate the generation of historic e-waste in NWT per annum. Table 4 presents the age of first and second life of the selected categories used. For some EE categories, average life was used to reflect the needs of the current study.

Table 4 Adaptation from OES discard model - average weights and age of first and second life

CATEGORY	AVERAGE KG / UNIT	AGE AT FIRST LIFE	% TO SECOND LIFE REUSE	% TO SECOND LIFE STORAGE	% TO DISCARD	AGE AT END OF LIFE	YEARS IN STORAGE
Desktop computers	7.4	6.5	0.4	0.1	0.5	9.5	3.0
Portable computers	2.9	2	0.4	0.1	0.5	5	3
Printers/Fax Machines/Peripherals	4.5	3.5	0.4	0.5	0.2	5.3	3
Display devices	22.9	7.0	0.6	0.1	0.2	10.0	3.0
Personal or portable audio/video systems	1.3	3.9	0.4	0.5	0.1	5.4	3.0
Vehicle audio/video systems (aftermarket)	2.3	7.0	0.4	0.5	0.1	8.5	3.0
Home theatre in a box systems	22.9	7.0	0.4	0.5	0.1	8.5	3.0
Home audio/video systems	11.2	6.5	0.4	0.5	0.1	8	3
Non-cellular phones	1.2	5.3	0.4	0.5	0.1	6.8	3.0
Cellular phones and wireless devices	0.2	1.5	0.4	0.5	0.1	3	3

Appendix 1 – Section 1.3 provides details on the adaptation and utilization of the discard model for the purpose of the current study. The complete OES discard model is presented in Appendix 2.

2 OVERVIEW OF EE IN NWT

2.1 QUANTIFICATION AND DESCRIPTION OF ELECTRONIC EQUIPMENT IN THE NWT

2.1.1 Estimation of sales of EE in NWT

The data collection methodology described in Section 1.3 resulted in the following estimates of electronic equipment available for collection and recycling in the NWT. Based on the household figures for NWT and market shares of the categories related to computer equipment,

- It is estimated that 36,696 units of electronic and electrical equipment were sold to NWT residents in 2011 (does not include cell phones and other wireless devices).
- Based on available standard unit/kg data this represents approximately 236 tonnes of equipment.
- Display devices (TVs and desktop monitors) account for 52% by weight of the total.
- Figures on sales of c*ellular phones and wireless devices* for NWT have not been found for this study nor could they be estimated.

Table 5 presents for 2011 the estimated amount of electronic equipment, in number of units and weight, distributed in the NWT for 2011. This estimation includes residential and industrial, commercial and institutional (ICI) sales.

Table 5 Estimated units sold in the NWT for 2011 and corresponding weight

CATEGORY	UNITS	KG / UNIT	TOTAL WEIGHT (KG)	SHARE OF TOTAL WEIGHT
Desktop computers	2,041	7.4	15,104	6.4%
Portable computers	4,337	2.9	12,578	5.3%
Printers/Fax Machines/Peripherals	6,255	4.5	28,149	11.9%
Display devices	5,347	22.9	122,671	51.9%
Personal or portable audio/video systems	8,103	1.3	10,303	4.4%
Vehicle audio/video systems (aftermarket)	759	2.3	1,746	0.7%
Home theatre in a box systems	475	22.9	10,867	4.6%
Home audio/video systems	2,376	11.2	26,609	11.3%
Non-cellular phones	7,002	1.2	8,402	3.6%
Cellular phones and wireless devices	n.a.	0.2	n.a.	n.a.
TOTAL	36,696		236,431	100%

NWT retailers of EE were contacted to obtain further information on EE sales, but in all cases were either unwilling or unable to share detailed sales information which would have been useful in helping to verify the estimated total territorial EE market. (A listing of retailers is contained in Section 2.3.2).

2.1.2 Estimation of the total functional and non-functional EE in NWT

The estimation of the functional and non-functional EE was primarily based of three calculation methods based on different assumptions:

- Method based historic estimation of 2011 sales data and EE lifespan from the OES discard model (residential and ICI sector included);
- Method based on ENR Survey (residential EE only);
- Method based on Statistics Canada Survey of household spending – percentage of household reporting (residential EE only).

The three methods cannot be used as a direct method of estimation because the EE categories are not exactly the same and for some categories, data were not available or were not targeted by the survey. Table 6 displays the results of the three methods of estimation.

Table 6 Estimation of the functional and non-functional EE units in NWT

CATEGORY	METHOD 1 HISTORIC SALES AND DISCARD MODEL	METHOD 2 ENR SURVEY	METHOD 3 STATCAN HOUSEHOLD SPENDING SURVEY
Desktop computers	16,420	10,072	10,775
Portable computers	15,837	37,016	Included in computer
Printers/Fax Machines/Peripherals	26,613	19,868	n.a.
Display devices	49,259	42,511	27,607
Personal or portable audio/video systems	45,598	54,163	n.a.
Vehicle audio/video systems (aftermarket)	6,354	8,307	n.a.
Home theatre in a box systems	3,971	5,459	Included in Home A/V.
Home audio/video systems	18,870	50,322	47,408
Non-cellular phones	48,756	n.a.	20,433
Cellular phones and wireless devices	n.a.	30,558	7,747
TOTAL	231,681	258,276	113,969

The three methods used to estimate the quantity of functional and non-functional EE have advantages and disadvantages. With regard to the sales calculation method and the discard model, although the method is based on reliable data for sales in NWT, this estimate does not take into account purchases made on the internet or outside of NWT. The calculation is entirely based on the assumptions of the discard model.

The ENR Survey results provide interesting data but the survey methodology did not allow extrapolation to all NWT households. In fact, as a survey mainly distributed through electronic channels, it is possible that the results overestimate the number of functional and non-functional computers because the responses were submitted electronically by people who had internet access.

The results of Statistics Canada's 2009 Survey of household spending may be representative of NWT population but it doesn't consider exactly the same categories. In some cases, such as cell phones, it doesn't estimate the total number of items (functional or non-functional) in the household but only the number of households reporting having a cell phone.

The analysis of the three estimations does not allow us to select one method. However, it is possible to provide minimum and maximum estimated quantities for each EE product category currently in NWT combining the results of the three methods.

Table 7 displays the minimum and maximum number of units estimated[10].

Table 7 Estimation of the minimum and maximum number of functional and non-functional units in NWT (2012)

CATEGORY	MINIMUM	MAXIMUM
Desktop computers	10,072	16,420
Portable computers	15,837	37,016
Printers/Fax Machines/Peripherals	19,868	26,613
Display devices	27,607	49,259
Personal or portable audio/video systems	45,598	54,163
Vehicle audio/video systems (aftermarket)	6,354	8,307
Home theatre in a box systems	3,971	5,459
Home audio/video systems	18,870	47,408
Non-cellular phones	20,433	48,756
Cellular phones and wireless devices	7,747	30,558
TOTAL (number of item)	176,358	323,959

[10] Minimum and maximum numbers correspond to the lowest and highest estimate for each category line in Table 6. Therefore, total figures in Table 7 are not intended to match the total of one of Table 6's three methods.

2.2 QUANTITY OF HISTORIC AND FUTURE E-WASTE

Estimates of the quantity and quality of existing historic e-waste in the NWT which will need to be managed as part of any e-waste program are based on 2012 estimated numbers of EE items, collected historic sales figures and calculations using the OES discard model. Appendix 1 shows details about the estimation.

Table 8 displays the estimation of the e-waste generated from 2009 to 2011. It is possible that a large number of these items has been managed through existing practices in NWT, such as discarded in garbage or returned to existing e-waste recovery initiatives. Storage of end-of-life units is another consideration. In fact, the results of ENR Survey shows that almost 50% of respondents indicated keeping them as a way to manage electronic items they no longer use or need. These stored quantities and tonnages are expected to be a factor at the beginning of any e-waste collection program but will be less of an issue over time as units which have been stored in anticipation of a program are collected for recycling.

Table 8 Estimated historic generation of e-waste

CATEGORY	2009		2010		2011		2009-2011	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Desktop computers	1,302	2,123	1,384	2,256	1,305	2,127	3,991	6,506
Portable computers	5,531	12,927	5,878	13,739	5,543	12,956	16,952	39,622
Printers/Fax Machines/Peripherals	4,016	5,379	4,268	5,717	4,025	5,391	12,309	16,488
Display devices	3,014	5,379	3,204	5,716	3,021	5,390	9,239	16,485
Personal or portable audio/video systems	8,823	10,481	9,378	11,139	8,843	10,504	27,044	32,123
Vehicle audio/video systems (aftermarket)	762	996	810	1,059	764	998	2,335	3,053
Home theatre in a box systems	476	655	506	696	477	656	1,460	2,006
Home audio/video systems	2,408	6,049	2,559	6,429	2,413	6,063	7,380	18,542
Non-cellular phones	3,068	7,320	3,260	7,779	3,074	7,336	9,402	22,435
Cellular phones and wireless devices	2,834	11,180	3,012	11,882	2,841	11,205	8,687	34,267
TOTAL Estimated e-waste generation (units)	32,234	62,488	34,259	66,413	32,305	62,625	98,799	191,527
TOTAL Estimated e-waste generation (kg)	167,987	310,165	178,540	329,650	168,356	310,847	514,882	950,661
TOTAL - Estimated e-waste generation (kg/capita)	4.1	7.5	4.3	8.0	4.1	7.5	12	23

Based on the same method, the quantity of future e-waste generation has been estimated. Table 9 shows estimations of the minimum and maximum quantities of e-waste generated in the years 2012 to 2020.

Table 9 Estimated future generation of e-waste in the NWT

CATEGORY	2012		2016		2020	
	MIN	MAX	MIN	MAX	MIN	MAX
Desktop computers	1,336	2,178	1,469	2,395	1,615	2,633
Portable computers	5,676	13,267	6,241	14,587	6,862	16,038
Printers/Fax Machines/Peripherals	4,121	5,521	4,531	6,070	4,982	6,674
Display devices	3,093	5,520	3,401	6,069	3,740	6,673
Personal or portable audio/video systems	9,055	10,756	9,956	11,826	10,947	13,003
Vehicle audio/video systems (aftermarket)	782	1,022	860	1,124	945	1,236
Home theatre in a box systems	489	672	537	739	591	812
Home audio/video systems	2,471	6,208	2,717	6,826	2,987	7,505
Non-cellular phones	3,148	7,512	3,461	8,259	3,806	9,081
Cellular phones and wireless devices	2,909	11,474	3,198	12,615	3,516	13,871
TOTAL – Estimated e-waste generation (units)	33,081	64,128	36,372	70,510	39,992	77,526
TOTAL – Estimated e-waste generation (kg)	172,396	318,307	189,552	349,982	208,415	384,810
TOTAL – Estimated e-waste generation (kg/capita)	4.2	7.7	4.6	8.4	5.0	9.3

2.3 SOURCES OF EE IN NWT

2.3.1 EE Brand Owners – Responsible Producers

Drawing on the discussion in Section 1.2.2 and on the Atlantic Canada Electronic Stewardship (ACES) program definition, responsible producers can be identified as any of the following: manufacturer, brand owner first importer, distributor, multi-provincial/territorial retailer, NWT only retailer, internet or catalogue seller, computer assembler, value-added reseller and licensee or owner of an electronic product brand name. Variations of this definition are used in other programs and by the CCME CAP.

The members of Electronic Product Stewardship Canada (EPSC)[11] represent the primary and familiar brand owners who sell across Canada and they are expected to be the same primary electronics producers selling in and into the NWT. EPSC members are as follows: Apple, Canon, Lenovo, Cisco, LG, Dell, Panasonic, Samsung, HP, Sony, IBM, Toshiba, Asus, General Dynamics Itronix, Benq, Lexmark, Brother, Microsoft, Ciaratech, Northern Micro, Epson, Oracle, Fujtsu, Philips MMD, Getac and Xerox.

In addition other brand owners, including the following are expected to be selling other electrical and electronic equipment in and into the Territory:

[11] There may be some confusion regarding the name to be used as a transition from EPSC to EPRA in underway.

Acer, Alcatel-Lucent, Alpine Mobile Solutions, Audiovox, Aviat, Boston acoustics, Bushnell, Clarion, Compaq, Coby, Data General, Denon, Dynex, Ericsson, FujiFilm, Funai, Haier, Harris, Hitachi, Intel, JVC, Kenwood, Kodak, Lava, Lenbrook, LG, Marantz, Maxell, Motorola, Nikon, Nokia, Olympus, Onkyo, P&F, Pentax, Pioneer, QMS, RIM, Sharp, Synnex, TCL, Uniden, Vistek, Vtech, Webbsight Imaging, Yamaha.

2.3.2 Sources and Flows of EE into the NWT

A small retail market for EE exists in the NWT with most electronics specialized retailers located in Yellowknife. With the exception of The Source and Staples, major national retailers such as Future Shop and Best Buy have not established stores in the NWT. Table 10 lists EE retailers in the NWT and identifies the suppliers from which the units are shipped into the NWT.

It is likely that significant sources of EE in the NWT include online orders shipped by postal services or by courier, by internet retailers such as Amazon, BestBuy, Future Shop, and mac.com, Staples, TigerDirect.ca, Ncix.ca, Cendirect.com, Computervalley.ca, Newegg.ca and Directcanada.com. Data on such sales is unavailable.

Another significant source of EE is purchases made directly outside the NWT and brought in for use in the NWT. It is likely that purchases by NWT residents are made elsewhere in Canada and especially adjoining provinces, particularly Alberta and likely to a lesser extent British Columbia. Similar to internet sales, there is no available data to quantify the number of direct external sales because retailers outside the NWT do not collect, nor are interested in data on where units of EE they have sold are ultimately used. A more detailed discussion of this issue, including data from a survey conducted by ENR is included in Section 7.3.1.

Quantities of both internet sales and external direct purchases could be estimated using the estimated overall territorial market as a base if direct retail sales data were available. Subtracting the estimate of NWT retail sales from the total estimated NWT EE market would generate an estimate of all other sales, including internet and external purchases. In the absence of any NWT retail sales data, this cannot be done.

Other provincial e-waste programs have had to address the issue of internet sales and indications are that the issue is so far not a significant one. All programs have to address the free rider issue to degrees and all programs with support from regulators do occasionally need to inform obligated parties of their responsibilities under regulations. In jurisdictions with regulated EE EPR programs, all brand owners selling into the jurisdiction are covered by the regulation regardless of whether their product is delivered through an on-line marketing model, such as used by Dell, or sold in a retail store. The major brand owners or responsible producers who sell via the internet are generally part of the EPR program and remit fees to the EPR producer responsibility organization in the same way more conventional retailers do. A more detailed discussion is also included in Section 7.3.1.

Table 10 EE retailers in the NWT and their suppliers

RETAILER	COMMUNITY	TYPES OF EE	SUPPLIER
Power Surge (The Source)	Hay River	TV, computers, audio, video equipment, cell phones	The Source Distribution Centre (Ontario)
Roy's Audiotronic	Yellowknife	TV, computers, audio, video equipment, cell phones, portable electronics, vehicle electronics, peripherals.	Major manufacturers (outside NWT)
Superior Sound	Hay River	TV, computers, audio, video equipment	Major manufacturers
The Source	Yellowknife	TV, computers, audio, video equipment, cell phones	The Source distribution centre (Barrie, ON)
Wal-Mart	Yellowknife	TV, computers, audio, video equipment	Wal-Mart distribution centre (Calgary, AB)
Northwest Company (NorthMart, Northern)	18 locations across NWT	TV, computers, audio, video equipment	Logistics Service Centre (Winnipeg, MB)
ICE Wireless	Inuvik, Yellowknife	Cell phones	Sony Ericsson, Nokia, Motorola, and LG
Arctic Co-op	8 locations across NWT	Modems, peripherals	Warehouse in Winnipeg, MB
Global Storm IT	Yellowknife	Computers, peripherals and related products	All major suppliers (outside NWT)
SSI Micro	Yellowknife	Modems, peripherals	Suppliers outside NWT
World of Wireless	Yellowknife	Cell phones and related products	
Tamarack Computers	Yellowknife	Computers and related products	Major distribution centres in BC and ON
Creative Basics	Yellowknife	Printers, computer accessories	Brother, HP and other major manufacturers
Staples / Business Depot	Yellowknife	TV, computers, audio, video equipment, computer accessories	Staples Canada Distribution centre (Ontario)
Shoppers Drug Mart	Yellowknife	Laptops, cameras, headphones, audio, video and gaming equipment	Shoppers Drug Mart Distribution centres (Alberta and Ontario)
Sears	Yellowknife	TV, home theatre systems, audio, video equipment, DVD players, cameras	Sears Canada Distribution centres (Calgary, AB and others)
Canadian Tire	Yellowknife	Cameras, audio equipment	Canadian Tire Corporation Distribution Centre (Brampton, ON)
Extra Foods	Yellowknife	Audio, video equipment, game consoles, remote controls, peripherals	Major suppliers (outside NWT)
Fiddles & Stix	Yellowknife	Electronic musical instruments, sound systems, audio equipment	All major suppliers (outside NWT)
Home Building Centre	Yellowknife	Tools, A/C units, electronic plumbing and building equipment	All major suppliers (outside NWT)
Arctic Data Systems	Yellowknife	Computers	All major suppliers (outside NWT)
Arctic Digital	Inuvik	Cell phones, laptops, TVs, computers	All major suppliers (outside NWT)
EECOL Electric	Yellowknife	Electronic parts for lighting automation, communications, and wires.	Suppliers outside NWT
Pioneer Industrial Supply (1993) / Workplace Office Plus	Yellowknife	Computers and related products	All major suppliers (outside NWT)
Cascade Computers / Graffiti Home and Office	Fort Smith	Computers and related products	All major suppliers (outside NWT)
Sahtu Computer Services	Norman Wells	Computers, laptops, peripherals, printers, modems	DELL, IBM, Apple, Hewlett Packard, Corel, Canon, Touch, Epson, Lotus, NEC, Toshiba, 3Com, D-Link, Cisco
The Brick	Yellowknife	TV, home theatre systems, audio, video equipment, DVD players, Digital cable and satellite	The Brick Distribution Centres (Alberta)

3 E-WASTE MANAGEMENT AND RELEVANT INFRASTRUCTURE IN NWT

3.1 CURRENT STATE OF E-WASTE MANAGEMENT IN NWT

The NWT does not currently offer an e-waste program for residents, nor support specific electronic waste regulations. Nevertheless, the following EE waste recovery and reuse initiatives have been identified in some of the larger communities. Information has also been drawn from interviews with program and depot operators.

3.1.1 Recovery initiatives

Government of Northwest Territories and Federal Agencies: Since mid-2012, all surplus government computers are sent to Shanked Computer Recycling Inc (SCRI), an e-waste processor registered with Alberta's regulated program. Prior to 2012, this service only covered North Slave GNWT offices.[12]

Yellowknife and **Hay River**: The City of Yellowknife and the Town of Hay River have begun segregating electronic waste from other types of waste at their respective solid waste facilities. Both communities are working with Precision North Recycling on this matter, and processors in Edmonton (including SCRI and Global Electric Electronic Processing (GEEP)) are among options being considered. Hay River has about 200 items waiting to be sent for processing. An exact weight is not yet available.

Fort Smith: E-waste currently goes to landfill where it has been separated/ stockpiled for a couple of years. No group has expressed an interest in getting involved in e-waste collection/processing and options for the proper management of the stock piled e-waste outdoors are unclear. The phone call with the local contact suggests that the town would be interested in participating in an e-waste program.

Behchoko: E-waste currently goes to landfill and no group is involved in e-waste collection/processing. E-waste collection and recycling was identified as a feasible option.

Fort Good Hope: E-waste currently goes to landfill and no group is involved or has plans to get involved in e-waste collection/processing. No room is available in current facilities for e-waste storage and processing. Transportation was defined as a particular challenge, especially with barge containers considerably difficult to obtain.

Norman Wells: E-waste currently goes to landfill and no group is involved or has plans for e-waste collection/processing. Transportation was identified as the biggest challenge since barges and the winter ice road are the only current viable options. Storage room for collected e-waste before being shipped out would be available.

Inuvik: No data was obtained from Inuvik so far. Efforts were made to contact the responsible parties but without success.

[12] Information confirmed by Russ Jones, PWS's North Slave Warehouse Supervisor.

3.1.2 Reuse initiative

Smart Communities Society (SCS) operates a small computer refurbishing business based in Yellowknife, although they cannot handle large volumes of material and generally only accept functioning equipment from federal agencies, the GNWT and the City of Yellowknife. SCS is considering options to accept and/or refurbish electronic equipment from the public on a fee for service basis; however there has been no formal decision to follow this course.

YKtrader.com and Freecycle are web portals where consumers can give away equipment in good condition. Sellers or donators have to create a post on the websites and consumers interested in the posted products contact them through the website message service.

3.2 RECYCLING INFRASTRUCTURE AVAILABLE IN NWT

This section will describe the existing recycling infrastructure with particular emphasis on the beverage container system established to support the beverage deposit regulation. Since 2010, the NWT Beverage Container Program also covers milk and dairy container. A detailed listing in Appendix 3 shows the 22 beverage container collection depot operators and the seven satellite depot operators in the NWT.

The City of Yellowknife's six recycling depots accept #2, #3, #5, and #7 plastics, mixed paper, fine (white office) paper, corrugated cardboard, glass containers, and tin cans. Designated drop-off areas at the Yellowknife landfill site accept batteries, fluorescent light bulbs, and white goods (dishwashers, refrigerators, freezers, stoves, washing machines and dryers). Food scraps, yard waste and other organics are also accepted in compost bins located at the landfill, and are processed into compost at a centralized compost facility adjacent to the Yellowknife Solid Waste Facility. Tires are also stockpiled on-site and the City of Yellowknife is expecting to have them recycled.

While scrap metal has been stockpiled for years in many NWT communities, the City of Yellowknife Solid Waste Facility has had metal recovery initiatives since 1997. Approximately 1,600 tons of auto hulks, white goods and light steel are recovered every other year. No revenue is currently generated from the recovered steel as the contractor receives the majority of the tipping fee revenue and the transporter retains all profits from selling the steel to scrap metal recyclers in exchange for no transportation fees.

Call2Recycle has collection boxes for batteries and cell phones located at 99 Taylor Road in Yellowknife (Public Works Garage) and in the Hay River Recreation Centre as part of their network of 30,000 drop-off locations throughout North America. Other collection points for batteries and cell phones are also located in Yellowknife.

A number of beverage container depot operators and processing centres were approached and had the following comments on the possibility of an e-waste program and how it might affect their operations.

- Fort Good Hope – The depot operator, Chief T'Selehye School, reported that they would not have the necessary storage space; however the Town Senior Administrative Officer (SAO) stated that the Town could provide space for e-waste storage prior to shipment.
- Norman Wells – The depot operator said e-waste storage space would not be an issue but raised concerns about transportation which may provide challenges as it does under the existing beverage program. The operator also indicated in a phone call that the Town could provide additional storage space if required.
- Behchoko – The depot operator indicated that there was plenty of room to expand and being within 100 km of the processing centre, did not foresee any barriers to participating in an e-waste program.
- Fort Smith – The operator did not foresee any issues. The Town SAO strongly supported the idea of an e-waste program and stated an interest in participating if a program was established.
- Hay River – The processing centre owner felt the GNWT and ENR deserves credit for moving ahead with investigating the feasibility of an e-waste program. The program should operate as the beverage container program does with the depots sending everything to three current processing centres. An e-waste program could piggy back with containers and links to the beverage program would help with transportation and backhauls. The existing infrastructure is already in place and would require limited training The depot operator would like to see some processing done in the north and would purchase the necessary equipment. Space and transportation were not identified as an issue.
- Yellowknife – The processing centre owner indicated that there isn't a lot of additional storage space but this could be resolved through the use of shipping containers. Training for an e-waste program would be needed. The existing depots and three processing centres were identified as a good model for any possible e-waste program.
- Inuvik depot does not have extra room for storage.
- Fort Simpson would have plenty of room for storage. Interest was also expressed in running a consolidation/processing facility.

4 E-WASTE MANAGEMENT, RELEVANT INFRASTRUCTURE AND MARKETS OUTSIDE OF NWT

4.1 E-WASTE MANAGEMENT IN REMOTE COMMUNITIES OUTSIDE THE NWT

British Columbia

In the Electronic Stewardship Association of British Columbia (ESABC) program, many remote communities in northern and coastal B.C. areas are currently covered by e-waste collection services through backhauling. According to the ESABC, the key element in offering such program services is the local community administration's interest in recycling. Generally recycling and separate collection is only possible in remote communities by combining different stewardship program services in multi-material depots.

In the case of coastal aboriginal communities such as the Heiltsuk First Nation, the Aboriginal Affairs and Northern Development Canada has offered financial support in partnership with the community for the construction of multi-material recycling depots and other waste management facilities. Bella Bella (Heiltsuk Nation) is located 350 km south of Prince Rupert and 200 km north of Port Hardy. It has no road link and is only accessible by ferry. In the case of this community, plans are for collected e-waste to be managed along with other segregated wastes and barged to Vancouver where it is passed into the ESABC system. Transportation costs are paid by ESABC. Location details are shown on figure 1.

In another example shown in figure 1, a collection route exists for the sparse population in communities along Highway 16's 700-km corridor between Prince Rupert and Prince George. Prince Rupert (pop.13, 000) generates about a skid of e-waste per week. Every other month, e-waste is truck-hauled to Prince George along with bottles and cans where it is consolidated before being shipped to GEEP in Edmonton (another 750 km). At such frequency, transportation costs for this collection route are around $40/skid. From there, transportation costs to Edmonton are about $700+fuel/truckload. It is difficult to estimate the total costs of the full collection/transportation cycle since materials are usually added at the consolidation step in Prince George before being shipped to Edmonton.

Figure 1 Location of Heiltsuk Nation (circled) and Highway 16 corridor (blue)

Alberta

The Alberta Recycling Management Authority (ARMA), an agency of the provincial government, is responsible for the e-waste programs for the entire province. In Northern Alberta, the area which is considered to be north of Township Line 70, registered processors receive a transportation incentive of $200/tonne, as compared to $50/tonne for the Calgary Edmonton corridor and $150/tonne in the rest of Alberta. In addition to the transportation incentive, processors also receive a $700/tonne processing incentive. The area here called «Northern Alberta» covers 350,000 sq kilometres and includes 240,000 residents, with more than half located in Grande Prairie and Fort McMurray. This differential incentive fee recognizes the additional costs of servicing more remote communities and hauling collected e-waste to processing facilities which are concentrated in the Edmonton and Calgary areas.

The depots in northern Alberta have both continuous drop-offs and events which are held an average of twice yearly. Event costs are subsidised by ARMA, and all collection is subsidised up to $100/tonne. Pick-ups are planned twice yearly, on average, but a depot can call to report a full site, and the recycler will send out a vehicle for a pick up. Recyclers will often stop at other sites in order to return with a full truckload. Registered recyclers in the province make their own business arrangements with registered collection sites so there are no consolidators in the arrangement.

Saskatchewan

La Ronge, 250 km north of Prince Albert, is the most northerly collection depot in Saskatchewan. There are currently no other collection services offered for the northern part of the province, which represents about 30,000 residents, although a pilot project for the most remote communities is expected to kick off at the end of 2012. In 2011, the La Ronge depot collected 20,182 kg of e-waste which represents 0.64% of the total recovered quantity in the province. In terms of recovered quantity per resident, 1.6 kg per capita are collected yearly in the La Ronge area as compared to a provincial average of 2.72 kg per capita. The other communities in northern Saskatchewan do not currently have waste management or recycling services available to partner with. Unlike Alberta, transportation payments are not differentiated by location or region, are the same for any site in the province and are included in the province's collection service agreement with SARC. SWEEP is charged the same rate regardless of the location within the province.

Manitoba

Electronic Products Recycling Association Manitoba (EPRA) manages Manitoba's new waste electronics recovery program, effective since August 1st, 2012. Manitoba regulations cover the same list of equipment selected by NWT in chapter 1 with the addition of microwaves. In Northern Manitoba, depots are currently accessible from May to October in The Pas, Flin Flon and Thompson. The latter two depots are approximately 800 km away from Winnipeg. Since environmental handling fees are paid by every consumer, EPRA advocates for collection services covering all communities in the province to be provided on the same basis, regardless of the additional costs to haul from more remote communities. It is not possible to have a full picture of the financial costs related to this approach as the program has been in place for a few months only. Waste electronics collected in depots are currently being trucked directly to GEEP in Alberta. EPRA is also considering consolidating the collected material somewhere in Manitoba before shipping it to Alberta.

Ontario

Ontario Electronic Stewardship (OES) pays $150-230/tonne to collect and haul e-waste out of remote communities in Northern Ontario. A mobile tour undertaken as a promotion initiative, took place from May to August. In 2011 OES toured Northern Ontario raising awareness about responsible e-waste disposal by providing educational information and activities to participants during 2-day stops in 29 different communities along Hwy 11 and Hwy 17 using an RV and pickup truck. Tour dates coincided with festivals, fairs and pow-wows. Collection events in those communities were usually organized with local service providers on the second day of the tour's stop with local radio shows broadcasting on site. Means of promotion also included post cards and local newspaper ads. In 2011, participation in the 29 communities tripled compared to 2010 and tonnage surpassed initial forecasts in every location: in 2011, 180,716 kg of waste electronics was recovered. Special promotion funding ($1,000/year/site or event) is also made available to smaller more remote communities (less than 50,000 residents), north of North Bay or underserviced communities with one collection site or less.

Yukon

The City of Whitehorse adopted a bylaw banning waste electronics from landfill. To support its enforcement, Whitehorse operates a collection program first offering reuse options with Computers for Schools or e-waste recovery at Raven Recycling Depot or at Whitehorse Waste Management Facility. Peripherals such as cables, mice, keyboards, and power supplies are collected free of charge. Computers, monitors, TVs, printers, scanners, stereos, VCRs, DVD players and phone are accepted for a nominal fee, depending on the product. In 2011, Whitehorse collected and shipped five tractor trailer loads of e-waste for a total weight of 43.333 metric tonnes. Overall, program has cost approximately $1,018 per tonne in 2011. Since the collection infrastructure is shared with other materials, no collection, storage or communication expenses were estimated. The following table details the program's expenses for 2011.

Table 11 Cost details for e-waste collection program in Whitehorse (2011)

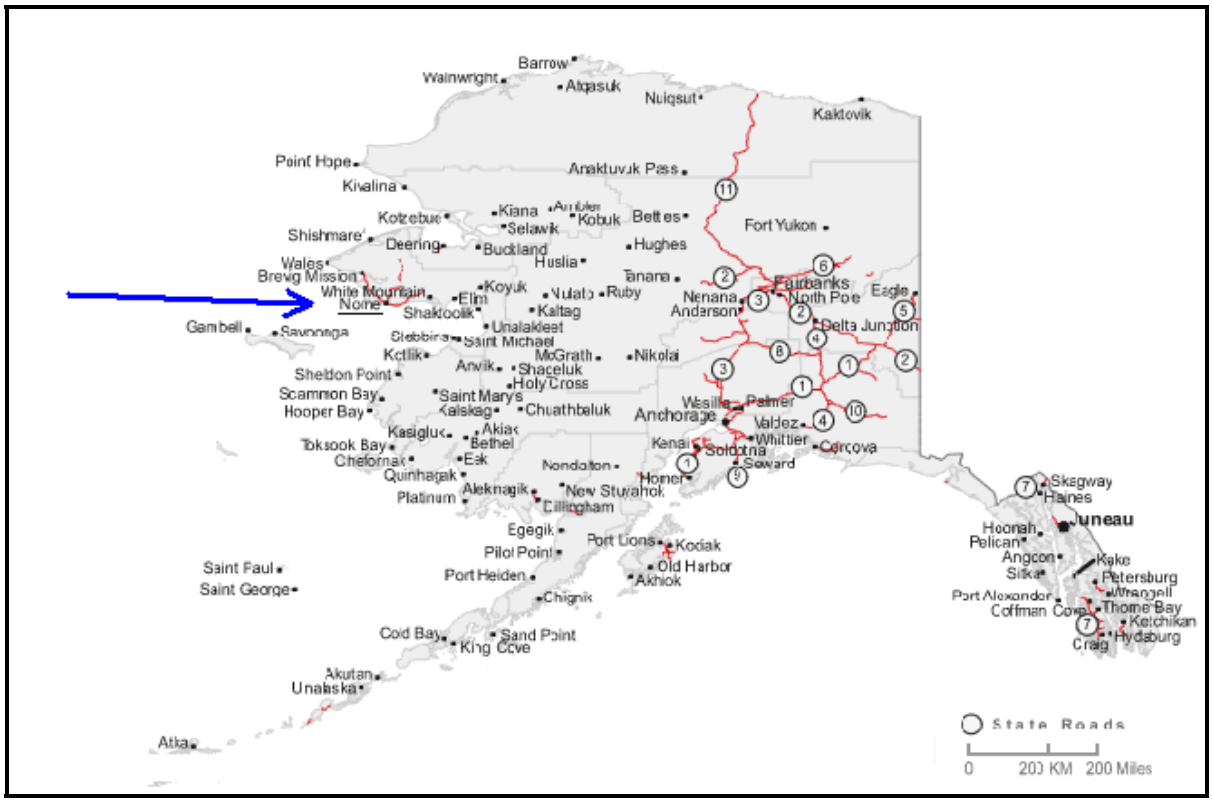
COST CATEGORIES	TOTAL 2011	COST PER TONNE
Transportation	$10,059	$232
Processing	$30,071	$695
Overhead costs	$3,986	$92
Total expenses	$44,116	$1,018

Expenses in 2012 are expected to be lower than 2011 as a better rate was recently negotiated with the processor. Yukon is currently working to implement a program to reach remote communities outside Whitehorse. If e-waste from communities located in the Beaufort Delta area is to be hauled to Edmonton via the Dempster Highway, Yukon may be interested in a possible linkage with the NWT program as this may allow cost reductions for communities of both jurisdictions.

Alaska

Nome, along with seven other communities in Seward Peninsula / Norton Sound area (around 6,000 residents), collected 2,800 kg of e-waste in 2010 and 6,400 kg in 2011 through a community based ad hoc voluntary program. Since there is no road access to the communities, they are serviced either by air or by sea barge in season. Collection events usually consist of a large amount of advertising and educating the community about bringing in their recyclables and then facilitating the backhaul process. This e-waste collection system relies on grants to aboriginal communities by the U.S. EPA and on one small airline which donates the back haul flights of the e-waste for free. Sea barge transporters and recyclers, such as Total Reclaim of Seattle, are paid to process the waste via Anchorage. It is important to note that high speed internet penetration rates are higher in Alaska than most of northern Canada, thus creating a stronger market for buying or replacing IT electronic equipment. No state-wide collection program is currently in place.

Figure 2 Location of Nome and Seward Peninsula in Alaska

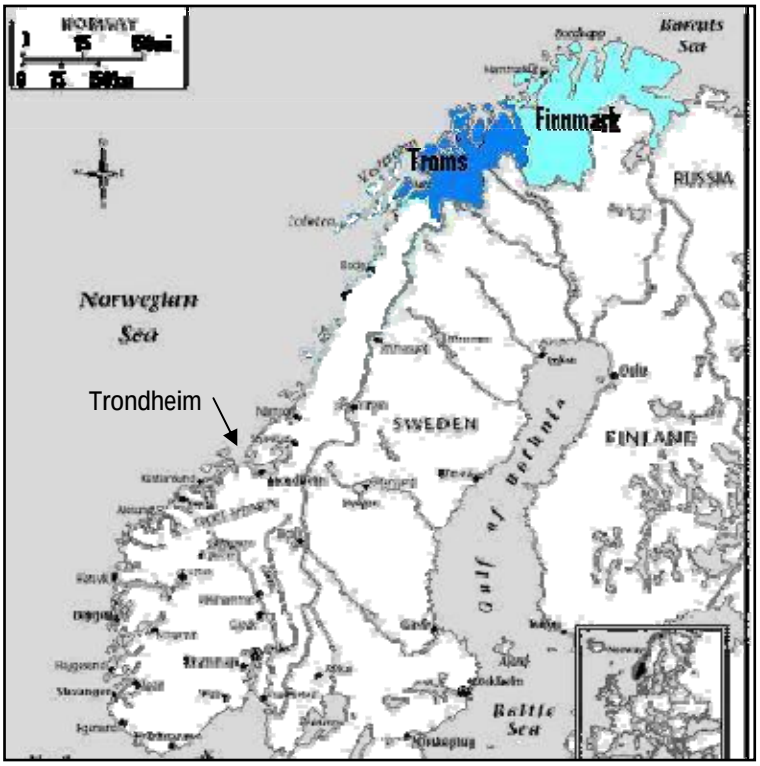


Norway

El-Retur is the EPR producer responsibility organization (PRO) for e-waste in Norway and it has been obligated to ensure collection and treatment of Waste Electrical and Electronic Equipment (WEEE) in Norway since 2001. In addition to IT equipment, cooling systems, appliances, and white goods are also included in this WEEE recovery program which has more than 2,500 collection points throughout the country. All regions are covered by a year-round service managed by eight regional operators including the ones above the Arctic Circle. While most regions are accessible by road, transportation may involve barging operations for many remote areas. In 2011, Norway's two northernmost counties, Troms and Finnmark, have recovered 6.73 kg/capita of e-waste[13], 16.48 kg/capita adding cooling systems and heaters, tools, appliances and white goods. These two counties have a total population of 230,000 with Tromso (70,000) as the largest city. This area stretches a 1,000 km long with distances up to 1,800 km from Trondheim, where the closest processors are located. The area's geographical location is provided in Figure 3. Metal and other material sold from appliances and white goods partly offset treatment costs paid for electronic equipment.

[13] Only televisions, audio and video equipment, computers, data processing, telecommunications and office equipment are the categories accounted for in those figures.

Figure 3 Distance between Trondheim and Norwegian counties of Troms and Finnmark



Sweden

El Kretsen is the PRO which manages the WEEE collection and treatment program since EPR was made mandatory in Sweden in 2000. Similarly to Norway, cooling systems, appliances and white goods are also included in the WEEE recovery program provided throughout the country including the more remote northern areas. Since 2009, batteries are also collected under the same program. Recovered quantities are currently around 7 kg/capita for electronic waste only[14]. In an effort to optimize the program's efficiency, El-Kretsen's loading carriers are marked with bar codes which are read by the transporters. This facilitates tracking waste quantities collected from each collection point.

Australia

The Australia and New Zealand Recycling Platform is a not-for-profit EPR program for electronics founded in May 2012 under a federal co-regulation agreement adopted in 2011. The government legislation targets computer-related products and televisions. It requires the program to cover all regions of Australia, including remote communities, by December 2013. 'Reasonable access requirements' in the agreement also define the level of service for remote areas. Under these requirements, at least one collection must be organized for every town of 2,000 inhabitants or more, once every 2 years. In addition, a collection infrastructure has to be provided to a remote

[14] Idem as 10.

community if a service at a town of 2,000 is available within 200 km away. These requirements still ensure a broad coverage throughout the country in remote towns often located hundreds of kilometres away from the closest community – especially in Western Australia and the Northern Territory. Furthermore, such obligations ensure coverage of smaller communities located at reasonable distances from those small urban areas (2,000 inhabitants or more). The co-regulation agreement also calls for a variety of service approaches, including permanent collection depots, return to retailers, collection events or mail shipping in remote areas.

Although many of the examples presented in this section can be considered as serving remote communities, it is important to keep in mind that the programs themselves were not intended specifically for remote communities only, as a NWT electronics program would be. There is very little applicable experience with waste electronics in northern or remote jurisdictions' that would help guide the GNWT. Except for the cases presented in Whitehorse and Alaska, where one or only a few communities where served, the e-waste infrastructure in remote areas is usually part of a larger program, making it possible to offset part of the overhead costs or operational issues related to remote areas.

4.2 CURRENT INFRASTRUCTURE FOR OTHER WASTE MATERIAL IN REMOTE COMMUNITIES

Yukon

The Yukon Government has implemented a series of waste management initiatives in the past decade. The deposit-refund system for beverage containers has a network of 27 registered recycling depots throughout the territory. The used tire stewardship program is based on a $5 per tire purchase surcharge. The territory is trying to amend the tire regulations to include some larger off-the-road vehicles. If they do get approval on all the recommended changes to the Designated Materials Regulation, they plan to add electronics as well, modeled after the B.C. Recycling Regulation.

Yukon currently provides its communities with periodic Household Hazardous Waste and special waste collections (which include scrap metal, white goods, batteries, tanks, C&D material and some e-waste). Since 2009, many solid waste facilities and open burning locations have been transformed into waste transfer stations with containers for sorting various kinds of waste.

Kivalliq Region (Nunavut) and Northern Manitoba

Since 2004, Nunavut's Kivalliq Region and northern Manitoba's Bayline communities along Hudson Bay have been backhauling accumulated scrap metal using a seasonal barge route connecting the communities to the Port of Churchill from where recovered metal is shipped by rail to recyclers in Southern Manitoba. Combining the metal recovery using a single route has allowed the communities to lower transportation costs that were previously often prohibitive.

Iqaluit, Nunavut

In 2008, Recyclage Lévis (Quebec) and the City of Iqaluit started recovering thousands of tonnes of build-up and half-buried scrap metal in landfill areas around Nunavut's capital. The recycling company offered to crush and ship the metal south for just $1 while the City has to pay for moving the metal from the dump areas to the crushing equipment. The Government of Nunavut also takes part in financing the project in order to use the crushing equipment in other communities on Baffin Island. In 2010, more than 3,000 tonnes of metal were hauled south to be recycled.

Arctic Co-ops also operate a take-back aluminum can recycling program. Partially funded by a 10-cent levy on plastic bags sold in the co-ops, this program allows the cooperatives to grant $1,500 to non-profit groups for each 20-foot shipping container sold in the south.

Central Coast Regional District, British Columbia

The Central Coast Regional District includes many isolated communities only accessible by water or located in valleys where road links involve significant distances to the nearest towns in the BC Interior (more than 400 km). A recycling depot is located in Bella Coola where beverage and milk containers, paint, car batteries and e-waste are recovered either by truck or using barges at various moments throughout the year. Backhauling on barges is used as the primary mean of transporting C&D materials, tires, tin cans, glass containers and scrap metal from Thorsen Creek Waste and Recycling Centre to recyclers in the Vancouver area. Reduced backhaul rates are paid by the respective PROs present in BC and the municipalities; strategy development is supported by Aboriginal Affairs and Northern Development Canada. Heiltsuk First Nation in Bella Bella, as noted earlier, has recently implemented a third Waste and Recycling Depot in the district. Compacting waste or recyclable materials on-site has been identified as a primary strategy for reducing transportation costs.

British Columbia Used Oil Management Association

In a similar fashion to the e-waste examples cited above, EPR programs for used crankcase oil, containers and filters have recognized and responded to the need to offset collection and transportation costs from remote communities. For example, with the British Columbia used oil program, run by the British Columbia Used Oil Management Association (BCUOMA), all British Columbians pay the same Environmental Handling Charge (EHC) for the purchase of oil, filters, antifreeze and oil and antifreeze containers. The EHC is used by BCUOMA to fund the operation of the provincial EPR program. However, the cost of providing the service to the rural and remote areas of BC is much more per litre of oil and antifreeze and per kg of filters and oil and antifreeze containers. Like the "postal service model", where all Canadians pay the same for postal service regardless of where they live, the service in the remote areas is provided just as in the more populous centres even though it is more challenging and costly for the BCUOMA program. The amount BCUOMA pays to collect and recycle the used oil and antifreeze materials from rural and remote communities is up to over five times what it costs in the Metro Vancouver area. In effect the fees collected in the more urban parts of the province, where costs are lower, are used to offset the higher costs of collection in more remote areas.

Ontario Tire Stewardship

In a similar way, the collection of used tires under the Ontario Tire Stewardship (OTS) program has addressed a similar challenge in a similar way. Points of purchase eco fees charged on new tires to cover the cost of the program are the same across the province, regardless of where a tire is purchased. OTS pays tire collectors and haulers to collect and ship tires for recycling. A higher fee is paid as a "bounty" to used tire collectors to offset the costs of collection and transportation to recycling facilities from remote communities. Payments to haulers are differentiated by zone across the province and range from $0.90/tire to $5.00/tire paid for haulage further from the processing centres. The bounties are calculated based on three elements – costs of collection, sorting costs and transportation costs for delivery to a tire processor.

In both programs cited above a single environmental handling fee structure is uniformly applied across the jurisdiction regardless of depot or collection location or size of population. A balance has been struck in each case between lower costs in larger population centres and higher costs in more remote and smaller communities.

4.3 CURRENT E-WASTE MARKETS IN CANADA, US AND ABROAD WHERE NWT MATERIALS COULD END UP

E-waste recyclers and e-waste materials end markets

Since ARMA was the first provincial e-waste program implemented in Canada, Alberta is home to a number of Western Canada's major e-waste recyclers. There are currently six registered e-waste processors in that province and e-waste stewardship programs in Saskatchewan and British Columbia have ongoing service agreements with Alberta recyclers such as GEEP, and E-cycle Solutions. In addition, this market would be the most natural since NWT's main road link is with Alberta. Companies like GEEP shred and separate recovered materials – shredded circuit boards, copper, batteries, mercury lamps, aluminum and ferrous components, shredded plastic, CRT glass, etc. These materials are then shipped to end markets like the Teck/Toxco facility in Trail, BC where lithium and cobalt-based materials (e.g. batteries) are processed or to the Horne smelter in Rouyn-Noranda, QC. In some cases, materials might also be shipped overseas to more specialized facilities like the one operated by Umicore in Belgium or to facilities in the USA. Metals retrieved in those facilities are then shipped to refineries, such as CCR (Canadian Copper Refinery) and CEZ (Canadian Electrolytic Zinc) located in Montreal area, where they are processed along with unrefined extracted ore. The following table presents the industry's actors who are most frequently involved in Western Canada's e-waste recycling chain.

Table 12 Processors and recyclers most frequently involved in Western Canada's e-waste recycling chain

TYPE OF ACTOR	CORPORATE NAME	LOCATION
E-waste Processor	E-Cycle Solutions	Chilliwack, BC; Airdrie, AB; Edmonton, AB
E-waste Processor	Recycle-Logic	Red Deer, AB
E-waste Processor	Shanked Computer Recycling Inc (SCRI)	Acheson, AB
E-waste Processor	TechnoTrash	Calgary, AB
E-waste Processor	Genesis Recycling Ltd.	Aldergrove, BC
E-waste Processor/Recycler	Global Electric Electronic Processing (GEEP)	Edmonton, AB
E-waste Processor/ Recycler	FCM Recycling	Delta, BC
E-waste Processor/ Recycler	Exner e-Waste Processing	Morden, MB
E-waste Processor/ Recycler	Redemtech	Guelph, ON; Duncan, BC
Endstream Lithium and Cobalt Recycler	Teck / Toxco	Trail, BC
Endstream Copper and Zinc Recycler	Horne / Xstrata Recycling	Rouyn-Noranda, QC
Endstream Precious Metals Recycler	Umicore	Hoboken, Belgium

Environmental and social responsibility has been a growing concern among general public, governments and waste electronics collectors following many controversies on waste electronics management conditions in countries such as China, Bangladesh and India. In the most recent years, some third party initiatives such as *R2* (Responsible Recycling Practices) and *E-stewards* have been developed to address these issues. Launched in 2010 by the Basel Action Network, the *E-stewards* program certifies responsible e-waste management practices for recyclers and processors. With this certification, companies pledge to provide documentation audit, track the toxic materials from electronic waste to final disposition, and keep toxic materials out of developing countries, prisons, solid waste landfills and incinerators. To guarantee that recycling responsibility targets are met, a growing number of cities or governments in the USA now require their recycling partners to adhere to these corporate responsibility initiatives.

5 LEGAL AND REGULATORY FRAMEWORK

The *Northwest Territories Waste Reduction and Recovery Act*, referred to as 'the Act', provides the legislative framework for the current Beverage Container and Single-use Retail Bag Programs.

Brought into force on July 15, 2005, Section 4 of the Act authorizes the Commissioner in Executive Council to establish programs relating to the reduction and recovery of waste and the designation of materials that may be subject to the programs. The Act also establishes a special purpose fund, the Environment Fund, into which all surcharges and other fees collected through recovery programs operated by the GNWT must be paid. The Fund may then be used for the operation and funding of waste recovery programs as well as education and awareness, research, development and evaluation activities related to solid waste.

With respect to the authorities to enter into agreements, Section 7(1) explicitly enables the Minister to enter into agreements with the government of a province or territory in respect to the administration of the Act and regulations while Section 7(2) enables the Minister and the Commissioner to enter into agreements with the Government of Canada in respect to the reduction or recovery of waste.

The Commissioner in Executive Council may also make regulations under section 14 of the Act relating to the following:

(d) Respecting programs in respect to the reduction or recovery of waste;

(e) Establishing different classes of designated material for different purposes;

(h) Providing for a system of registration of manufacturers, distributors or retailers;

(i) Respecting terms and conditions that must be met by a manufacturer, distributor or retailer in order to distribute or sell a designated material in the NWT;

(j) Respecting methods for the recovery of a designated material; and

(l) Respecting the establishment and operation of facilities to receive, collect, store, transport, process, recycle or dispose of a designated material, including the qualifications of persons who may operate them.

The Canada-Wide Action Plan for Extended Producer Responsibility, which was adopted in principle on October 29, 2009 by the GNWT through the Canadian Council of Ministers of the Environment (CCME) describes two approaches to solid waste management which are currently being used in Canada. The first approach, which is referred to as 'Product Stewardship', incorporates programs which are largely operated through government agencies and where manufacturers, distributors or retailers are not directly responsible for program design or operations. The Beverage Container and Single-use Retail Bag Programs are examples of successful product stewardship programs. The second approach, which is referred to as extended producer responsibility, incorporates programs where manufacturers, distributors or retailers are fully and directly involved in the post-consumer management of their specific products.

The electronic waste programs that are currently operating in Nova Scotia and British Columbia are examples of Extended Producer Responsibility programs.

To the consumer, product stewardship and extended producer responsibility programs may appear to be very similar, but it is the lack of direct responsibilities on the part of manufacturers, distributors or retailers to design, operate and fund the programs that distinguish the two approaches.

For the purpose of this study, legislation from Nova Scotia, Alberta and British Columbia has been selected as being representative of Canadian provincial waste management authorities. An analysis of this legislation identifies several common characteristics respecting each government's ability to designate products and producers and to mandate Extended Producer Responsibility stewardship plans and other regulatory obligations regarding programs for the end-of-life management.

5.1 RELEVANT AUTHORITIES IN NOVA SCOTIA, ALBERTA AND BRITISH COLUMBIA

With respect to entering into agreements, Section 19(1) of the Nova Scotia *Environment Act* states:

> "Subject to subsection (2), the Minister may enter into agreements with any person relating to any matter pertaining to the environment".

Similarly, section 19 of the *Alberta Environmental Protection and Enhancement Act* states:

> "The Minister may on behalf of the Government enter into agreements relating to any matter pertaining to the environment with:
>
> (a) The government of any other jurisdiction or an agency of the government,
> (b) A Government agency, or
> (c) Any person".

With respect to regulation making authority as it relates directly to extended producer responsibility, Section 102(1)(a)(iv) of the Nova Scotia *Environment Act* states that:

> "The Governor in Council may make regulations requiring the development and implementation of a waste minimization, recycling or recovery plan for designated material by manufacturers, distributors, retailers or any other person, specifying the manner in which designated material is to be managed".

In Alberta, Section 175(h) of the *Environmental Protection and Enhancement Act* states:

> "The Lieutenant Governor in Council may make regulations requiring the development and implementation of a waste minimization, recycling or recovery plan for designated material by manufacturers or distributors of the designated material or by any other person".

Finally, in British Columbia, Section 21(1)(q) of the *Environmental Management Act* states:

> "Without limiting section 138(1), the Lieutenant Governor in Council may make regulations requiring prescribed industrial, commercial and institutional operations or classes of operations to develop and implement a waste reduction and prevention plan for packaging, product containers or any other material or substance, and prescribing the contents of the plan".

5.2 SETTING CONDITIONS ON THE SALE AND DISTRIBUTION OF DESIGNATED PRODUCTS

Experience in the NWT clearly demonstrates that the *Waste Reduction and Recovery Act* provides the Commissioner in Executive Council with authority to establish product stewardship programs relating to solid waste recovery and recycling. This authority is derived through Section 4 and the various regulation making powers described in Section 14 of the Act. However, unlike statutes in Nova Scotia, Alberta and British Columbia, Section 7 of the *Waste Reduction and Recovery Act* only explicitly provides the Commissioner in Executive Council with authority to enter into agreements with the government of a province, territory or Canada, and does not provide for agreements with 'any person', including businesses and corporations. Further, unlike the provincial statutes, Section 14 of the Act does not explicitly provide for the making of regulations that would require manufacturers, distributors or retailers to develop and implement waste minimization, recycling or recovery plans.

Arguably, Sections 4 and 14 of the Act could be interpreted to enable the Government to establish an EPR program for e-waste as a condition of sale or distribution within the NWT. A level of uncertainty remains however,as these authorities are not explicitly stated as they are in the Nova Scotia, Alberta and British Columbia statutes. Before proceeding, the authority of the Commissioner in Executive Council to legislate an extended producer responsibility program using Sections 4 and 14 of the *Waste Reduction and Recovery Act* needs to be confirmed in consultation with Legislative Counsel in the Legislation Division of the territorial Department of Justice. Further, Legislative Counsel should be asked to confirm whether Section 7 of the Act provides the Minister with authority to enter into agreements with manufacturers, distributors and retailers with respect to the development and implementation of waste minimization, recycling or recovery plans.

The Minister's authority to restrict or limit access to the market through the setting of terms and conditions under section 14(i) is a powerful regulatory tool and may be sufficient incentive for manufacturers, distributors and retailers to voluntarily implement an extended producer responsibility program. Similar restrictions have not been applied in any of the Canadian e-waste programs that were reviewed. Concerns that producers may stop selling certain products in order to avoid an EPR obligation will be discussed in Chapter 8. In all cases, this may need to be considered when developing the regulations.

6 DESCRIPTION OF PROGRAM OPTIONS

There are five basic options for structuring an e-waste program. Four options include an EPR component – from producers being solely responsible for all aspects of the program to shared producer/government responsibility models. The fifth option, which is product stewardship, public sector operated program, involves a publicly managed and operated program similar to the existing beverage container program.

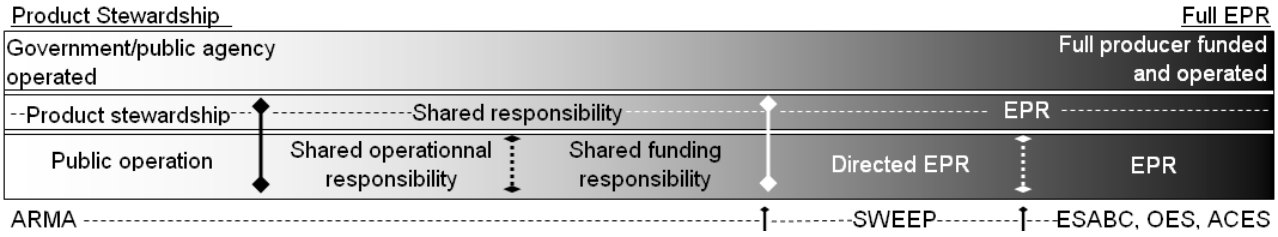
The primary options which will be reviewed are as follows:

- **EPR with full producer responsibility for funding and operation;**
- **Directed EPR;**
- **Shared responsibility: Public Sector Operation with Full Producer Funding;**
- **Shared responsibility: Divided Operational Responsibilities/Collection and Recycling Split;**
- **Product Stewardship program: Public sector operation.**

Each of these options represents different scale towards EPR. Figure 4 illustrates the continuum of the options between a product stewardship program operated by the public sector and a full EPR program.

It should be noted that from each option there may be a number of possible option variations. Also within each model opportunities might exist to transition such things as operational responsibilities and costs from a degree of sharing to full EPR and to do so over a period of time. .

Figure 4 Product stewardship/extended producer responsibility continuum



The following sections describe each program option.

6.1 EXTENDED PRODUCER RESPONSIBILITY

6.1.1 Overview

Producers would be given a legal obligation to collect and recycle designated end of life electronics in the NWT and meet program performance targets and reporting obligations. Final decisions on program design, funding, including any fees and how they are collected, and program operation would be a responsibility of producers themselves.

6.1.2 Key Elements

- An EPR regulation adopted by the GNWT would require producers to collect and manage end of life electronics generated in the NWT as a condition of being able to sell, offer for sale or distribute designated electronic products in the NWT.
- Regulations would list designated products and require producers to prepare a stewardship plan documenting how they intend to meet program obligations and targets and manage the e-waste collected.
- Regulations or other guidance would establish the core elements of any e-waste program that must be addressed in a stewardship plan.
- Stewardship plans would be approved by the government authority, either by the minister or a designated senior public official.
- Performance measures or targets could be set in regulation, or guidance could be provided identifying the performance measures and targets which must be addressed in a stewardship plan.
- Producers would have a high degree of latitude in how they choose to design and operate the program and would be obligated to report on performance measures[15] and meet performance targets set by the GNWT.
- Funding the program would be a direct and sole responsibility of producers. GNWT could mandate that no visible fee be added at the point of purchase and that no environmental handling charge would be allowed to be passed on explicitly to consumers. If the GNWT remains silent on the issue of fees it is likely that producers will choose to add a visible consumer fee at the point of purchase as is done in all Canadian industry EPR programs currently operating in Canada, with the exception of Quebec, where such visible fees are banned at point of purchase but can be advertised to consumers as being part of the price.
- Producers would both fund the program and be responsible for all operational elements including collection and contracting with e-waste processors. Producers would have the option of contracting with existing depot operators and municipalities to provide collection services or could set up and operate their own collection network.
- Producers would have the ability to determine whether the collection program contains a return to retail element. Return to retail will need to be assessed on a case by case basis with regard to such issues as safe storage and handling of equipment returned for recycling.
- Producers would have the option of establishing their own individual producer responsibility program for their own products. It is more likely however that companies would join a not-for-profit producer responsibility organization (PRO) / industry funding organization (IFO) which would be legally incorporated in the NWT to collectively fulfil their obligation.

[15] A number of performance measures could be put in place, such as per capita collection rate, a recycling rate as % of that collected, or other more qualitative measures such as the % of program awareness in the general public.

- Producers would have the primary responsibility to promote the program and to communicate with and educate the public to ensure maximum participation. The GNWT, municipalities and communities could supplement such communications if they wished.

6.1.3 Roles and Responsibilities

- GNWT would have the responsibility to mandate the establishment of an EPR program for electronics by identifying responsible producers, designating products to be covered by the program, establishing stewardship plan requirements, setting out performance measures, targets and reporting obligations.
- GNWT would oversee the program to ensure performance measures are met and establish consequences for failure to meet targets.
- GNWT would work with producers to ensure all legally obligated producers were part of the EPR program.
- Existing depot operators, municipalities and communities could act as service providers under contract to the industry PRO in areas such as the operation of collection depots.
- Program funding and program operation would be the responsibility of producers selling designated electronics in the NWT. No public funds would be used to support or operate the program other than to ensure producer performance measures and targets are met.

6.1.4 Considerations

- A full EPR model would allow producers a high degree of latitude to design and implement the e-waste program within the broad program guidelines provided by the GNWT for inclusion within an approved stewardship plan.
- The details of program operation and implementation would be the producers' responsibility and government involvement in the program would be limited to broad oversight and ensuring that program performance measures and targets are met.
- Government would have some ability to influence certain elements of program design and implementation but day to day operational details including such things as choice of depot operators, locations and the hours of operation of a depot would exclusively be a responsibility of the producers running the program.
- Government accountability for the program rests ultimately on the program's ability to meet and report on the established performance measures and targets.
- Government oversight and monitoring of the established performance metrics is critical to the success of the program.
- GNWT would need to ensure that the public is made aware that producers are responsible for the program's operation and that questions, comments or concerns about day to day operations should be directed to the responsible producers and producer responsibility organization and not to government.

6.1.5 Examples

- The recently implemented electronics collection and recycling program in Quebec will operate as a full producer responsibility program with costs of the program to be internalized in the posted and cash register price charged to the consumer in accordance with Quebec's consumer protection legislation. Internalized fees for end-of-life management can however be advertised to consumers as part of the price of the product.
- The Electronics Stewardship Association of British Columbia (ESABC) operates a fully funded and operated producer responsibility e-waste program. In contrast to the upcoming Quebec program, the costs of the program are raised through a point of purchase environmental handling fee which is identified and separately added to the product price at the cash register at the point of purchase. Similarly structured and funded programs operate in Ontario (Ontario Electronics Stewardship (OES), and in Nova Scotia and Prince Edward Island (Atlantic Canada Electronics Stewardship (ACES)).

6.2 DIRECTED EXTENDED PRODUCER RESPONSIBILITY

6.2.1 Overview

Producers would have the primary operational and funding responsibility for the EPR program, but the GNWT would prescribe key program elements such as possibly using the existing beverage processing and depot network for e-waste collection.

6.2.2 Key Elements

- The funding and operational responsibilities would be clearly assigned to producers and the program would be structured in the same way as a full EPR program within the framework of a legislated mandate and with clear performance obligations.
- As distinct from a full EPR program where producers would have full latitude to decide on how to design and implement the program to meet established performance criteria and targets, under a directed EPR model producers would be given explicit direction on certain required program elements for inclusion in the e-waste program.
- As with a full EPR program, elements to be included in a stewardship plan would be specified and broad guidance would be provided on program design and implementation. In addition however the GNWT would identify certain mandatory program elements with a view to guarantee the GNWT's objectives in particular areas were met.
- One area where direction could be given would be in the areas of level of service and collection system design and operation. For example, direction could be given to integrate, to the degree possible and appropriate, an e-waste program with existing recycling networks and municipal programs with the goal of providing comparable levels of public access and service.

6.2.3 Roles and Responsibilities

- Similarly to a full EPR program model, GNWT would have the responsibility to mandate the establishment of an EPR program for electronics by identifying responsible producers, designating products to be covered by the program, establishing stewardship plan requirements, setting out performance measures, targets and reporting obligations.
- GNWT would monitor the program to ensure performance measures are met and establish consequences for failure to meet targets.
- GNWT would work with producers to ensure all legally obligated producers were part of the EPR program.
- Program funding and program operation would be the responsibility of producers selling designated electronics in the NWT.
- No public funds would be used to support or operate the program other than to ensure producer performance measures and targets are met.
- Producers would be obligated to follow specific direction given by the government authority on certain identified program elements.

6.2.4 Considerations

- Directing the establishment of certain program elements is a more formal and mandatory way of ensuring that certain elements of a stewardship plan are implemented in a prescribed way to the government's liking.
- Government will need to be clear as to what program elements it wishes to ensure are included in the e-waste program.
- Guidelines for other components of a stewardship plan and the issues that it should address are commonly provided in regulation or in supportive documents and would be a government responsibility.
- The direction given by government removes some of the latitude that producers would be otherwise given under a full EPR program model.
- Reducing the degree of latitude in program design and implementation may, in certain cases, remove a competitive element in contracting for and providing certain program services and could therefore negatively affect the price of the required service and overall program costs.

6.2.5 Example

- Saskatchewan used a directed EPR approach with the Saskatchewan Waste Electronic Equipment Program (SWEEP).
- Producers were required to use the existing Saskatchewan Association of Rehabilitation Centres (SARC) network of 71 depots in 63 communities across the province for waste electronics collection and some intermediary processing. SARC is a non-profit organisation representing community based organizations that provide residential, development, and employment support and services to individuals with disabilities. Its depots were an established and well known

location for return of deposit return beverage containers, used paint and containers and empty milk containers.

- The province was interested in strengthening SARC's services by providing them with the opportunity to participate in the electronics program.
- In addition the province wished to ensure that the e-waste program integrated with the existing and well-known SARCAN depot program and that it would provide a comparable level of public access and service.
- Responsible producers under the e-waste program might have decided themselves to contract with SARCAN even without provincial direction but the direction provided ensured that the province's vision for the depot network across the province was supported.

6.3 SHARED RESPONSIBILITY : PUBLIC SECTOR OPERATION WITH FULL PRODUCER FUNDING

6.3.1 Overview

The public sector would have full responsibility for the establishment, operation and direct costs of the e-waste program including the delivery of collected e-waste to a final processor and payment for recycling. Producers would be responsible to fund the program and would pay the public sector operators for their net program costs based on an agreed upon funding formula.

6.3.2 Key Elements / Roles and Responsibilities

- The funding responsibilities for the e-waste program would be assigned to producers and the program would be structured in the same way as a full EPR program within the framework of a legislated mandate and with clear performance obligations.
- Producers would be obligated to raise and provide the necessary funds to cover the net costs of the program.
- GNWT or its agents would however be responsible for collection, transportation and processing of e-waste and for the overall operational management of the program.
- GNWT could directly undertake some of the operational responsibilities themselves and/or could designate and work with municipalities, communities, existing beverage depot operators and others to implement a collection system which would meet public objectives regarding level of service and public access.
- GNWT would be ultimately responsible for transportation of collected materials and contracting for processing.
- The public sector program operators would be remunerated by producers for 100% of net program costs based on an agreed upon funding formula.
- The funding formula would recognize certain agreed upon levels of service and operating standards that producers would be obligated to pay. Services beyond the agreed upon formula would not be paid by producers and would remain a public obligation. For example a municipality

may wish to provide a higher level of access to a depot than the agreed upon common level of service.

- Responsibilities for program promotion and communications could be shared between government and producers but government would likely play a major role in ensuring the success of the collection program.
- GNWT would work with producers to ensure all legally obligated producers were part of the EPR program.

6.3.3 Considerations

- The primary responsibility to design, implement and operate the e-waste program would rest with the public sector.
- Because producers would not be directly responsible for collection but only for transportation and processing, they could not be made directly accountable for meeting program targets. Meeting targets for the collection of e-waste would be largely a responsibility of the public sector.
- The public sector would directly fund the program but would be remunerated by producers under their legislated EPR obligation.
- Producers would be obligated to raise funds and to enter into a funding formula agreement to identify legitimate program costs that are eligible for funding.
- The funding formula and its specific case by case application could be cause for disagreement between the parties. Producers will be interested in reducing their costs as much as possible whereas the GNWT, municipalities and others will be interested in maximizing the levels of service and public access which could raise costs above agreed upon levels.
- A mediation system may need to be structured to arbitrate any funding disputes.
- The public sector operators of the program would be obliged to meet accepted standards for the handling and transportation of collected e-waste in order to meet the requirements of processors.

6.3.4 Example

- The packaging and printed paper program in Quebec operates on this model. Municipalities have been mandated to continue operational responsibilities for municipal recycling programs and for curbside collection, processing of materials and marketing.
- In the Quebec program municipalities which had historically launched and operated curbside recycling programs continue their primary operational role but with assured funding provided by producers through Éco Entreprises Québec, the organization representing packaging sector stewards.
- Producers pay for the net costs of the program through a funding formula which is transitioning from an original share of approximately 50/50 to paying 100% of net program costs.
- The Ontario blue box program operates in a similar manner to the Quebec program with municipalities operating the program from collection to processing but with only 50% of their net

costs paid by Stewardship Ontario, the producer responsibility organization representing packaging stewards.

- In Ontario an annual survey of municipalities is managed by Waste Diversion Ontario to determine eligible net program costs. The funding is based on a formula which sets out the level of municipal recycling service that is eligible for 50% producer funding.

6.4 SHARED RESPONSIBILITY : DIVIDED OPERATIONAL RESPONSIBILITIES/COLLECTION AND RECYCLING SPLIT

6.4.1 Overview

Operational responsibilities for a program and the associated funding for operations would be divided between the public sector and producers. Producers would be given responsibilities for designated e-waste under an EPR regulation but with only a partial share of responsibility for overall operations and financing. The GNWT would determine the degree of shared operational responsibilities with each partner responsible to fund their own operational program element.

6.4.2 Key Elements

- The distinct areas of responsibility would be clearly identified in an EPR regulation designating obligated producers.
- The producer obligations would be legislated and structured in the same way as a full EPR program within the framework of a legislated mandate and with stewardship plan requirements.
- A workable division of responsibilities could be to have operational responsibilities for collection and possible consolidation at intermediary processing centres rest in public hands.
- Transportation, final processing and marketing of the e-waste collected from the public program could be an operational responsibility of producers.
- Agreements would have to be reached between the parties as to specific terms and conditions of the two parts of the operational program and such things as standards for handling and storage of collected materials prior to shipment and processing would have to be negotiated and acted on in a reliable manner.
- Under this scenario the GNWT would have the ability to design and operate a collection system and to directly meet its objectives regarding levels of service and public access to the program.
- Both the public sector and producers would have obligations to monitor performance and report publically on their operational responsibilities.

6.4.3 Roles and Responsibilities

- The public sector and producers would be responsible for funding their own part of the program operation.
- While a variety of divisions in responsibility for operations could be imagined the most appropriate and workable model would likely be to divide responsibilities at the point between collection and processing.

- Under this scenario the public sector would have direct operational and funding responsibility for the collection program and could thereby ensure that the desired level of service and program access is met across the NWT.
- Producers would be directly accountable after collection for the transportation and processing of the collected e-waste and would be responsible to raise the necessary funds to support this obligation.
- Protocols would need to be negotiated to determine leads and responsibilities for program promotion and education.
- GNWT would work with producers to ensure all legally obligated producers were part of the EPR program.

6.4.4 Considerations

- Because producers would not be responsible for collection but only for transportation and processing, they could not be made directly accountable for meeting program targets. Meeting targets for the collection of e-waste would be largely a responsibility of the public sector.
- GNWT would be obligated to both operate and fund, directly or through the application of a point of purchase fee, a significant part of the program.
- If funds to support the program are raised through any kind of point of purchase fee decisions will have to be made as to how to manage and share such funds between the two operational parts of the program.
- Any split in operational responsibilities would require roles and responsibilities to be clearly written out with a clear set of standards and protocols set out to facilitate efficient transfer of materials between the two responsible parties.
- Producers will have an interest in ensuring that the collected e-waste meets accepted industry standards for transportation and for acceptance at processing facilities and producers could be in a position to refuse loads if they did not meet standards.
- A mediation system may need to be structured to minimize operational issues between the two parts of the program and to arbitrate any disputes.

6.4.5 Example

- There are no operational partial EPR programs based on a divided operations model or a split in responsibilities between collection and recycling. No pure example of this option exists in Canada, but elements of the programs cited below provide some explanation on how this option may work.
- The current Ontario packaging and printed paper blue box program model has elements of divided responsibilities but with municipalities fully responsible for program operations and materials marketing[16].

[16] This differs from Quebec's example provided in section 6.3 which has 100% producer funding but municipal operational responsibilities.

- In Ontario municipalities operate the curbside collection program and are responsible for the processing of materials and in some cases also for direct marketing of separated materials. There is no division between collection and processing or recycling although processing is often handled through private sector facilities under contract to municipalities. Producers pay approximately 50% of calculated net costs. In Manitoba producers pay for 80% of the municipally operated packaging and printed paper recycling program and in Quebec funding is transitioning to 100% from an original 50% share.

6.5 PRODUCT STEWARDSHIP PROGRAM: PUBLIC SECTOR OPERATION

6.5.1 Overview

The e-waste program would be operated as a stewardship program by government or an independent agency with no direct producer involvement in either program funding or operations. Funding would likely be achieved through the placement of visible fees charged to consumers at point of sale[17].

6.5.2 Key Elements

- The program could be directly operated by the GNWT ENR (or by another government department) as is done with the existing NWT beverage recycling program.
- The program could be operated by a special purpose not for profit agency, reporting directly to the responsible minister, and established under regulation with a mandate to operate an e-waste program.
- Program costs would be covered by visible fees or surcharges placed at point of sale on products sold in the NWT. Any such fees would be set by government. The issue of purchases of electronics outside the NWT and its implications for the funding of a GNWT product stewardship/public operation model are fully discussed in Section 8.4.
- Funds collected at point of sale would be remitted to the responsible department or special purpose agency and would be managed directly by the responsible department or by the special e-waste agency to establish and run the program.
- The department or the designated agency would be responsible for the development of an e-waste stewardship plan.
- The department or the designated agency would be responsible to implement an approved stewardship plan and establish and directly fund the necessary capital and operational requirements for the e-waste collection program, including the necessary collection and transportation infrastructure and contracting with e-waste processors for recycling of the collected materials.

[17] Producers would not be targeted in such model. The obligation to collect any fees would be upon whoever sells in the NWT – in Alberta's case that is defined as "manufacturers, distributors, wholesalers or retailers that sell or supply designated electronics" – anybody who sells becomes a fee collector for the government or government agency.

- Program promotion and education would also be a direct government or agency responsibility.
- The department or the agency would be required to audit its operations and report on program performance to the public.

6.5.3 Roles and Responsibilities

- All responsibilities to fund and operate the program would rest with the GNWT or with a not for profit crown agency reporting to the Minister and established for the purpose.
- There would be no responsibility or roles given to producers.
- Producers could however participate in program consultations or serve on an advisory committee.

6.5.4 Considerations

- The GNWT would have the direct ability to determine the level of service to be provided by the program and the degree of public access to the program.
- Costs for the program would either be a direct or indirect responsibility of the GNWT.
- Authority to directly run a program as a departmental responsibility appears to exist under the Waste Reduction and Recovery Act but would need to be confirmed and necessary administrative oversight and staffing established within the designated responsible department.
- Financial management of the program within the department might benefit from a dedicated e-waste program budget separate from and independent of the overall departmental budget to ensure that the program maintained the necessary independence of operation sufficient to meet program expectations.
- Authority to establish a special purpose agency to fund and operate an e-waste program would need to be investigated, by-laws adopted, members appointed, mandate developed, staff hired and an organization established.
- Operating a program through a not for profit agency would transfer day to day program operational decisions and administration out of the direct hands of government but would allow for direct program accountability and would facilitate a close linkage of program goals and objectives with those of the government.
- A product stewardship program could have more challenges in providing a return to retail collection option than the producer responsibility models where electronics retailers are closely tied to electronics producers. The Alberta product stewardship program has however negotiated return to retail with a few of the major big box electronics retailers such as Future Shop, Best Buy and Staples.
- Program auditing, reporting and transparency could be assured and would meet standard public sector requirements such as those in place for the Beverage Container Program.
- Any fees or surcharges would be set by government, either directly or indirectly through an agency, and could be placed on designated electronics sold by territorial retailers and on internet sales into the NWT (as is successfully done in provincially regulated programs).

- Electronic equipment purchased outside the NWT, predominantly in Alberta, will however avoid paying any fee or surcharge to fund the NWT program and such equipment could become a significant unfunded financial liability if it is collected and recycled in the NWT.
- Because a significant, if unknown, amount of electronic equipment is purchased outside the NWT fees or surcharges applied at point of purchase in the NWT, if set at a comparable level to charges in provincial e-waste programs, are unlikely to be sufficient to cover anticipated costs of collection and recycling in the NWT.
- Similarly, if fees or surcharges are set at a level to cover program costs it is likely that they would be high compared to other programs and such high fees would negatively impact territorial retailers by possibly driving more purchases into adjoining jurisdictions. This issue is discussed in more detail in Sections 8.3.1 and 8.4.

6.5.5 Example

- The Alberta program operates as a provincially run stewardship program not as an EPR program.
- The Alberta program is not operated directly by the provincial government but by the Alberta Recycling Management Authority (ARMA) which operates as a not for profit Delegated Administrative Organization incorporated under the Alberta Societies Act.
- ARMA's members are appointed by the Province and the ARMA board is accountable to the Minister of Environment
- ARMA receives its authority to budget for and operate the provincial e-waste program from the Minister of Environment and its business plans must link with the goals and performance indicators of the provincial government and the Environment Department, to which it reports.
- Funds for the program are collected as point of purchase fees on all designated electronic equipment and are remitted to ARMA
- Fees collected at the point of purchase to support the program are regulated and are not set by producers.
- ARMA appoints electronics industry representatives to advise it on program operations.
- ARMA fully manages the e-waste program, is responsible for the collection system, and for contracting for the transportation of collected materials
- Separate contracts between private sector consolidators and e-waste processors allow competitive pricing for processing.
- ARMA supports or directly undertakes all promotion and education activities supporting the program.

6.6 SUMMARY OF PROGRAM OPTIONS

The following table sums up the pros, cons, risks and opportunities associated with the five program options described in this section.

Table 13 Summary of Program Options

OPTIONS	PROS	CONS	RISKS	OPPORTUNITIES	MITIGATION MEASURES	COMMENTS AND CONSIDERATIONS
Full EPR	▸ No direct GNWT costs ▸ Operations and funding a producer responsibility	▸ Reliance on producers	▸ - Producers have direct responsibility for meeting program targets or objectives	▸ Producers have the ability to integrate program with other e-waste EPR programs ▸ Development of a more broadly based collection system including return to retail ▸ Precedent for use of EPR for other wastes	▸ Rigorous performance measurement requirements and reporting obligations. ▸ -Clear consequences for failure to meet performance measures	▸ Producers may choose to negotiate about fees collected in Alberta on products used and recycled in NWT ▸ Integration with BC and other industry EPR programs is more straightforward because the programs are operated by the same producers
Directed EPR	▸ No public funding responsibility ▸ GNWT can mandate certain program elements, and would have the ability to be more prescriptive.	▸ Could result in public sector costs if certain collection and service levels are mandated	▸ Possible higher infrastructure and program costs due to constraints imposed on producers	▸ Higher level of assurance regarding levels of service and access ▸ Maximization of efficiencies associated with possibly building on existing beverage program	▸ Clearly defined and mandated elements and expectations ▸ Rigorous performance measurement requirements and reporting obligations ▸ Clear consequences for failure to meet performance measures	▸ Producers may resist prescriptive program design and operation ▸ Producers may choose to negotiate about fees collected in Alberta on products used and recycled in NWT ▸ Integration with BC and other industry EPR programs is more straightforward because the programs are operated by the same producers

OPTIONS	PROS	CONS	RISKS	OPPORTUNITIES	MITIGATION MEASURES	COMMENTS AND CONSIDERATIONS
Partial EPR: Public Sector Operation/ Full producer funding	▸ Full producer funding of the program	▸ Public sector responsible for program operation	▸ Disagreements over funding eligibility and appropriate levels of service	▸ Ability to influence level of service and access; ▸ Cost split could be transitioned over time towards 100% producer funding	▸ Clearly defined and agreed upon financial eligibility formulas and program cost accounting	▸ Jurisdictions with shared funding responsibilities continue to have disagreements about funding calculations and money available from producers ▸ Public sector operation will have to decide whether to provide services above the agreed funding formula
Partial EPR: Divided operational responsibility	▸ Partial producer funding ▸ More direct control over collection and other program elements	▸ Public sector responsible for partial program operation ▸ Sustainability of public sector funding	▸ Disagreements over operational issues – e.g. collection or intermediary processing standards	▸ Ability to direct levels of service and access ▸ Operational split could be transitioned over time towards greater producer responsibility	▸ Clearly defined and agreed upon operational protocols and standards	▸ Discussions with Alberta and other adjoining jurisdictions about products purchased outside NWT will be necessary ▸ Administrative structure to manage and operate program will need to be established ▸ Operational split likely best made on collection vs. transportation and processing. ▸ Precise operational split would need to be negotiated and roles and responsibilities identified. ▸
Product Stewardship / Public Sector Operation	▸ Full public sector control over operations and funding	▸ Public sector fully responsible for both operation and funding ▸ Sustainability of public sector funding	▸ Operational challenges. ▸ Fees raised within the jurisdiction will likely not be sufficient to cover costs	▸ Ability to direct levels of service and access ▸ Build on existing beverage depot/processing network; ▸ Fit with existing administrative system	▸ Addressing a potential funding gap by negotiating with adjoining jurisdictions for e-waste fees collected from products purchased in other jurisdictions	▸ Discussions with Alberta and other adjoining jurisdictions about products purchased outside NWT will be necessary ▸ Administrative structure to manage and operate program will need to be established

7 COSTS AND BENEFITS OF AN E-WASTE RECOVERY PROGRAM

This section presents the various costs and benefits associated with an e-waste recovery program for the NWT. Costs have been estimated either in dollar figures or in a qualitative fashion. Operating and overhead costs are based on the actual published costs of four provincial programs – British Columbia, Saskatchewan, Ontario and Atlantic Canada. Start-up costs were estimated based on available data from the Ontario program. Government, retailer and consumer support which may have to be added to the implementation costs of any e-waste collection and recycling program have also been described.

The risks associated with current practices of landfill disposal and the environmental, economic and social benefits of a collection and recycling program as an alternative disposal system are also presented in this section.

7.1 PROGRAM COSTS

7.1.1 Cost Estimation Methodology

Operating and overhead costs are estimated based on ESABC, SWEEP, OES and ACES programs' reported costs per tonne[18]. The dollar values found in the programs' 2011 annual reports were used to get a minimum-maximum cost range. This enables the lowest and highest program costs to be taken into account when estimating potential program costs for the NWT.

Since the cost of living in the NWT is substantially higher than the Canadian average, the 2009 Cost of Living Statistics provided by the NWT Bureau of Statistics was used to determine how costs should be adjusted to the NWT specific context. With Edmonton as a base for comparison (100), the cost of living in NWT communities is reported to range between 115 and 180 (+15% to +80%). Costs provided for each NWT community were weighted along with each community's population to obtain community costs of living. Those costs were then weighted according to regional population figures to obtain a +32% NWT average cost of living increase compared to Edmonton. Unless indicated otherwise, this 32% cost of living difference has been added to the minimum and maximum costs of the four referenced provincial programs in order to estimate the cost range for an NWT e-waste program. Costs per tonne were then obtained by dividing the estimated program cost range by the estimated average yearly e-waste tonnage as presented in Section 2.2.

In some cases, lack of NWT-specific data made it difficult to come up with dollar figures. In those cases, costs were given a qualitative description.

[18] Those four programs were selected because cost breakdown was made available in their annual reports.

7.1.2 Program Operating Costs

Operating costs have been described using three general categories: costs related to collection, to transportation, and to processing and recycling. Operating costs for the NWT are estimated to range between $1,323 and $1,720 per tonne, which represents approximately 75-85% of the overall program costs. All costs are summarized in Table 14.

It should be noted that program operating costs have been calculated using the estimated yearly sales figures, which amount to 236.43 tonnes, as presented in Table 5. Costs would be significantly higher during the initial years of any program until the stockpiled non-functional units have been collected, transported and processed.

7.1.2.1 Collection costs

Cost estimates regarding collection operations include collection and storage infrastructure as well as human resources necessary for operating the collection sites or events. Adding the 32% cost of living difference, it is estimated that collection costs would vary between $251 and $308 per tonne, or between $59,000 and $73,000 per year. It is important to note that those costs are based on the level of service found in BC, Saskatchewan, Ontario and Atlantic Canada. E-waste collection services in NWT may be of less frequency and rely on a much smaller number of permanent sites.

7.1.2.2 Transportation costs

Given the long distances and difficult transportation logistics in the NWT, transportation is considered the category where differences in cost would be greatest between provincial and NWT e-waste programs. Transportation cost estimates are based on shipping rates provided by the Northern Transportation Company Ltd (NTCL) which set their highest shipping rates at $405 per tonne and backhaul route rates at $182 per tonne.

It is assumed that costs for transportation between Hay River and Edmonton will be close to costs paid by ARMA to haulers in Northern Alberta and by the City of Whitehorse, which is currently $200 per tonne. This rate for out of NWT transportation was added to the costs listed in the previous paragraph. This addition allows taking into account the transfer of e-waste from NWT to recyclers mainly located in the Edmonton area.

Yearly transportation costs would then range between $90,000 and $143,000. Air transport rates may be much higher, although some companies might offer lower rates in government backed waste management programs. Unfortunately, costs per tonne for air routes were not available. Moreover, the rates posted by NTCL might be overestimated considering previous preferred rates offered to the Beverage Container Program. Only experience and agreements with hauling companies will allow a precise picture on the cost of transporting waste electronics.

7.1.2.3 Processing/recycling costs

Since processing/recycling operations would be taking place mainly in Alberta (see Section 4.4), no extra cost based on the cost of living in NWT was added to this category. A review of the four provincial programs sets the cost range for processing and recycling operations between $690 and

$807 per tonne. Annual costs are estimated to be between $163,000 and $191,000 per year when the average waste electronics generation presented in section 2.2 – 236.43 tonnes – is taken into account.

7.1.3 Overhead costs

Overhead costs have been categorized as general administration costs, communication and education costs and other expenses. Globally, these overhead costs are estimated to range between $186 and $630 per tonne and account for approximately 15-25% of the overall program costs.

7.1.3.1 Administration

Administrative expenses include office rent and human resources related to program management. If the Government of the Northwest Territories was to include handling fees as part of the program funding, fee management and compliance would also be included in this category. Using the same adjustment to NWT cost of living as used for operating costs, administration cost are estimated to range between $115 to $280 per tonne, or between $27,000 to $66,000 per year. As seen in the ACES and SWEEP programs, administration costs may go down with years as monitoring may be less of an issue once the program has become well established.

7.1.3.2 Communication and education

Communication and education costs include program promotion and advertising expenses, an education and awareness program and community incentives. Communication and education costs for a program in the NWT are estimated to range between $67 and $288 per tonne, or between $16,000 and $68,000 per year.

7.1.3.3 Other expenses

Other expenses include research and development costs, processors auditing and contracting specialized professional expertise. This category of costs is estimated to range between $4 and $62 per tonne, or between $1,000 and $15,000 per year.

7.1.4 Start-up Costs

Ontario Electronic Stewardship's 2009 Final Revised WEEE Program Plan provides the only available detailed start-up costs for Year 1 among the Canadian waste electronics programs. According to this document, start-up costs accounted for the equivalent of 25% of the annual program overhead costs[19]. Based upon Ontario's experience, start-up costs for a NWT program would range between $61 and $165 per tonne based on the minimum and maximum estimates presented in Table 14. For Year 1, start-up costs are estimated to range between $14,400 and $39,000.

Start-up costs may include legal aspects of start-up, program design, and data tracking system implementation, processor audits as well as any early design adjustment. A program phase-in for

[19] Program Plan Development and Start-Up accounts for $1,275,300 of the $5,145,300 administration costs estimated in OES WEEE Program Plan (OES, 2009: p.105).

accepted e-waste would also imply that part of Year 1 start-up costs would be replicated in the year prior to Phase 2 or any subsequent phase implementation. Such costs cannot be estimated with any accuracy as they would vary according to the chosen phase-in scheme and program specifications. Start-up costs would have to be added to the overall program costs for Year 1.

7.1.5 Overall program costs

Overall program costs are estimated to range between $357,000 and $555,000 per year. Table 14 provides a summary of the estimated program costs presented in Sections 7.1.2 and 7.1.3, comparing them with program costs in British Columbia, Saskatchewan, Ontario and Atlantic Canada.

Table 14 Estimated NWT Program Costs Summary compared with ESABC, SWEEP, OES and ACES Costs

COSTS CATEGORY	PROGRAM COSTS				COST ESTIMATE FOR NWT	
	ESABC (BC) 2011	SWEEP (SK) 2011-2012	OES (ON) 2011	ACES (NS & PEI) 2011	MIN. ESTIMATE	MAX. ESTIMATE
Total Operating Costs	$1,126 / T	$1,334 / T	$1,250 / T	$1,133 / T	$1,323 / T	$1,720 / T
Collection	$233 / T	n/a	n/a	$190 / T	$251 / T	$308 / T
					$59,000 / yr	$73,000 / yr
Transportation	$203 / T	n/a	n/a	$136 / T	$382 / T	$605 / T
					$90,000	$143,000
Processing/Recycling	$690/ T	n/a	n/a	$807 / T	$690/ T	$807/ T
					$163,000 / yr	$191,000 / yr
Total Overhead Costs	$ 158 / T	$426 / T	$ 259 / T	$286 / T	$186 / T	$630 / T[20]
Administration	$87/ T	$161 / T	$ 108 / T	$212 / T	$115 / T	$280 / T
					$27,000/ yr	$66,000/ yr
Communication & Education	$68 / T	$218 / T	$ 148 / T	$51 / T	$67 / T	$288 / T
					$16,000/ yr	$68,000/ yr
Other expenses	$3/ T	$47 / T	$ 3 / T	$22 / T	$4 / T	$62 / T
					$1,000/ yr	$15,000/ yr
Total Program Costs ($)	$22,746,913	$6,027,340	$ 78,800,000	$6,934,540	$357,000	$555,000
Total Program Costs (Per Tonne)	$1,284 / T	$1,760 / T	$1,509 / T	$1,419 / T	$1,509 / T	$2,349 / T
Total Program Costs (Per Capita)	$5.02	$5.70	$5.97	$6.53	$8.60	$13.40

As an example for Year 1 of a program, when start-up costs are added to these figures, estimated program costs range from $371,000 to $594,000 for Year 1 of the program or $1,570 to $2,514 per

[20] Minimum and maximum overhead cost estimates correspond to the sum of minimum and the sum of maximum costs estimates for administration, communications and other expenses for the NWT as show on the lines below.

tonne. Another way to express these costs is between $8.95 and $14.34 for each resident of the NWT.

7.2 OTHER COSTS AND SUPPORT TO CONSIDER

7.2.1 Government support

Various government support, including legal, regulation drafting and auditing support, may be needed in designing, implementing and operating a collection/recycling program for waste electronics. The magnitude of such support is difficult to estimate before a program design option is selected. For example, a product stewardship program would see a need for significant government support over time in program planning and operating whereas an EPR option would focus government support during the period prior to the program's implementation including legal and regulatory aspects, consultations and negotiations with producers. Dollar values could be better estimated after the choices in program design are made.

7.2.2 Industry/retailer support

Two aspects of industry and retailer support would need to be considered - program funding and program operations. An EPR oriented approach would mandate producers to fund collection and recycling operations. Depending on the selected program option, producers would have to pay in part or all of the costs presented in Sections 7.1.2 to 7.1.5.

At the local level, a return to retailer approach added to the program would require retailers to provide storage of collected waste, human resources and administration and reporting. In the same fashion, an environmental handling fee would create additional fee administration costs for retailers.

7.2.3 Household/consumer support

Eco handling fees

Consumers' response to a visible handling fee would need to be considered as this would involve obvious extra costs for consumers. In Alberta, such fees range between $1.20 and $10 depending on the electronic equipment. Section 8 of this report discusses the various risks and benefits associated with applying visible handling fees.

Time

Personal consumer support has to be considered in terms of additional transportation and storage requirements for residents of communities where no local, or only periodic, collection options are available (i.e. drive between household and out of community collection infrastructure, or time dedicated to storage in household until collection event). The time related to long term storage in households would be minimized for consumers in communities where local collection options are available on a regular basis.

7.2.4 Market-related costs

Reduced competition

The availability of specific electronic brands, competition and prices may be affected if some producers decide to leave the NWT market in order not to fund an EPR waste electronic recovery program. Although the possibility and impacts of this are difficult to assess, there remains a possibility that the NWT electronics market may be altered by reduced availability and competition in marketed electronics. However, there is no documented case of producers withdrawing from a provincial or national market following the implementation of such a program.

7.2.5 Environmental costs

Costs of current electronics waste management approach

E-waste is becoming the fastest growing waste stream in the industrialized world and the establishment of a waste management framework in the NWT is critical in order to reduce the environmental and social impacts that result when e-wastes are poorly managed.

Electronic products are produced using a variety of hazardous and scarce materials. Up to 60 different materials can be found in today's complex, but common, electronic products.

Epoxy resins, fibreglass, polyvinyl chlorides (PVC), thermosetting plastics, lead, tin, copper, silicon, beryllium, iron and aluminum are examples of substances that can be found in large quantities in common consumer electronic devices. Metals such as cadmium, mercury and thallium can be found in smaller amounts while americium, antimony, arsenic, barium, bismuth, boron, cobalt, europium, gallium, germanium, gold, indium, lithium, manganese, nickel, niobium, palladium, platinum, rhodium, ruthenium, selenium, silver, tantalum, terbium, thorium, titanium, vanadium, and yttrium can all be found in trace amount in some electronic products.

Table 15 provides a brief overview of materials that can be found in electronic devices, their main usages and their potential health and environmental effects. As described in the table, the potential public health, worker safety and environmental impacts associated with electronic waste handling and disposal must be considered as electronic products can contain a large number of hazardous substances. Experience from other jurisdictions around the world has demonstrated that poor management of these wastes can have considerable impacts on the environment as well as human health and worker safety.

Table 15 Selected elements contained in electronic products that are hazardous for the human health or/and for the environment

ELEMENTS / SUBSTANCES	USAGE	HEALTH AND ENVIRONMENTAL EFFECTS
Barium	Used in the front panel of the CRT to protect users from radiation	Health effects: short-term exposition can cause brain swelling, muscle weakness, and damage to the heart, liver and spleen
Brominated flame retardants (BFRs)	Flame retardants in plastics in most electronics *Note: Polybrominated biphenyl (PBB), Polybrominated diphenyl ethers (PBDEs) - DecaBDE, OctaBDE & PentaBDE - are not manufactured anymore*	Health effects: impaired development of the nervous system, thyroid problems, and liver problems Environmental effects: similar effects in animals as in humans
Cadmium	Surface Mount Device (SMD) chip resistors, infrared detectors, semiconductors and older types of cathode ray tubes contain cadmium. This element is also used as a plastic stabilizer, in light-sensitive resistors corrosion-resistant alloys for marine and aviation environments, and nickel-cadmium batteries (6 and 18% cadmium)	Health effects: inhalation of cadmium causes severe damage to the lungs, kidneys, and fragile bones Environmental effects: leach into the soil, harming microorganisms and disrupting the soil ecosystem
Copper	Copper wire, printed circuit board tracks, component leads	Health effects: long-term exposure to copper can cause irritation of the nose, mouth and eyes and causes headaches, stomachaches, dizziness, vomiting and diarrhea. Intentionally high uptakes of copper may cause liver and kidney damage and even death Environmental effects: copper does not break down in the environment and accumulates in plants and animals when it is found in soils. Limits the number of plants that has a chance of survival. Interrupt the activity in soils, as it negatively influences the activity of microorganisms and earthworms
Germanium	1950s–1960s transistorized electronics (bipolar junction transistors) – Note: germanium hydride and germanium tetrahydride are extremely flammable and even explosive when mixed with air	Health effects: abdominal cramps caused by inhalation, burning sensation, cough, skin redness, pain in eyes Environmental effects: the gas is heavier than air and may travel along the ground; distant ignition possible, and negative impact in aquatic ecosystems as it is a heavy metal
Halogenated hydrocarbons	Used in computer plastics	Health effects: May result in the formation of dioxins if the plastic is burned. Dioxins are highly toxic compounds and their effects include: + On animals: immunotoxicity, endocrine effects, tumor promotion, wasting syndrome, delayed death, cleft palate, hydronephrosis, disturbances in tooth development and sexual development + On humans: reproductive and developmental problems, damage the immune system, interfere with hormones and cause cancer
Hexavalent chromium	Used in galvanized steel plates and as a hardener for steel housing	Health effects: cause DNA damage and asthmatic bronchitis

Tableau 15 (Cont'd) Selected elements contained in electronic products that are hazardous for the human health or/and for the environment

ELEMENTS / SUBSTANCES	USAGE	HEALTH AND ENVIRONMENTAL EFFECTS
Iron	Steel chassis, cases, and fixings	Health effects: conjunctivitis, choroiditis, and retinitis if it contacts and remains in the tissues. Chronic inhalation result in siderosis and may enhance the risk of lung cancer Environmental effects: Iron (III)-O-arsenite, pentahydrate may be hazardous to flora, air and water
Lead	Most solder used in circuit boards, cathode ray tube (CRT) monitor glass, lead-acid batteries and some formulations of polyvinyl chloride (PVC) + CRT computer and television display has approximately 4-8 lbs of lead + Monitor glass contains about 20% lead by weight	Health effects: damage to the central and peripheral nervous systems, blood system, reproductive system, and kidneys. Children suffer developmental effects and loss of mental ability, even at low levels of exposure Environmental effects: accumulates in the environment, and has highly acute and chronic toxic effects on plants, animals and microorganisms
Lithium	Lithium-ion batteries	Health effects: corrosive to the eyes, the skin and the respiratory tract. Corrosive on ingestion. Inhalation may cause lung oedema. Environmental effects: Flammable and explosive. Metallic lithium will react with nitrogen, oxygen, and water vapor in air and its product represents a potentially significant hazard because it is extremely corrosive
Mercury	Light bulbs in flat panel displays (numerous applications), printed wiring boards all contain mercury	Health effects: sensory impairment, dermatitis, memory loss, and muscle weakness. High level of exposure contribute to brain and kidney damage and harm the developing fetus Environmental effects: death, reduced fertility, slower growth and development (animals)
Nickel	Nickel-cadmium batteries	Health effects: higher likelihood of lung, nose, larynx and prostate cancer; sickness and dizziness after exposure to nickel gas; lung embolism; respiratory failure; birth defects; asthma and chronic bronchitis; allergic reactions such as skin rashes; heart disorders Environmental effects: concentrations in sandy soils can damage plants and high nickel concentrations in surface waters can diminish the growth rates of algae. Micro organisms can also suffer from growth decline due to the presence of nickel
Sulphur	Lead-acid batteries	Health effects: kidney damage, heart damage, eye and throat irritation Environmental effects: corrosive as sulphuric acid

It has been demonstrated that 40% of lead and 70% of heavy metals, including mercury and cadmium, found in landfills originate from disposed electronic equipment (Scanlon, 2001). As no landfills in the NWT currently operate leachate collection systems, leachate containing these hazardous materials could potentially leave the disposal site and contaminate local land and water supplies[21]. In addition, concentrations of persistent bioaccumulative toxins such as lead, mercury, cadmium, and BFRs can accumulate in living organisms impacting their health and the health of animals that may prey on them.

It is recognized that over time the composition of electronics and the environmental impact of disposal will change. Electronics that were manufactured to meet the requirements of the European Commission's Restriction on Hazardous Substances (RoHS) Directive will have less hazardous and toxic materials than equipment manufactured prior to the enactment of the Directive. As this newer equipment enters the end of its life there will be positive changes in landfill disposal impact and associated with processing and recycling (National Measurement Office UK, 2010).

Emissions related to transportation

Additional transport would be required as electronic waste collected in communities would be transported to Alberta where it would be processed for recycling. The minimum travelling distance for each load of electronic waste sent south for processing is 1,125 km[22]. Air emissions are difficult to predict as travel emissions are dependent upon the volume of waste collected in each community, whether backhauls could be utilized and whether shipments could be combined with existing beverage container consignments to create full loads. Overall, air emissions related to transportation are expected to increase, but these increases would be minimized by utilizing backhauls and combining waste electronics with other transportable goods to create full loads. For indicative purposes, Table 16 shows GHG emission estimates based on one-way truck routes.

Those estimates are based on the assumption that waste electronics collected through NWT would be consolidated in Hay River due to its geographical location. In the case of the Beaufort Delta communities (Tuktoyaktuk, Inuvik and Fort McPherson), road shipments were calculated using the Dempster Hwy through Yukon with shipments driven directly to Edmonton. For the communities along the Mackenzie Valley (Fort Good Hope to Wrigley), 1 truckload and 1 container barge per year were considered in the calculations to take into account that ground shipments are possible only in the winter time, while maritime shipping containers can be considered for the remaining months. Those estimates would be lower if backhaul is preferred since empty trucks would already be serving the backhaul routes.

[21] Cadmium, lead, germanium, mercury, iron, zinc and lithium are metals known the have a high potential of leachability.

[22] 1,125 km corresponds to the distance between Hay River, the closest NWT community to Alberta on Hwy 1, and Edmonton.

Table 16 Estimates of GHG Emissions related to transportation

ROUTE	DISTANCE (KM)	FREQUENCY (TRUCKLOAD / YEAR)	GHG EMISSIONS (MTCE*)[23]
Behchoko – Yellowknife	105 km	2	22.8
Yellowknife – Hay River	480 km	12	624.9
Forth Smith – Hay River	272 km	2	59.0
Tuktuyaktuk – Inuvik	140 km	1	15.2
Inuvik – Fort McPherson – Edmonton (Dempster Hwy)	3,218 km	2	698.2
Fort Good Hope – Hay River Winter road	1,133 km	1	122.9
Fort Good Hope – Hay River By ship	1,133 km	1	3.02
		Total Transfers within NWT	1,543
Hay River – Edmonton	1,125 km	12	1,464.5
		Total GHG for Transportation	3,007.5

** Metric Tons Carbon Equivalent*

7.3 PROGRAM BENEFITS

The benefits of a collection and recycling program for NWT e-waste are described on the basis of benefits to the environment, overall economic activity and community awareness. Benefits are described in qualitative terms and not financial terms.

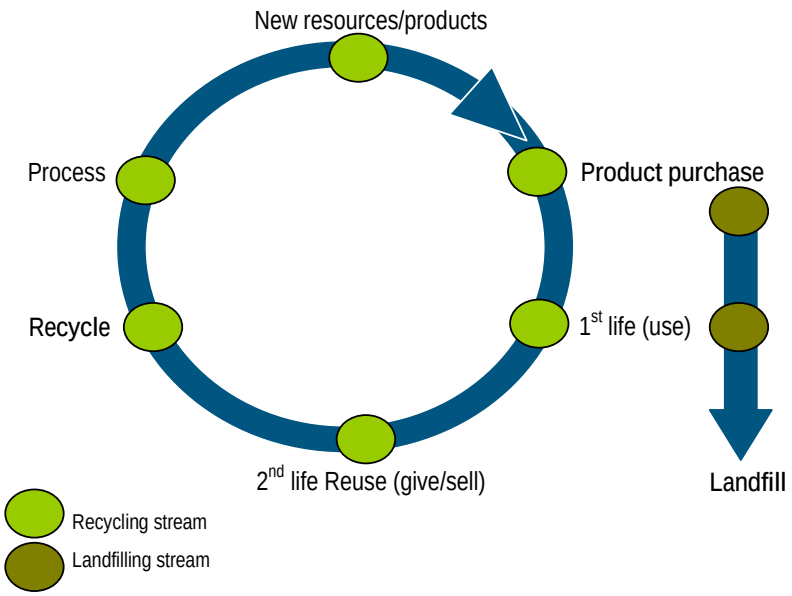
The following figure illustrates the different life stages of a product as a function of its disposal methods.

[23] GHG emissions were estimated based on the Global Warming Potential (GWP) of each vehicle type for CO2, CH4 and N2O and GHG Emissions Factors (g/L fuel) for the same substances. Factors for Heavy-Duty Diesel Vehicles and Diesel Ships were used.

GWP: Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Synthesis Report Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Core Writing Team, Pachauri RK, Reisinger A., editors. Geneva (CH): IPCC. Available online at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf

GHG Emissions Factors: Government of Canada, 2012. National Inventory Report 1990-2010: Source and Sink Category Emissions and Trends in Canada, Gatineau, Canada.

Figure 5 Life sequence of an e-waste as a function of its disposal stream



7.3.1 Environmental benefits

In terms of environmental benefits, two reviewed studies[24] acknowledge that recycling e-waste enables an overall lifecycle reduction in GHG emissions, reduces the need for extraction of new raw materials, extends the lifetime of landfills and reduces environmental and human health liabilities through the reduction of global e-waste loadings. Moreover, as demonstrated by the successful beverage container recovery program, e-waste recovery would provide additional social benefits by enabling local full and part-time employment which in turn builds local economies, promotes the environmental education and awareness of citizens as well as promotes a sustainable lifestyle.

Reduced environment and human health burdens

Any e-waste program which incorporates the refurbishment or reuse of collected materials (i.e. the second life principle), further enhances the environmental and health benefits associated with processing and recycling of used electronic equipment.

Avoided raw material extraction and use

The extraction, processing and transportation of new raw materials, which are the necessary feedstocks for manufacturing new electronic equipment, are energy and resource intensive processes. Collecting and recycling e-waste significantly reduces the amount of raw materials needed for today's manufacturing processes. This helps to preserve the earth's limited non-renewable resources, reduces the associated impacts on the environment and risks to human health and safety, and reduces overall emissions of GHGs.

[24] Swissco and CIRAIG

Emissions reduction with diversion from landfill

The United States Environmental Protection Agency (US EPA) has developed a computer model called WARM that enables users to calculate the GHG emissions associated with various disposal methods for common municipal solid waste. One of the waste types considered by this model is personal computers. WARM considers that personal computers are composed of steel (housing), internal electronic components, a cathode ray tube (CRT) monitor, a plastic case, and circuit boards. It is noted that peripheral equipment (i.e. keyboards, external cables, printers) are not included in WARM's analysis.

Table 17 presents the potential reduction of GHG emissions associated with landfill disposal when recycling operations are implemented. Please refer to table 9 for quantities of desktop and laptop computers generated. The incremental GHG emissions represent reductions in 'metric tons carbon equivalent' that could be realized through recycling of computers as compared to disposal in landfills. However, a brief look and the total GHG emissions estimated suggests that the potential reduction related to diversion of computers from landfills is very limited and almost insignificant compared to potential emissions related to transportation of e-waste to processors in the south, as shown in Table 16. As all categories of e-waste were not taken into account due to the limitations of the WARM model, greater reductions could potentially be achieved through the recycling of all types of electronic equipment.

Table 17 Potential reduction of GHG emissions associated with landfill if recycling is implemented

CATEGORY	2012		2016		2020	
	Min	Max	Min	Max	Min	Max
Computers (desktops) – units	1,305	2,127	1,435	2,339	1,577	2,572
Computers (laptops) – units	5,543	12,956	6,095	14,245	6,701	15,662
Weight of desktops – kg[25]	9,657	15,739	10,619	17,308	11,669	19,032
Weight of laptops – kg	16,074	37,572	17,675	41,310	19,432	45,419
Total weight of computers – kg	25,731	53,312	28,294	58,619	31,102	64,452
Total weight of computers - t.	25.7	53.3	28.3	58.6	31.1	64.5
Potential Reduction GHG emissions (MTCE*)	-18.13	-37.61	-19.97	-41.35	-21.94	-45.51

** Metric Tons Carbon Equivalent*

[25] For the purpose of these calculations, an average weight of 2.9 kg/unit for laptops and 7.4 kg/unit for desktop computers was used, as seen in Table 5 of Section 2.1.

Extended landfill life

Diversion from landfill would allow some extending the life of landfill infrastructure and delay the need for new landfills to be planned and developed. This will impact positively on the environment in terms of soil and water quality as the risks of contaminating a new area associated with a new site is delayed. Financial savings would also be realized.

Reduced litter

Significant quantities of waste electronics are currently being stockpiled in Yellowknife, Hay River and Fort Smith community landfills (see Section 3.1.1). Implementing a collection program would prevent more quantities from being adding to the inventories and enhance on-site safety with the removal of the stockpiled material, which may not be beneficial for community image.

Increased waste diversion synergy

Addressing e-waste management may have a positive effect on other waste streams. For instance, an e-waste collection might facilitate picking up other (potentially hazardous) materials.

7.3.2 Expanded economic opportunities

Employment

Depending on the selected program option as discussed in section 8, full and part-time employment opportunities may arise in communities through the collection process. Potential regional consolidation operations designed to pre-process collected wastes before waste materials are shipped to processors in Alberta would create long lasting jobs in selected regional centres. Moreover, hiring staff for program management would create highly qualified jobs in environmental management.

7.3.3 Community benefits

Education and awareness

Program communications which help to link harmful recycling with environmental and health benefits would enable residents to better understand the importance of responsible waste management and improve the overall waste management in communities. These awareness benefits may be significant in communities where education and awareness initiatives are endorsed or promoted by community leaders and local role models.

8 FEASIBILITY ASSESSMENT OF OPTIONS

8.1 METHODOLOGY

To facilitate a comprehensive and thorough analysis of the options previously described the following methodology and steps were undertaken resulting in a quantitative ranking of the five options. It is upon this ranking and a subsequent discussion of program implementation issues that recommendations for the GNWT are built. The four steps are described as follows:

8.1.1 Step 1: Principles, goals and objectives

A set of core principles and goals and objectives for an e-waste program in the NWT were first identified in consultation with the GNWT. The principles reflect existing GNWT environmental and waste management policy as set out the Waste Reduction and Recovery Act (WRRA) adopted in October 2003, policies expressed through operational waste diversion programs and further reflect the GNWT's adoption of the CCME's Canada-wide Action Plan for EPR in October 2009.

8.1.1.1 Principles

- The natural environment continues to be protected and enhanced.
- The collection, recycling and environmentally sound management of electronic waste is a responsibility of producers with roles to be played by distributors, retailers and consumers.
- Adaptability and innovation are the foundations of waste electronic equipment best management practices.

8.1.1.2 Goals

- Maximize the recovery and recycling of electronic waste and reduce the overall volume of waste disposed to landfills.
- Implementation and operation of an electronic waste recovery and recycling program are revenue-neutral for the GNWT.
- All residents of the NWT have reasonable access to local electronic waste collection systems. The collection and recycling of electronic waste results in minimal impact to existing electronic equipment sales and existing recycling infrastructure.
- Increase the public awareness and understanding of multi-material waste recovery and recycling and encourage environmentally responsible and ethical purchasing.
- The recovery and recycling of electronic waste results in new local employment and economic development opportunities for residents.
- The NWT electronic waste recovery and recycling system is integrated to the extent practicable with electronic waste recovery and recycling programs in Alberta and British Columbia.
- Program design implementation and administration is simple and efficient, and can be effectively managed
- E-waste collection and recycling operates transparently and meets established program performance measurement and reporting requirements

8.1.2 Step 2: Evaluation criteria

Drawing on the principles, goals and objectives identified in Section 8.1.1 above, a number of evaluation criteria were identified and grouped by program effectiveness, program efficiency, legality and program implementation. These criteria were also weighted with 15, 10 or 5 points out of a possible 100 to indicate their relative importance. For example the 'Ability to reduce and divert electronics from landfills, responsibly process e-waste, and meet targets' and 'Service to residents' criteria under program effectiveness relate to the most important goals and are weighted more heavily at 15 points than program communication which is weighted at 5 points.

The evaluation criteria and the point weightings are set out in the table below.

Table 18 Evaluation criteria and point weighting

CRITERIA CATEGORY	CRITERIA	POINTS
Program effectiveness 50	Ability to reduce and divert electronics from landfills, responsibly recycle e-waste, and meet targets	15
	Service to residents	15
	Ability to measure performance	10
	Program transparency and accountability	10
Program Efficiency 30	Least cost and risk for GNWT	10
	Impact on existing retail market and consumers	10
	Ease of administration and flexibility	5
	Respect for existing infrastructure	5
Legality 10	Regulatory authority	5
	Clarity of roles and responsibilities	5
Program implementation 10	Addresses municipal and community concerns	5
	Program communication	5
Summary score		100

8.1.3 Step 3: Criteria Importance

The criteria from Step 2 were then ordered according to their respective importance ratings, as indicated by the points for each, into 3 groupings and indicators and descriptions of performance measures for each were developed as follows:

Most important criteria (15 pts)

- Ability to reduce and divert electronics from landfills, responsibly recycle e-waste, and meet targets
  - Collection, reuse/refurbishing and recycling rates are maximized to meet targets
  - In the mid to long-term, ability to move towards reducing or limiting the amount or weight of electronics entering the NWT market, so that fewer quantities will have to be managed in the future
  - Ability to ensure that processing and recycling be conducted in a responsible fashion, following principles such as the ones of the Basel Action Network.
- Service to residents
  - A significant proportion of the public have access to the program and service level and public access standards are established using a variety of collection models (depots, special events etc.) to ensure reasonable public access

Important criteria (10 pts)

- Least cost and risk to GNWT
  - Overall program cost to GNWT (e.g. $ per kg collected and $ per capita) is revenue neutral or as low as possible.
  - Level of financial risk which could potentially be of GNWT's responsibility to cover.
- Impact on existing retail market and consumers
  - Negative impacts on the local market are minimized and purchase patterns outside NWT are addressed in a way that does not disadvantage local retailers. Fees linked to direct NWT sales could be problematic if they are too high and are designed to cover all EE potentially recycled in the NWT but purchased elsewhere
  - Costs of electronic items and/or EHFs remain in-line with provincial programs
- Ability to measure performance
  - Program operations can be easily audited and are tracked to provide a means to measure performance (eg. kg collected; kg recycled, etc.)
- Program transparency and accountability
  - Program can be independently audited – both operations and financial, - there are reporting guidelines which establish reporting frequency, standards, methodologies, etc.
  - Program is accountable to public, consumers, producers and retailers

Somewhat important criteria (5 pts)

- Addresses municipal and community concerns
  - The option addresses municipal and community interests regarding program operations (e.g. familiar depot locations). Degree to which it provides employment opportunities or helps maintain existing employment.
- Ease of administration and flexibility
  - The degree of administrative flexibility and responsiveness is important to program operations as is the ability to react to changing situations, enter into contracts etc. Ability to measure total program costs spent on administration
- Respect for existing infrastructure
  - The potential to build on the existing recycling system infrastructure. Is new infrastructure needed? Can the program option link with the existing transportation system for shipment to processing centres such as those in Alberta?
- Regulatory authority
  - Compliance with the existing legal framework and approval process. Is new authority needed?
- Clarity of roles and responsibilities
  - A clear understanding of producer and government/community roles and responsibilities and can there be clarity regarding service and funding obligations between parties?
- Program communication
  - Requirements to effectively communicate the program to residents and educate the public on how to participate be undertaken effectively under the option?

8.1.4 Step 4: Evaluation of program options

In a fourth and final step, the five program options were evaluated against the Step 3 criteria using the Holmes Ordinal Evaluation Method. The Holmes methodology has been used since 1971 and was developed and first used by the Jack Holmes Planning Group under contract to the UK Secretary of State for Scotland as a process for evaluating a number of proposed new road alignments. The process has been widely used, particularly in urban planning and development studies, to evaluate and rank various proposals and options. It is based on grouping criteria based on greater and lesser importance as was done in Step 3 and ranking options as 1st, 2nd 3rd place etc, against the criteria. Here are examples of how this method works. In the case where two options tie for 1st place, no 2nd place is shown and the following rank will be 3rd place. Then, if two options are tied for that 3rd place, no 4th place will appear in the ranking and the remaining option will be ranked 5th. In a similar way, four options tied for 1st place imply that the remaining option will be ranked 5th even though it might not be that far off from the 1st place.

In a second step, once rankings are given for each evaluation criterion, each option is granted a number of points depending on the criterion's weight. The most important criteria will score a maximum of 15 points, the important criteria a maximum of 10 points and a maximum 5 points can

be granted to the somewhat important criteria. There is a three-point difference between ranks for the most important criteria, two points for the important criteria and one point between ranks for the somewhat important criteria. The sum of the points equals a mark out of 100. The table below shows how many points are given to criteria according to their level of importance in Section 8.1.3.

Table 19 Possible score according to a criterion's level of importance and ranking

LEVEL OF IMPORTANCE	1ST PLACE	2ND PLACE	3RD PLACE	4TH PLACE	5TH PLACE
Most important criteria	15 pts	12 pts	9 pts	6 pts	3 pts
Important criteria	10 pts	8 pts	6 pts	4 pts	2 pts
Somewhat important criteria	5 pts	4 pts	3 pts	2 pts	1 pt

Using the Holmes methodology the five options were ranked against each of the most important, important and somewhat important criteria. Each criterion is addressed individually below with a summary score for all the criteria following (see Section 8.2).

8.1.4.1 *Ability to reduce and divert electronics from landfills, responsibly recycle e-waste and meet targets*

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	First sellers into the NWT would be obligated - producers would have no role or stake in the program. This will lessen the program's ability to meet reduction objectives. Collection/diversion services' scope would be subject to the available budget which would be entirely EHFs-linked revenues. A government-run program may achieve higher diversion rates through better knowledge of local NWT considerations (social structure, communication approach) Service contracts may mandate processing of e-waste in a responsible fashion.	Producers would be legally obligated to operate and fund part of the program. Collection/diversion services' scope would be subject to the available budget which would be entirely linked to fee revenues. Service contracts may mandate processing of e-waste in a responsible fashion. Diversion may benefit from government expertise regarding local NWT considerations (social structure, communication approach, etc.).	Producers would be legally obligated to fund the program but would not operate it. Their participation may add more resources for diversion than EHF-linked revenues only. Diversion may benefit from government expertise regarding local NWT considerations (social structure, communication approach) Producers' direct funding may act as an incentive to promote reduction approaches. Reduction of quantities managed would allow lower costs of future operations. Service contracts may mandate processing of e-waste in a responsible fashion.	Producers would be legally obligated to fund the program, thus adding more resources to achieve program goals than EHF-linked revenues only. Compared with full EPR, GNWT would have direct influence over collection which could positively influence diversion. Producers' direct funding may act as an incentive to promote reduction approaches. Reduction of quantities managed would allow lower costs of future operations. Service contracts and regulation may mandate processing of e-waste in a responsible fashion.	Producers would be legally obligated to fund the program, thus adding more resources to achieve program goals than sole EHF-linked revenues only. Depending on mandates included in regulation or agreement with producers, collected quantities may be limited in most remote communities. Producers' direct funding may be an incentive to promote reduction approaches. Reduction of quantities managed may allow lower costs in future operations. Service agreement may mandate processing of e-waste in a responsible fashion.
Scoring assumption	A public sector-run product stewardship program may achieve higher diversion rates through better knowledge of local issues.	Legal obligation for producers may help the program to meet targets although producers can't be held accountable if they do not control all operations, especially collection. A shared operational responsibility model might benefit from public expertise in diversion through better knowledge of local issues EHF-linked budget availability may limit diversion services.	Legal obligation for producers may help the program to meet targets although producers can't be held accountable if they do not control all operations, especially collection. This shared responsibility model might benefit from public expertise in diversion through better knowledge of local issues. Funding coming from producers may not be linked to fee revenues[23]. Producers' funding may be incentive for quantity reduction.	Funding and support coming from producers may not be linked to fee revenues[26]. Closer monitoring by government may bring the program to achieve better diversion results. Legal obligation including penalties for producers may enhance ability to meet objectives/targets Producers' funding may over time act an incentive for quantity reduction.	Funding and other support coming from producers may not be linked to fee revenues[23]. Diversion program may be limited in most remote communities without regulatory mandate. Producers' funding may over time act an incentive for quantity reduction.
Ranking	3	3	1	1	3

[26] See section 8.3.5 for further details.

8.1.4.2 Service to residents

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	Public sector would be responsible for operating the program, thus ensuring the desired level of service is offered to residents. Depending on the ability to partner with/leverage funds from other jurisdictions, EHFs may need to be high in order to provide desired service levels.	GNWT would have the ability to design and operate a collection system and to directly meet its objectives regarding levels of service and public access to the program. Depending on the ability to partner with/leverage funds from other jurisdictions, EHFs may need to be high in order to provide desired service levels.	An agreement with producers would make the public sector responsible for operating the program, thus ensuring the desired level of service is offered to residents. Collection, transportation and contracting for processing would be ensured by public sector. Depending on the ability to partner with/leverage funds from other jurisdictions, EHFs may need to be high in order to provide desired service levels.	Producers would be given explicit direction on service to residents in order to provide acceptable and comparable levels of public access and service for all communities.	Producers would have a high degree of latitude in how they choose to design and operate the program Producers might not agree to fund later design modifications in the program aiming at improving service in some communities.
Scoring assumption	Level of collection service to residents is under public control, thus ensuring the desired level of service is offered to residents.	Level of collection service to residents is under public control, thus ensuring the desired level of service is offered to residents.	Producer agreement on funding for the desired level of service would be required Level of service to residents subject to agreement between the two parties with mediation protocol possibly needed.	While not under the public sector's responsibility, the level of service to residents could be directed by GNWT.	Producers may choose the level of service to residents as long as it allows them to meet the targets
Ranking	1	1	4	1	4

8.1.4.3 Least cost and risk for GNWT

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	Funding would be based on EHF. Producers will not be involved in the funding – first sellers will be responsible for fee collection (e.g. ARMA). Web and out of NWT sales might bring more quantities to manage than actual sales. GNWT would likely need to partner with other jurisdiction(s) (such as BC and AB) to access funds paid to EPRA and ARMA for equipment purchased by NWT residents in their jurisdictions. EHF raised in NWT will likely not be sufficient to cover all of program's costs, especially in program's first years.	Funding would be based on EHF. Operational responsibilities and funding would be shared between government and producers following the terms of an agreement. Web and out of NWT sales might bring more quantities to manage than actual sales. Shared operational responsibility may reduce risks for GNWT if fees do not cover program costs.	Program funding would be of producers' responsibility. They would be obligated to pay the public sector operators for their net program costs based on an agreed upon funding formula. Public program operators would be paid by producers based on agreed formula. Some public funds may be required for expenses falling out of the agreed formula.	Funding and operating the program would be a direct and sole responsibility of producers. GNWT only involved in explicitly directing how the program is to be designed and implemented. Producers would likely partner with other producer run programs in other jurisdictions and share administrative and other operational services such as communication/promotion may be more challenging for producers & require GNWT to enter into agreement with provinces – e.g. PEI did not enter into an agreement with NS to facilitate the ACES program	Funding and operating the program would be a direct and sole responsibility of producers. GNWT only involved for broad oversight and ensuring that program performance measures and targets are met. Producers (national brand owners) would likely partner with other producer run programs in other jurisdiction and share administrative and other operational services such as communication/promotion – e.g. PEI did not enter into an agreement with NS to facilitate the ACES program
Scoring assumption	While GNWT will not have to fund the program out of general revenues, the public sector remains fully responsible for the funding mechanism and program operation. The program's financial capability is limited to revenues generated from EHFs. Out of NWT sales might bring more management and operational costs than revenues.	While GNWT will not have to fund the program out of general revenues, the public sector remains responsible for all operations. The program's financial capability is limited to revenues generated from EHFs. Out of NWT sales might bring more management costs than revenues.	While GNWT will not have to fund the program, some public funds may be required for expenses falling out of the agreed funding formula. Such funding may not be able to be linked to EHFs.	GNWT will not have to fund the program. Funding and other support may not have to be exclusively linked to EHFs. Full operational and funding responsibility by producers will facilitate program efficiencies Cost of regulatory amendment, of informing all obligated parties of regulations/obligations, and enforcement are to be assumed by producers while GNWT retain right to modify the obligations with notice.	GNWT will not have to fund the program. Funding and other support may not have to be exclusively linked to EHFs. Full operational and funding responsibility will facilitate program efficiencies Cost of regulatory amendment, of informing all obligated parties of regulations/obligations, and enforcement to be assumed by producers.
Ranking	3	3	3	1	1

8.1.4.4 *Impact on existing retail market and consumers*

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	Such program would fully rely on EHF funding. In Alberta, the burden of fee administration and reporting to program managers relies on retailers who are registered with the program. Alberta structure operates without producer funding or operational responsibilities. Fees raised within the jurisdiction could negatively impact retailers' operations and/ or benefit margins. Such fee would likely not be sufficient to cover costs in NWT. Ability to partner with, and access funds from, other jurisdictions will significantly affect GNWT's ability to operate a revenue-neutral program without setting EHFs at levels that could adversely affect consumers and retailers in the NWT.	If funding of such a program is tied to sales (fees/charges), there are likely to be impacts related to price competitiveness of NWT retailers. Unless restricted by GNWT, visible fees may be added at the point of purchase and/or passed on to consumers. This allows more flexibility and competition pricewise.	If funding of such a program is tied to sales (fees/charges), there are likely to be impacts related to price competitiveness of NWT retailers Unless restricted by GNWT, visible fees may be added at the point of purchase and/or passed on to consumers. This allows more flexibility and competition pricewise.	Unless restricted by GNWT, visible fees may be added at the point of purchase and/or passed on to consumers GNWT can mandate that no visible fee be added at the point of purchase and that no environmental handling charge would be allowed to be passed on explicitly to consumers. A return to retail option could be added at GNWT's request which would help support NWT retailers. More prescriptive regulations tend to mean higher costs to producers and to the consumer.	Unless restricted by GNWT, visible fees may be added at the point of purchase and/or passed on to consumers. GNWT can mandate that no visible fee be added at the point of purchase and that no environmental handling charge would be allowed to be passed on explicitly to consumers. This allows more flexibility and competition pricewise. Producers would determine whether the collection program includes return to retail.
Scoring assumption	Fees could affect NWT EE retail sales while not being sufficient to cover costs. Fee administration and reporting relies on retailers who are registered with the program and may negatively affect their operations or financial margins.	Fees or charges may affect EE retail sales. Fee administration may affect retailers. Cost internalization could restrict fee or charge added explicitly at point of purchase	Fees or charges may affect EE retail sales. Fee administration may affect retailers. Cost internalization could restrict fee or charge added explicitly at point of purchase	Fees may affect NWT EE retail sales. Fee administration may affect retailers. Cost internalization could restrict fee or charge added explicitly at point of purchase. Higher costs could occur if the government specifies higher levels of service in remote communities.	Fees may affect NWT EE retail sales. Fee administration may affect retailers. Cost internalization could restrict fee or charge added explicitly at point of purchase
Ranking	4	1	1	4	1

8.1.4.5 *Ability to measure performance*

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	Ability to measure against sales would be possible through EHF-revenue figures. Information on reduction or other environmental objectives could not easily be collected without producer involvement	Performance measurement would be mandatory in stewardship plan Both the public sector and producers would have obligations to monitor performance. Ability to measure against sales would be possible through EHF-revenue figures.	Performance measurement could be mandatory in stewardship plan GNWT would be obligated to monitor performance. Sales data would have to be shared by producers. The absence of EHF would complicate the validation of figures provided by producers. GNWT wouldn't necessarily see the details of the producer funding	Performance measurement would be mandatory in stewardship plan Producers would be obligated to monitor performance including possibly targets against sales, although the absence of EHF might complicate the validation of figures provided by producers. If prescribed in agreement, GNWT could ask for any details or figures regarding funding or sales to assess performance metrics.	Performance measurement would be mandatory in stewardship plan Producers would be obligated to monitor performance including possibly targets against sales. The absence of an EHF might complicate the validation of figures provided by producers. GNWT wouldn't necessarily see the details of the producer funding and sales.
Scoring assumption	Performance measurements would be included in the program. Performance could be measured against directly comparable Alberta program. Sales data could be made available through EHF revenues.	Performance measurements would be included in the program but would be more difficult if responsibility is shared. Some data (sales) would have to be made available by the producers if EHFs are not raised.	Performance measurements would be included in the program but would be more difficult if responsibility is shared. Some data (sales) would have to be made available by the producers if EHFs are not raised.	Producers have access to the necessary data. Performance measurements would be included in the program requirements. Would facilitate measurement against comparable programs (ESABC, SWEEP etc.). Some data (sales) would have to be made available by the producers if EHFs are not used. GNWT may prescribe any details or figures regarding funding or sales.	Producers have access to the necessary data. Performance measurements would be included in the program requirements. Would facilitate measurement against comparable programs (ESABC, SWEEP etc.). Producers would decide whether some data (sales) would be made available if EHFs are not used.
Ranking	2	4	4	1	2

8.1.4.6 *Program transparency and accountability*

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	A public program would allow transparency in reporting. ENR publicly accountable for program operations Producers can't be held accountable for targets if they do not control program operations.	Both producers and GNWT would be obligated to report publicly in accordance with third party audit requirements. Producers can't be held accountable for the operations they do not control, especially collection.	Producers could not be made accountable for the program collection because this would be a public sector responsibility. Reporting in accordance with third party audit requirements Producers can't be held accountable for the operations they do not control, especially collection.	Producers would be accountable for program transparency and reporting in accordance with GNWT third party audit requirements. Although sales data is currently provided in Saskatchewan (Directed EPR), financial transparency is not necessary with absence of visible fees, unless prescribed. With visible EHFs and if prescribed in agreement by GNWT, financial transparency will be mandatory.	Producers would be accountable for program transparency and reporting in accordance with GNWT third party audit requirements Financial transparency is not necessary with absence of visible fees. If costs are internalized, producers would not be required to report on costs, and administration expenses would not be public.
Result	Transparency in accordance with GNWT public sector standards.	Both producers and GNWT would be obligated to report publicly in accordance with agreed roles and responsibilities.	Both producers and GNWT would be obligated to report publicly in accordance with agreed roles and responsibilities.	Directed EPR enables GNWT to prescribe elements to be reported in the regulations and stewardship agreement/plan.	GNWT would be able to prescribe some elements to be reported in the regulations and stewardship agreement/plan
Ranking	1	3	3	1	3

8.1.4.7 *Ease of administration and flexibility*

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	Service would be provided directly by ENR or a special purpose crown agency	Relationships between parties would follow agreements' terms and conditions. Standards for collection and shipment prior to transportation and processing would have to be negotiated. Producers will want to ensure that the collected e-waste meets accepted industry standards for transportation and processing and producers could be in a position to refuse collected loads if they did not meet standards.	Theoretical flexibility but producers will be interested in reducing their costs as much as possible whereas the GNWT will be interested in maximizing the levels of service and public access. All program operational expenses are to be managed by public sector which will then be paid by producers based on an agreed funding formula.	Program administration would be a producer responsibility GNWT would be able to direct levels of service and access. Prescriptive programs tend to have a greater administrative burden for producers.	Administration completely in producer hands.
Scoring assumption	Administration would follow existing public protocols. Establishment of special crown agency may need to be considered to ensure a higher degree of financial and operational flexibility.	Mediation may be need when disagreements occur. GNWT may have to manage refused loads collected.	Disagreements over eligible costs may arise and create disputes. Mediation may be needed.	Administration will be decided by producers without any GNWT input. Could operate directly or on contract basis through a third party service provider like Encorp or Product Care. Direction on program aspects may have administrative consequences for the program. Producers would be given explicit direction on certain required program elements for inclusion in the e-waste program	Administration will be decided by producers without any GNWT input. Program could operate directly or on contract basis through a third party service provider like Encorp or Product Care
Ranking	1	5	4	3	1

8.1.4.8 *Addresses municipal and community concerns*

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	A publicly operated collection would likely better address already known community concerns, although budget limitations may restrain addressing them fully. A government-run program has more direct knowledge of the local considerations which set NWT apart from other jurisdictions.	A publicly operated collection would likely better address already known community concerns, although budget limitations may restrain addressing them fully. This model would benefit from the government's direct knowledge of local issues.	A publicly operated program would likely better address already known community concerns/limitations. This model would benefit from the government's direct knowledge of local issues.	Having identified known community concerns, GNWT could require that certain community/local aspects be addressed in the program design process.	Producers would have a high degree of latitude in how they choose to design and operate the program within the parameters set in the stewardship plan
Scoring assumption	Concerns regarding collection and storage may be better addressed through a public-run product stewardship program considering the stakeholder consultation mechanisms already developed. Concerns may arise regarding the ability of public funding to address identified issues.	Concerns regarding collection and storage may be better addressed through a publicly operated program considering the stakeholders consultation mechanisms already developed. Concerns may arise regarding the ability of public funding to address identified issues.	Assuming agreement on private funding envelope, concerns regarding collection and storage may be better addressed through a publicly operated/private funded program considering the stakeholders consultation mechanisms already developed.	Stewardship plan requirements set by GNWT should address community-specific concerns, reflecting the ENR's knowledge of the local situations, thus ensuring that elements to be addressed are taken into account.	Producers would decide how concerns are to be addressed and may overlook some community concerns.
Ranking	3	3	1	1	5

8.1.4.9 *Respect for existing infrastructure*

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	A public service program would facilitate use and expansion of existing infrastructure. The use of current transportation networks does not appear problematic, a detailed approach should be developed during program design. GNWT may encourage a return to retail scheme in communities where this approach suits best.	GNWT would be able to design and operate a collection system and to directly meet its objectives regarding levels of service and public access to the program. GNWT may encourage a return to retail scheme in communities where this approach suits best. The use of current transportation networks does not appear problematic, a detailed approach should be developed in the program design requirements.	GNWT may integrate the program with existing recycling infrastructure where possible to ease the program's implementation. GNWT may encourage a return to retail scheme in communities where this approach suits best. The use of current transportation networks does not appear problematic, a detailed approach should be developed in the program design requirements.	GNWT may require the program to integrate with existing recycling infrastructure in order to optimize level of public access. GNWT may encourage a return to retail scheme in communities where this approach suits best. The use of current transportation networks does not appear problematic, a detailed approach should be developed in the program design requirements.	Producers could make agreements with existing depot operators and municipalities to provide collection services or set up and operate their own collection network. Producers would determine whether the collection program includes return to retail. The use of current transportation networks does not appear problematic, a detailed approach should be developed in the program design requirements.
Result	To the degree possible the program could be built on existing BCP and recycling network. Program may be a useful way to manage other materials from various communities that are not currently recovered/collected under regulation (i.e. HHW)	Such program could be built on existing recycling network, although some operational elements under producers' responsibility may use different infrastructure	Parties may agree to use existing infrastructure where possible. Producers could tend towards other structures if there were financial benefits.	If required by GNWT, such program could be built on existing recycling network.	Producers may select the infrastructure they feel is the most appropriate.
Ranking	1	3	3	1	5

8.1.4.10 Regulatory authority

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	Potential fit with existing administrative and legal system Possible establishment of a special purpose body or structuring under existing organization framework (i.e. Environment Fund)	The producer obligations would be legislated and structured according to an EPR framework with stewardship plan requirements to be approved by GNWT.	The producer obligations would be legislated and structured according to an EPR framework with stewardship plan requirements to be approved by GNWT	Stewardship plan to be approved by GNWT Program's design and implementation would be given explicit direction with a view to guaranteeing that the GNWT's objectives in particular areas were met.	Stewardship plan to be approved by GNWT Government would have some influence in certain elements of program design and implementation but program design and operational details exclusively would be under producers' responsibility
Result	Confirmation of authority required if a DAO is to operate the program Only minor changes would likely be necessary regarding the regulatory authority. Regulations would be directed at first sellers into the NWT not at producers.	Confirmation of authority required EPR and stewardship management elements need to be clearly established.	Confirmation of authority required EPR and stewardship management elements need to be clearly established.	Confirmation of authority required Producers would have to fully comply with regulations/direction mandated by GNWT. Program design and operations would have to meet GNWT's specific requirements.	Confirmation of authority required Producers would have to fully comply with regulations/direction mandated by GNWT. Program design and operational authority would be under producer's responsibility.
Ranking	1	2	2	2	2

8.1.4.11 Clarity of roles and responsibilities

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	Fit with existing administrative system or establishment of new agency.	Where one party is responsible for collection and another for transportation and processing, setting out the specific roles and responsibilities can be more challenging and disagreements may arise.	When producers fund a program and the public sector is responsible for operations, disagreements can arise regarding eligible expenses. The funding formula might cause disagreement between the parties.	Producers manage a program following GNWT's requirements as stated in regulation. They are fully responsible No public funds would be used to support or operate the program.	Producers may decide to manage their own program for their own products or join in an association. They are fully responsible No public funds would be used to support or operate the program.
Result	GNWT is fully responsible for program funding and operations. (Funding would be achieved through the Environment Fund through surcharges on designated materials).	Roles and responsibilities regarding operation need to negotiate. Dispute resolution and mediation mechanisms may be necessary to address potential issues regarding responsibilities.	Roles and responsibilities need to be negotiated. Dispute resolution and mediation mechanisms may be necessary to address potential issues regarding responsibilities.	Producer responsibility within set program operational requirements	Full producer responsibility – both operations and funding.
Ranking	1	5	4	3	1

8.1.4.12 Program communication

	PRODUCT STEWARDSHIP/ PUBLIC SECTOR OPERATION	PARTIAL EPR: DIVIDED OPERATIONAL RESPONSIBILITY	PARTIAL EPR: PUBLIC SECTOR OPERATION/ FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Observations	A product stewardship program may be able to use existing public communication channels to ensure a cost-effective communication approach. Partnership with ARMA might enable use of existing ARMA public education materials, advertising campaigns and web-based support/tools.	Protocols would need to be negotiated to determine leads and responsibilities for program promotion and education.	Responsibilities for program promotion and communications could be shared between government and producers but most probably under GNWT's leadership.	Producers have primary responsibility to promote the program and to communicate with and educate the public to ensure maximum participation following GNWT's specific requirements. GNWT may need to notify public that producers are the ones responsible for the program's operations Producers may be able to mount more edgy advertising campaigns (not constrained by government style guides). Producers able to draw from advertising/public education materials used by PROs in other (larger) jurisdictions (efficiency)	Producers have primary responsibility to promote the program and to communicate with and educate the public to ensure maximum participation. GNWT may need to notify public that producers are the ones responsible for the program's operations Producers may be able to mount more edgy advertising campaigns (not constrained by government style guides). Producers able to draw from advertising/public education materials used by PROs in other (larger) jurisdictions (efficiency)
Result	GNWT responsible for communication/education initiatives	Primary responsibility for program promotion and communication would be centred on collection and would be primarily a public sector responsibility.	While funding would be a producers' responsibility, lead would have to be determined with a possible public role.	Producers would be mandated to fund and implement program communication by fulfilling obligations set out in a stewardship plan.	Producers would be mandated to fund and implement program communication by fulfilling obligations set out in a stewardship plan.
Ranking	3	5	4	1	1

8.2 OVERALL RANKING

8.2.1 Scores according to the importance order

The following tables show the rankings granted to each program option according to the importance order presented in Section 8.1.3.

8.2.1.1 Rankings and total scores for most important criteria

CRITERIA	PRODUCT STEWARDSHIP: PUBLIC SECTOR OPERATION	SHARED RESPONSIBILITY : DIVIDED OPERATIONAL RESPONSIBILITIES/ COLLECTION AND RECYCLING SPLIT	SHARED RESPONSIBILITY : PUBLIC SECTOR OPERATION WITH FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Ability to reduce and divert electronics from landfills, and responsibly recycle e-waste	3	3	1	1	3
Service to residents	1	1	4	1	4
Score out of 30 pts	24	24	21	30	15

8.2.1.2 Rankings and total scores for important criteria

CRITERIA	PRODUCT STEWARDSHIP: PUBLIC SECTOR OPERATION	SHARED RESPONSIBILITY : DIVIDED OPERATIONAL RESPONSIBILITIES/ COLLECTION AND RECYCLING SPLIT	SHARED RESPONSIBILITY : PUBLIC SECTOR OPERATION WITH FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Least cost and risk for GNWT	3	3	3	1	1
Impact on existing retail market and consumers	4	1	1	4	1
Ability to measure performance	2	4	4	1	2
Program transparency and accountability	1	3	3	1	3
Score out of 40 pts	28	26	26	34	34

8.2.1.3 Scores for somewhat important criteria

CRITERIA	PRODUCT STEWARDSHIP: PUBLIC SECTOR OPERATION	SHARED RESPONSIBILITY : DIVIDED OPERATIONAL RESPONSIBILITIES/ COLLECTION AND RECYCLING SPLIT	SHARED RESPONSIBILITY : PUBLIC SECTOR OPERATION WITH FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Ease of administration and flexibility	1	5	4	3	1
Addresses municipal and community concerns	3	3	1	1	5
Respect for existing infrastructure	1	3	3	1	5
Regulatory authority	1	2	2	2	2
Clarity of roles and responsibilities	1	5	4	3	1
Program communication	3	5	4	1	1
Score out of 30 pts	26	13	18	25	21

8.2.2 Summary Score

The following table provides a summary of the rankings obtained by each option for the evaluation criteria.

Table 20 Summary score of the evaluated program options

CRITERIA CATEGORY	CRITERIA	PRODUCT STEWARDSHIP: PUBLIC SECTOR OPERATION	SHARED RESPONSIBILITY : DIVIDED OPERATIONAL RESPONSIBILITIES/ COLLECTION AND RECYCLING SPLIT	SHARED RESPONSIBILITY : PUBLIC SECTOR OPERATION WITH FULL PRODUCER FUNDING	DIRECTED EPR	FULL EPR
Most important	Ability to reduce and divert electronics from landfills, and responsibly recycle e-waste	3	3	1	1	3
	Service to residents	1	1	4	1	4
Important	Least cost and risk for GNWT	3	3	3	1	1
	Impact on existing retail market and consumers	4	1	1	4	1
	Ability to measure performance	2	4	4	1	2
	Program transparency and accountability	1	3	3	1	3
Somewhat important	Ease of administration and flexibility	1	5	4	3	1
	Addresses municipal and community concerns	3	3	1	1	5
	Respect for existing infrastructure	1	3	3	1	5
	Regulatory authority	1	2	2	2	2
	Clarity of roles and responsibilities	1	5	4	3	1
	Program communication	3	5	4	1	1
Summary score	Out of 100	78	63	65	89	70

According to the evaluation of the five different program options, the directed EPR model ranks first, followed by the Product Stewardship/ Public Sector Operation, while the full EPR model places third. The Shared Responsibility options come in fourth and fifth places.

8.3 OPTION IMPLEMENTATION ISSUES

Regardless of the option chosen for the end-of-life management of electronics waste in the NWT there are a number of issues which cut across and are common to all of the options evaluated. These are issues largely related to option implementation and they will need to be considered as the GNWT determines the next steps that it wishes to take towards the development and implementation of an electronics waste program. In the case of each issue a set of key actions are identified as next steps.

8.3.1 Electronics Purchased Outside the NWT

8.3.1.1 Out of Territory purchases

The number of retailers of electronics in the NWT is small, reflecting the size of the market, the population and its distribution throughout the NWT. While hard data is not available there is reason to believe that a significant number of purchases of electronic equipment are conducted over the internet, by phone or by mail order for delivery to NWT consumers by courier or Canada Post or through direct purchases in other jurisdictions.

The ENR Survey of Household Electronic Products in the Northwest Territories released in August 2012 gives some indication of the extent of purchases outside the NWT. While the survey does not claim to be representative of all NWT households and had a bias towards respondents with computer capability, because it was largely administered electronically, the results do confirm that purchases of electronics outside the NWT is an issue which will need to be addressed regardless of which program option is selected.

Based on 877 responses 81.7% of respondents reported having purchased electronics in Alberta, 20% had purchased in British Columbia and 20.8% in Ontario. In response to a question about purchasing intentions, 83% indicated that purchasing outside the NWT was one way they intended to purchase new items. The implications of any significant degree of purchasing outside the NWT are critical to the financial sustainability of whatever option is selected.

Anybody who purchases a piece of electronic equipment, such as a laptop computer, in Alberta for use in their place of residence in the NWT will pay a point of purchase fee in the retail store in Alberta which will be remitted to the Alberta Recycling Management Authority (ARMA) which runs the e-waste program. Similarly the purchaser of a laptop computer in British Columbia will be charged by the retailer an environmental handling fee at the point of purchase which will be remitted to Electronics Product Stewardship British Columbia (ESABC). The fact that the computer or any other electronics purchase might be used in the NWT and eventually could become an end of life management issue in the NWT does not enter into consideration. Monies collected on such purchases currently stay with ARMA and ESABC and are used to fund the e-waste programs in those provinces even though the likelihood is that the cost of collecting and recycling the product will be borne by another program in another jurisdiction.

With the existing provincial e-waste programs the distinction between place of purchase and place of end-of-life collection and recycling is largely irrelevant because of the large size of the markets in

the jurisdictions and the likely relatively small size of the purchases by residents from other provinces. For example an Edmonton resident may purchase a computer on a visit to Vancouver, pay the point of purchase fee in Vancouver and ultimately recycle the computer in Edmonton. The number of such purchases is likely to be relatively small compared to the total number of units purchased in Alberta and ultimately recycled in Alberta. An imbalance could occur as a result of population movements between jurisdictions but again this is likely to be relatively small compared to the overall size of provincial programs.

NWT is however a special case because of its small population compared to the adjoining large populations of Alberta and British Columbia and because of the likely significant imbalance between purchases and recycling demand. The impact of this imbalance will be felt in the financing of the program whether it is paid for by the GNWT or by producers using their favoured visible point of purchase fee approach to funding. If a significant amount of electronics is purchased outside the NWT, as is suspected, and if funds are to be raised based on unit sales, the funds raised in the NWT will of necessity have to be higher than if all the equipment was purchased in the NWT. The funds raised are going to have to cover off recycling obligations not only for equipment purchased in the NWT but also on equipment purchased outside the NWT for which no fee has been collected.

This issue is further addressed in Section 7.5 ‘Partnering with Provincial Programs’.

In order to address this issue the GNWT may need to enter into discussions with ARMA and with ESABC regarding these stranded fees. One of the first things to determine would be the extent of the issue. Major retailers will likely have access to data which would allow identification of the place of residence of a purchaser and this data could be made available to producers if the GNWT opts for a full EPR approach. This information would however likely be proprietary and would not be shared with governments. Alternatively a point of purchase postal code survey would be another way to generate such data. Such simple surveys are commonly used by businesses to support marketing strategies and to help make decisions about such things as opening a new store to service a new expanding suburb or population demographic. It would need to be funded and undertaken with the support and cooperation of both ARMA and ESABC.

8.3.1.2 Internet Purchases

Internet sales and purchases can be addressed in both an EPR regulated program and in a publicly operated stewardship program. Experience in the operating electronics programs, both those operated as EPR or product stewardship models, suggests that internet sales are not a major issue.

Firstly producers who market through the internet would be identified in regulation as is done in PEI (see Section 1.2). Brand owners who undertake such sales do not want to be in violation of EPR regulations and can also be relatively easily identified. They are also well known to competing brand owners who use a retail model for sales and experience in other EPR programs has shown that the participating producers are good at alerting regulatory authorities to companies that are not meeting regulatory obligations. Competitors who are not part of a stewardship program may be

able to capture an unfair competitive advantage which can be viewed as a threat by those operating within an EPR stewardship plan. Companies who market through the internet in this way also know where their products are shipped. None of the existing electronics programs reports any significant issues with such brand owners and importers using internet sales and a look at the list of those participating in the ACES program for example shows that major players such as Dell are members.

Key Actions

- Initiate further study to determine the extent of NWT resident purchases in Alberta and secondarily in other jurisdictions;
- Approach Alberta Environment and ARMA for discussion on fees collected from NWT residents;
- Initiate discussions with the Electronics Products Recycling Association (EPRA) and ESABC on the possible partnership of a NWT program with existing provincial extended producer responsibility programs.

8.3.2 Levels of service and public access to collection system

The level of service and public access to an e-waste collection and recycling program is of critical interest to the GNWT. It is also one of the major implementation challenges of such a program given the population of the NWT, the distribution of the population, the small size of many communities and the remoteness of many communities. In such circumstances there is no one broadly applicable level of service model which can be applied universally to all population centres because they are so different.

Service level standards for e-waste program public access do exist in a number of programs. In British Columbia for example ESABC has established the following standards:

- Urban/suburban – a depot within 30-minute drive; one depot per 150,000 population;
- Rural/remote – a drop off depot or collection event once or twice a year (depending on volumes) within 45 minutes drive; one depot per 4,000 population.

These levels of service do not readily apply to the NWT because of the significant differences in total population and the size and remoteness of the communities. There is obviously a major difference in the provincial and territorial populations and in addition a considerable difference between Yellowknife at one extreme (population 19,200) as the one major urban centre, small communities like Hay River (population 3,650) and even smaller remote fly-in/winter road access communities like Trout Lake (Saamba K'e) (population 110).

The distinction between urban and rural/remote categories used by ESABC is useful however and the depot approaches which have been used in Alaska and elsewhere provide examples of collection program approaches. The ESABC categories could be broadly applied with Yellowknife as one category and two further categories according to community size and location. For example Yellowknife could be serviced by a regularly available drop off depot, possibly supplemented by some return to retail (see Section 7.4.5.) while other large communities with populations approximately in the 2,000 to 4,000 inhabitant range – i.e. Hay River, Inuvik, Fort Smith and

Behchoko, could also be served by depots but perhaps open only on a scheduled basis for a number of days in a month. The smaller communities could be served by special one off collection events with the frequency related to the community's size and the volume of electronics likely to be collected.

Levels of service will need to be determined in advance of any program roll out and standards set and monitored for performance. In any EPR program or a program that GNWT might run itself the GNWT will first need to establish a clear goal for the population to be serviced by some level of e-waste collection. In ESABC's case they report that 90% of BC residents have access to a depot or collection service that meets ESABC's criteria. The GNWT will need to identify its goals in this regard and also set out the expectations regarding the level of service to be provided to different sized communities in the NWT.

These expectations will be applied to the GNWT if it runs its own program and in the case of an EPR program will be established as a performance expectation for producers. Under a directed EPR model producers would be instructed as to the level of service or how to provide the service as was done in Saskatchewan where the SWEEP program was directed to contract with SARCAN for collection.

Under a full EPR program guidance on the level of service would be provided to producers during the preparation of their stewardship plan and the high level goal of % of the total territorial population to have access to the program would be set out. Details on the exact level of service and how it was delivered would however be left to the producers.

Key Actions

- Set a goal for the overall territorial level of public access (percentage of population to be served by a program);
- Develop standards for the provision of service to the various sizes of community in the NWT (type and frequency of service to different size communities).

8.3.3 Building on existing recycling infrastructure

The existence of an operating and viable network of depots and processing centres for the NWT beverage container deposit return program and the provision of varying levels of recycling in communities suggests that a foundation exists for the development of an e-waste program. Some existing depots and processing centres might be adaptable and could possibly be expanded to service an e-waste program. In other cases the physical design and capacity of the depot and its organization and management may mitigate against its use as a place to handle e-waste.

Waste electronics present significantly different management challenges than used beverage containers and the handling and storage requirements are quite different. Whereas used beverage containers can be handled and stored with low risks, generally without special facilities and can be stored outside if properly packaged in plastic bags or Gaylord containers, such is not the case with waste electronics. Waste electronics need to be carefully handled to avoid breakage at the point of collection and to minimize the risks associated with such things as broken mercury containing

lamps. Other hazards exist from such things as broken CRT glass from monitors and TVs. Electronics also need to be carefully packaged and wrapped for shipment for intermediary or final processing and ideally segregated into basic categories at the point of collection – e.g. separating the CRT monitors. Care will also need to be taken to try and minimize the drop off of electronics which are not covered by the program. Waste electronics also need to be stored under cover and indoors prior to shipment.

Depots in the NWT Beverage Container Program are operated under licence with the GNWT by individuals, businesses, schools, non-profit groups and community development corporations. Some of these operators may be more qualified and capable of operating an e-waste drop-off depot or collection service than others. For example depots that are adjunct to commercial businesses or operated by community development corporations where staff are available on a regular basis to manage and service the depot are more likely candidates to also serve as a depot for waste electronics. Out of the 22 permanent beverage depots, six are run by schools and in some regions such as the Sahtu, schools play a major role in the beverage program. Schools are unlikely however to have appropriate facilities or to able to meet the necessary standards to operate an e-waste depot.

A detailed assessment will need to be undertaken of the operational and management capacity of existing beverage depots identified earlier and of the three processing centres (Inuvik, Hay River and Yellowknife) to determine which could be utilized for an e-waste program and under what terms and conditions. As a guide for depot facilities and operation the Electronic Products Recycling Association (EPRA) Collection Site Approval Program (CSAP) could be utilized. The CSAP defines the minimum operational, environmental, health, safety and data security requirements for organizations seeking to operate as an EPRA collection site. The CSAP description can be downloaded online on the EPRA-Recycler Qualification Program website.[27]

If the GNWT chooses to operate its own e-waste program along lines similar to ARMA in Alberta it will have to undertake this kind of assessment based on its knowledge of the Beverage Container Program. Under a directed EPR model electronics producers could be required to utilize the existing beverage depot network to the degree possible and meet prescribed service level standards and producers would be responsible for this task and the necessary upgrades and oversight to run the program. With a full EPR model GNWT would provide non-prescriptive guidance on the collection program.

Key Actions

- Undertake a detailed review of the capacity and possibilities of the existing beverage depot and processing network being used as a basis for an e-waste collection system;
- Develop depot standards and operational and management terms and conditions to operate a depot.

[27] http://rqp.ca/ESW/Files/EPRA_Collection_Site_Approval_Program_FINAL.docx

8.3.4 Transportation Logistics

Transportation of e-waste collected at depots to consolidation or regional processing centres and then to e-waste processors, likely in Alberta, will be a major issue which will need to be addressed in the implementation of whatever program option is decided upon. Transportation of beverage containers collected by the Beverage Container Program is a major expenditure area and will also be a major area of cost for an e-waste program. Back haul has been successfully used for used beverage containers in the NWT and similarly for recyclables including electronics in Alaska. In both the NWT and in Alaska examples some of the backhaul costs for sea cans or air freight and trucking have been donated by transportation companies. Northern Transportation Company Ltd (NTCL) has for example donated some of its shipping capacity to haul collected beverage cans in the NWT.

The existing transportation and back haul network in the NWT that currently provides service for the beverage program could also be utilized for electronics. Standard shipping rates quoted by Northern Transportation Company Ltd (NTCL) range between $220 - $405/tonne or per 2.5 cubic metre and for backhaul the rates are lower at $143 - $263/tonne or per 2.5 cu m. Under a full EPR model these costs would be borne by the designated producers who would likely directly or indirectly through an independent service provider contract for the transportation services. The frequency of transportation from depots would be a factor of the size of the population served by the depot and the amount of equipment that is collected and how long it is held before shipment. Donations for such transportation services could be sought but the likelihood is that a more formal contractual service would operate more reliably over the long term.

Key Actions

- Identify companies available and qualified to provide transportation services by barge, air and road (year round and winter).

8.3.5 Cost internalization or visible point of purchase fees

In an EPR program costs of the program are directly borne by producers and paid for by producers through a levy system commonly based on market share or actual numbers of units sold. Producers may choose to visibly add these fees to the point of purchase retail price or to internalize the costs into the product price with no visibly added cost to the consumer at the point of purchase. Internalized costing represents a truer form of EPR because the fees are not passed directly to consumers but become part of the cost of the product in the same way as the costs of materials, manufacture, marketing and distribution are built into the product price.

Internalization of costs is used in Canada for packaging EPR programs, for cell phones, batteries, pharmaceuticals, for some paint programs and for used agricultural pesticide containers. In all these cases the costs are covered directly by producers and any fees or levies to fund the EPR program are not explicitly added to the consumer invoice at the point of purchase. All other programs, including the currently operating electronics programs use a visible fee system, sometimes called an environmental handling charge, applied at the point of purchase and remitted

to the program's producer responsibility organization. Electronics producers have expressed strong support for a visible consumer fee system.

Quebec has recently adopted a new EPR framework (*Règlement sur la récupération et la valorisation de produits par les entreprises*, adopted in July 2011) under which it has mandated cost internalization for its EPR programs. Producers may not add a fee to a point of purchase invoice although they may provide information to a consumer that the price of the product they are buying includes a cost for end-of-life management, similar to what is shown on receipts in some gas stations. The new regulation set the implementation of the new recovery and reclamation program not later than July 14, 2012 for some categories of electronics materials and July 2013 for others. The approach was first used in Quebec with the Eco-Peinture and the used oil programs. New Brunswick has adopted a similar approach to cost internalization for its paint program which is modeled on Quebec's and the province has suggested that they plan to consider cost internalization for all future EPR programs in the province.

According to past and current provincial experiences in Canada, if the GNWT is silent on the fee visibility issue in any regulated EPR program electronics, producers will very likely opt to place a visible point of purchase fee on any product sold in the NWT. Such fees are applied in all EPR programs and also in the Alberta ARMA program where fees are remitted to a crown agency rather than to a producer responsibility organization. The fees may not necessarily represent the full cost of the program in the NWT because of issues related to out of territories purchases but given past experiences the interest by producers in having some level of visible fee would be very high.

The GNWT may however have the option under an EPR mandate of regulating against added visible fees as both Quebec and New Brunswick have done. Authority to mandate such cost internalization will need to be confirmed. National brand owners would then have to fund the program using non visible fees or direct funding such as what is seen in the United Kingdom, Finland and elsewhere in Europe where direct financing is divided among producers either proportionate to their market share (by weight placed on the market), proportionate to the weight or by the number of their own-branded products returned[28].

With cost internalization producers would also be freer to manage costs in a more harmonized cross jurisdictional way because they would not be as directly accountable to provincial jurisdictions for fees which might otherwise be collected visibly. This is the case with Clean Farms for example on their nationally-run pesticide container program with a producers cost internalization model based on total national market share for each member. In this case, cross subsidization between jurisdictions is not considered an issue because producers pay based on their Canadian market share.

Under a product stewardship model the GNWT would be accountable for all program costs and would have the option of applying a levy or surcharge on electronics sold that would be remitted to

[28] http://ec.europa.eu/environment/waste/weee/pdf/summary_okopol.pdf

government in the same fashion as deposits and surcharges are remitted for the Beverage Container Program.

Key Actions

- Review the legal authority necessary to mandate cost internalization of fees along similar lines to the approach taken by Quebec.

8.3.6 Return to retail

Retailers could play a role in an e-waste program by serving as depots for the collection of end-of-life electronics. Return to retail is mainly an option in Yellowknife where the highest number and concentration of electronics retailers exists[29]. The extent of use of a return to retail option would be determined through the development of the stewardship plan that producers would be obligated to prepare under an EPR regulation (see further discussion in Section 7.4). Return to retail appears to be a practical means to support a collection program but unfortunately many retail establishments are ill-suited to serve as depots for e-waste. Small retail premises are often challenged to provide storage for incoming new products and would be challenged to provide storage and proper management for e-waste. Small electronic products such as cell phones could however be returned to retail because storage requirements are minimal and hazard risks are low.

For most products storage will be a significant challenge or at best one that will require investment in areas such as physical storage capacity. An informal survey of some retailers conducted as part of this study (complete list in Section 2.3.2) confirmed that some retailers did not see themselves as being able to participate in a return to retail program.

However, several EE retailers have informally shown a willingness to participate in a return to retail program. In Yellowknife, Creative Basics, Staples / Business Depot, Canadian Tire, Shoppers Drug Mart, Fiddles& Stix and Pioneer Industrial Supply (1993) / Workplace Office Plus all expressed interest in storing e-waste if a collection program was to be implemented. Arctic Digital of Inuvik also agreed to make room for EE if they were picked up on a regular basis.

Another issue related to return to retail could be regulations governing the storage and management of electronic wastes which might impose restrictions on the type of wastes which would be acceptable and prescribe the conditions under which it should be stored if acceptable[30].

[29] Return to retail is mainly an option in Yellowknife because of the number of retailers which could possibly participate. In remote communities, the take up of return to retail may be similar to return to retail under the Beverage Container Program, although requirements for storing electronics are very different from bottles and cans.

[30] NWT may have regulations covering the storage and handling of waste and especially hazardous waste. Such regulations have typically a small quantity exemption which generally these apply to household quantities. The quantities managed through depots or return to retail are usually not exempted. In addition, there may be municipal by-laws of this matter.

Ultimately the amount of return to retail that could be envisioned in an EPR program will be up to the producers. GNWT can however indicate in its guidance for preparation of a stewardship plan that return to retail should be considered.

Key Actions

- Recommend in the guidance for stewardship plans that return to retail be considered;
- Review any applicable regulations which might have a bearing on the operation of a return to retail depot.

8.3.7 Phasing in program options

A new electronics program does not have to be implemented to cover all designated electronics all at once. In many electronics programs implementation is staged over a period of months or years for different product categories. The different categories of electronics are a useful way of thinking about how a new program could be phased. The CCME for example has categorized waste electronics into the following major groupings based on product similarity in its Recommended E-Waste Products list as follows:

- Computer and electronic products – e.g. PCs, monitors, peripherals, laptops, printers;
- Audio and video equipment – e.g. TVs, radios, VCRs, stereos;
- Communications equipment – e.g. telephones, fax machines;
- Leisure equipment – e.g. video game consoles.

The Atlantic Canada Electronics Stewardship (ACES) program which services Nova Scotia and Prince Edward Island has categorized the electronics which it accepts as follows:

- Desktop computers
- Computer peripherals
- Portable computers
- Desktop printers
- Display devices (including TVs)
- Personal and portable audio/video equipment
- Vehicle audio/video equipment
- Home theatre in a box
- Non-cellular phones

Most new e-waste programs have started by collecting computers and related peripheral equipment (monitors, keyboards, printers etc.) and televisions and have then in later phases included audio/video and other categories. In the case of British Columbia's electronics program, the July 1, 2012 expansion now includes most electronic and electrical equipment, including most products that use electricity or batteries. The B.C. program grew in five separate phases as described in Table 21 below:

Table 21 ESABC Implementation Phases

BRITISH COLUMBIA	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
E-Waste	▸ Televisions ▸ Computers ▸ Computer monitors, keyboards, mice and other peripherals ▸ Printers	▸ Audio-visual and Consumer equipment ▸ Thermostats ▸ Cell Phones ▸ Residential Fluorescent Lamps ▸ Batteries used in Phase 2 products	▸ Smoke detectors ▸ Batteries used in Phase 3 products	▸ Small appliances ▸ Batteries used in Phase 4 products	▸ Large appliances ▸ Electrical and electronic tools ▸ Medical devices ▸ Automatic dispensers ▸ Lighting equipment ▸ Toys, leisure and sports equipment ▸ • Monitoring and control instruments ▸ IT and telecommunications equipment ▸ Accessories for use with any e-waste products ▸ Batteries used in Phase 5 products
Stewardship Plan Submitted to Ministry	Completed 2007	January 1, 2010	July 1 2010	July 1, 2010	October 1, 2011
Launch recycling program	Completed 2007	July 1, 2010	April 1, 2011	October 1, 2011	July 1, 2012

Phasing the implementation gives time for the infrastructure to be established and start working efficiently, for the public to learn how to participate in the program, and in larger program launches, for e-waste processors to expand capacity to handle the volumes. Processing capacity is not an issue with a new e-waste program in the NWT because of the relatively small volumes anticipated to be collected compared with the size, capacity and number of processors outside the NWT (see Section 7.4.8).

Phasing the development of an e-waste program for the NWT would allow progressively expanding the levels of service with a slow and steady expansion of the list of designated products providing time to develop and adjust the necessary collection and transportation systems. As with other programs cited, starting with computers, associated peripherals such as monitors and keyboards, and with TVs would be an appropriate first phase for a new program. The GNWT would be able to specify the designated electronics and the phase in of their collection in the regulation establishing the EPR obligation or for a program that they operated themselves.

Phasing in a program could also be applied to different communities and regions, possibly starting with the larger centres. However this would complicate communications and logistics and given the number of the remote communities and the likely small quantities and frequency of generation of e-waste there is really very little reason why the remote communities could not be launched at

the same time. The perception of treating smaller communities differently than Yellowknife and other larger centres could also be problematic.

Key Actions:

- Develop the listings of designated products and their phasing based on comparable implementation steps taken in British Columbia.

8.3.8 E-waste processors and end markets

Because of the relatively small volumes of electronics waste that will be collected in the NWT compared with volumes collected in programs in adjoining provinces it is unlikely that processing of the collected materials would be undertaken in the NWT. Highway access to Alberta suggests that shipment of collected waste to the Edmonton area would be the most practical option for processing.

In both Alberta and British Columbia the programs have identified a number of companies that meet their environmental and operational requirements. Alberta through ARMA has identified 5 approved processors:

- eCycle Solutions – Edmonton and Airdrie
- GEEP Alberta – Edmonton
- Recycle-Logic – Red Deer
- Shanked Computer Recycling – Edmonton
- Technotrash Alberta – Calgary

The ESABC program in British Columbia has used the Electronics Product Stewardship Canada Recycler Qualification Program (RQP) for End-of-Life Electronics Recycling to assess and identify the following primary vendors for processing e-waste collected in the province:

- e-Cycle Solutions
- FCM Recycling
- GEEP Alberta
- Genesis Recycling
- SIMS Recycling Solutions
- Teck / Toxco

The Recycler Qualification Program sets out a number of standards that must be met in order for a company to become a qualified processor. Included are standards for the following: environmental health and safety management, operational controls, data security, sampling, auditing and other assessments, emergency planning and response, transportation, and identification of downstream recyclers. Under the RQP, recyclers are specifically required to ensure that downstream recyclers handle materials in a safe and environmentally sound manner in accordance with the standard and regulatory requirements. Approved e-waste recyclers are regularly audited to ensure continuing compliance.

GNWT could reference in guidance on stewardship plans or as a requirement that the Recycler Qualification standards for the ESABC program and the registration process for the Alberta program will be used as the basis of selecting e-waste processors for an NWT program. The listing of approved e-waste processors for both the B.C and the Alberta programs could also be explicitly cited as a pre-qualification list.

Key Actions

- A standard for e-waste processing should be established or referenced and used as the benchmark for selecting e-waste processors for all materials collected in the NWT.

8.3.9 Historic and orphan products

The commencement of all new recycling programs presents challenges associated with the management of historic and orphan products. Historic products are those that entered the market and were being used before the beginning of the program and orphan products are those for which there is no longer an identifiable producer/brand owner. At the beginning of any new program there is likely to be a larger volume of materials collected in the first weeks or months resulting from the collection of products which had been stored by consumers in anticipation of a recycling program or stored because they were uncertain how to manage them at end-of-life and did not want them to enter the disposal stream. Electronics stewardship and EPR programs are no different.

This challenge can be met by making sure that some excess capacity is available to collect and transport materials at the program's outset, by carefully controlling the amount of pre-program education and communications, by staffing depots and by phasing the implementation of the program with different dates set for the inclusion of different designated products. All of these methods will serve to help address excess program launch volumes but ultimately the program has to be designed in the early days to respond to these larger volumes. The key response is having available at relatively short notice the necessary storage capacity and extra transportation and shipping capacity in order to minimize the risks of depots being overloaded. In addition it might be necessary to have available extra staff at depots in the early weeks of the program to facilitate proper handling, sorting and storage.

Key actions

- Work with public institutions, businesses, government departments and communities who may have significant stockpiles of waste electronic equipment in order to reduce the quantities of waste EE prior to implementation of any recovery program.
- Ensure that provision is made for handling extra volumes at the beginning of a program and make addressing this issue a requirement of any stewardship plan.

8.3.10 Program Development and Oversight

The GNWT will be responsible for preparation of the necessary framework, guidance and the implementation of an e-waste program and in addition will have obligations regarding oversight of the program once it is operating.

Development of the program may require legislative and regulatory amendments, preparation of guidance on program implementation, directions as to the content of stewardship plans, discussions with producers, depot operators and communities, and other tasks which will require resourcing both financially and possibly with staff.

Program oversight is an important function that will need to be undertaken by the GNWT as part of its obligations to ensure that a program is operating as prescribed, that it is reporting as required and importantly that it is meeting its performance goals and objectives. An e-waste program should require independent 3rdthird party auditing and the filing of an annual report (see Section 7.3.11), but these reports and the program as a whole will need to be regularly evaluated and changes facilitated or directed as required. In cooperation with participating producers, the GNWT will also have a role to play in making sure that all producers covered by any e-waste regulation are fulfilling their obligation to participate.

GNWT resource and staff obligations will be greater in any option or situation where government has a significant operational and/or financial role. This would mostly clearly be the case with the product stewardship option and with those options where operational and financial responsibilities are shared.

Salaries and benefits for staff currently working in the ENR'swaste and product stewardship areas in the Waste Reduction and Recovery Program of the NWT are covered under the Environment Fund which was established as a special purpose fund to handle all income and expenses of waste reduction and recovery programs and initiatives including the Beverage Container Program and the Single-use Retail Bag Program. This fund is separate from the regular ENR Department budget which is funded from territorial general revenues. Some of the necessary resources to develop an e-waste program such as legal drafting capacity are not directly funded by the Environment Fund but do exist within the Justice Department, which has a mandate to provide legal support services to government departments, and other services, such as financial services and enforcement may be available elsewhere within the GNWT. The provision of the necessary legal, financial, administrative and staff resources will have to be addressed to ensure that the GNWT is in a position to adequately fulfill its obligations under an e-waste program.

The number of staff assigned in provinces to manage and oversee provincial EPR and stewardship programs is generally very small in number. New Brunswick's programs and program development are the primary responsibility of one dedicated staff member[31]. In Alberta similar functions are provided by two staff dedicated only to e-waste management. In BC, which has the largest number of EPR programs operating or under development, these functions are played by approximately six staff, again entirely dedicated to e-waste management. In all cases the staff needs are relatively modest because the EPR programs or the product stewardship programs, in the case of Alberta, are sufficiently resourced to undertake the necessary program operations, management and reporting. Staff workloads are higher in the earlier development stages of regulations and of

[31] Along with the support of a 12-member advisory committee.

programs in contrast to when the programs are actually operating when staff efforts are likely to transition to and be more focused on program oversight.

Key Actions

- The GNWT should review its existing resource and staff capacity to develop, implement and oversee an e-waste program and determine what capacity is required if current resources are not sufficient.

8.3.11 Performance Measurement and Reporting

An e-waste program will require the development and implementation of a clear protocol for measuring and reporting on program performance. As is currently required by the GNWT for its Beverage Container Program any program should be required to file annually an independent third party audit of its financial operations. Reports on waste diversion and recycling performance are prepared by ENR. In a situation where an EPR program is operating under a regulated ban on visible point of purchase fees, financial audits will not be, nor could be required, because program costs are internalized in the price of products and such information would be proprietary. Such a protocol is followed in B.C and Quebec.

Key performance indicators for EPR programs have been developed and are being used to measure a wide variety of operating stewardship and EPR programs and are available for use to measure an e-waste program in the NWT. The following key performance indicators are derived from the reporting guidance document for *Performance Measurement and Reporting for EPR Programs* (Stratos Consultants for Environment Canada, October 2007) and are cited in the CCME's Canada-wide Action Plan for EPR as the recommended basis to measure the performance of the product and material EPR programs:

- kilograms/capita collected (amount of material collected divided by the unit sales of the product) or recovered (amount of material collected divided by the amount of product discarded)
- dollars/kilogram collected or recovered
- per cent collected
- per cent recovered
- per cent collected and percent diverted

These indicators will provide a solid comparative basis to track year to year performance, to assess NWT program performance against comparable programs in other jurisdictions and to ensure that a program is meeting its performance targets. They can be used in all program options.

Key Actions

- Existing key performance indicators and auditing protocols are available to adopt as the performance measures and reporting protocols for an e-waste program in the NWT.

8.3.12 Reduction, Reuse and Refurbishment

Reduction and reuse are common elements in all waste diversion strategies and are of interest to the GNWT in the area of electronics. Reduction, reuse and refurbishment objectives, while commonly cited in e-waste programs in Canada, are not often acted on in any clear demonstrable way with programs or performance measures. Reduction is especially problematic because it is very hard, if not impossible to measure, especially at a sub-national level.

The one exception to this general pattern is Ontario's e-waste program run by Ontario Electronics Stewardship (OES). As part of its commitment to e-waste diversion through its approved stewardship plan, OES has developed a standard for reuse and refurbishment, similar to the EPSC standard for processors and has certified refurbishers. It has also established a searchable online database of approved facilities and set up a materials exchange that facilitates transfers of materials and components for reuse between vendors. Approved refurbishers are eligible for a collection incentive payment for any non-refurbishable equipment they collect in a similar way to approved e-waste processors[32]. OES also covers the end-of-life and logistics costs for any non-reusable and refurbishable electronics that require processing by an approved processor. In Ontario, a refurbished product is considered the same way as other end-of-life equipment that has not been refurbished.

The OES program allows the existing refurbishment network in the province to continue operating as it historically has done but with the added support as described above. Quantities or tonnages of electronics refurbished are not however reported by the program.

Key Actions

- That stewardship plans required by the GNWT must address reuse and refurbishment and that an e-waste program include support and encouragement, as is done in Ontario, of existing reuse and refurbishment programs in the NWT.

8.4 PARTNERING WITH PROVINCIAL PROGRAMS

8.4.1 The partnering precedent – Prince Edward Island/ACES

Because of its relatively small population (145,000 in 2012) Prince Edward Island has considered partnership opportunities whenever it has developed stewardship and EPR programs. In the case of its electronics EPR program, which is regulated through its Material Recycling Regulations and was started in 2010, the program is operated and funded by producers through Atlantic Canada Electronics Stewardship (ACES), the producer responsibility program which also operates and funds a comparable program in Nova Scotia. The advantages for both the province and the producers relate to economies of scale, shared communications and education and the ability for the PEI program to harmonize with and utilize collection infrastructure and recycling capacity

[32] Refurbishers pass those equipments on to processors and are paid the same way as any company who delivers e-waste to a processor. Refurbishers are usually not processors although some processors may do a small amount of refurbishment. They are generally two different operations.

supporting the larger provincial program in Nova Scotia. Geographic proximity and good road connections also help to make this possible.

To facilitate this partnership PEI harmonized its list of designated electronics and product definitions, its listing of obligated producers and other regulatory elements with those already used in Nova Scotia. Electronics producers, in submitting their stewardship plan to Prince Edward Island, built their submission around the existing ACES program, largely viewing PEI as an expansion of the Nova Scotia program rather than as a completely new program.

New Brunswick which is in the process of regulating an EPR e-waste program will likely link its program as PEI has done with Nova Scotia's through ACES.

8.4.2 Partnering opportunities and issues

Because both British Columbia and Alberta have operational e-waste programs and because of NWT's shared borders with both jurisdictions partnering opportunities along the lines successfully used by Prince Edward Island should be considered.

Geographic proximity and infrastructure are one of the major considerations but it is equally important to review the partnering opportunities in the context of the actual structure and operation of the two provincial programs which are quite different.

8.4.3 Infrastructure linkages

Despite sharing a border with BC the highway and infrastructure connections are poorly developed and direct access to recycling processing capacity in the province which is concentrated in the Greater Vancouver area is not possible. In contrast, a major highway link (NWT Hwy 1; Alberta Hwy 35) exists from the NWT to northern Alberta via Peace River which provides ready access to the e-waste processors clustered around Edmonton and Calgary which have developed and expanded in response to the quantities of e-waste collected by the Alberta program. This highway is the major route for commercial traffic entering and leaving the NWT and it could also be used to transport collected and/or partially processed e-waste from the NWT. The available transportation infrastructure and e-waste processing capacity and the existence of an e-waste program in Alberta suggests that Alberta would be the most obvious partnership candidate on this basis.

Regardless of the program structure which is decided upon in the NWT the strong infrastructure linkages to Alberta, processing capacity in Alberta and the absence of recycling processors in the NWT will mean that much if not all of the electronic waste collected in the NWT will be transported for processing at facilities in Alberta. The relatively small quantities of e-waste generated in the NWT mitigate against any significant private sector e-waste processing capacity being constructed in the NWT in response to the development of an NWT e-waste program.

8.4.4 Program linkages.

The important factor which has the most bearing on the question of possible program partnerships is related to the fundamentally different structures of the Alberta and British Columbia programs. The Alberta program is run by a provincial crown agency whereas the BC program is run and funded by electronics producers.

8.4.5 Partnering with industry EPR programs - British Columbia, Saskatchewan

If the EPR option is selected electronics producers could be encouraged to consider linking an NWT program to the existing producer run and funded ESABC program in BC. The partnership could follow a similar pattern as that between PEI and Nova Scotia through ACES with similar designated producers undertaking similar regulated obligations. Program structure and funding could be similar to the ESABC program, operational protocols the same and the programs could share common communications materials. In a similar way an NWT program could be linked with the program in Saskatchewan because again it would involve the same designated producers.

In fact linking an EPR program with any or all other existing EPR programs would be workable because the producers are the same. Transporting collected e-waste from the NWT to a processor in Alberta would have no bearing on this partnering opportunity. When given responsibility producers will operate the program in the most efficient way possible within the confines of regulatory direction or an approved stewardship plan and will contract with the e-waste processor which best meets their standards and operational requirements.

8.4.6 Partnership with Alberta

Partnering with the Alberta, ARMA run program would require a different approach because ARMA is a crown agency and the program is not run by producers.

If the GNWT decides to establish a product stewardship publicly operated e-waste program, partnering with Alberta is a possibility because both programs would operate on the publicly operated product stewardship model. Any moves to enter into a program partnership will require discussions and negotiations with ARMA and possibly with the Provincial government itself through the Ministry of Environment. Any discussions with Alberta would in effect have to take place as government to government discussions. For example it is likely that any decision regarding Alberta fees collected from NWT residents would ultimately rest with the Alberta's Minister of the Environment. ARMA has considerable latitude in funding and expending funds for the provincial e-waste program but any sharing of funds with an adjoining jurisdiction or program would likely be beyond their mandate[33].

If a full producer EPR program was established as the preferred option, and a partnership with Alberta was to be considered, producers would similarly have to discuss this issue with ARMA and in effect the Government of Alberta. Such discussions would be problematic and a partnership between a publicly operated program and an industry program is not very feasible. Cooperation and cordial relations do exist between ARMA and the producer run EPR programs but partnership on key program elements like program fees is not possible because ARMA's fees are regulated by government in contrast to ESABC fees which are set and adjusted by the producers. If a decision is

[33] Alberta has to be considered distinctly from the other provincial programs in the sense that the government, through ARMA, has full control on the fees raised in the program. In the case of the other programs, industry controls the funds or fees raised. In an EPR scenario, GNWT would establish the obligation and leave the producers to organize the funding. PEI, as explained in Section 8.4.5, did not enter into a financial or other formal province to province arrangements with Nova Scotia, this was dealt between the producers associations.

taken to establish an EPR program in the NWT, producers would be better positioned to partner with the ESABC program because the producers regulated and obligated in the NWT and in BC would be the same, and the programs could be linked in the same fashion as the PEI program which is partnered with Nova Scotia through the integrated ACES program. Such a producer/public program partnership cannot be immediately visualized with Alberta because of the different Alberta structure which operates without producer funding or operational responsibilities[34]. The key structural difference in Alberta's case is that the Alberta regulation is directed at any retailer and/or wholesaler who sells in Alberta, not at the producers. Best Buy, Staples, Wal-Mart, The Source and independent retailers in the province are expected to fund the system by remitted fees charged to their customers whereas in the other provinces, the producers, such as Dell, Sony, Samsung or LG, are fully responsible for managing those tasks.

An EPR program partnering with another similar program may use administration and communications structures and materials from the partner program if both parties agree to do so. It would not involve cross-subsidization because such agreements are dealt between private organizations. Since national brand producers are free to decide on their program design, partnership agreements between EPR structured programs may be possible (e.g. ACES) whereas proper cross-subsidization would not be possible between two public bodies, like ARMA. At the national level, EPRA is starting to more formally act in this cross-provincial partnership approach which will simplify the producers' involvement in electronics recovery and recycling.

[34] In the case of Prince Edward Island and Nova Scotia, fees are harmonized under the ACES program which covers both provinces. Over time, it is expected that fee harmonization will further develop elsewhere as programs grow and processing capacity continues to develop.

9 CONCLUSION

9.1 OVERVIEW

The two main objectives of this report were to conduct an inventory of existing and future electronic equipment in the NWT and to assess the feasibility and options for addressing electronic waste. In summary the report first focuses on defining the main issue parameters and the development of an e-waste inventory and a methodology, including sales estimates, historic and future e-waste quantities per product category. This allows a determination of the quantities available for collection and recycling, now and in the future. The current state of e-waste management and the other available recycling infrastructure in place in NWT is also portrayed.

The review of different e-waste and comparable initiatives in other jurisdictions and in remote communities confirmed that there was only limited directly applicable or comparable program experience elsewhere that could be applied to the NWT's situation. This review also made possible the drafting of product designation phase-in and timeline setting for program implementation, which will be developed below. The authority provided under the *Waste Reduction and Recovery Act* as well as other Canadian regulatory frameworks regarding stewardship and EPR programs was also reviewed. Five e-waste program options were then fully described - Extended Producer Responsibility, Directed Extended Producer Responsibility, Public sector Operation with Full Producer Funding, Divided Operational Responsibilities with a Collection/Processing Split and a Product Stewardship publicly operated program – and pros and cons for each were identified. Following the option descriptions a thorough feasibility assessment was undertaken using 12 evaluation criteria and a series of issues to be considered in the specific NWT context were presented.

The primary conclusion of the study and the analysis presented is that the GNWT should consider the establishment of a regulated EPR program for e-waste in the NWT following the Directed EPR model. This option offers the financial advantages to the GNWT of full EPR while allowing public control on the way the program is implemented.

The following concluding sections draw together the key findings of the feasibility assessment, list some final recommendations for implementing an e-waste collection and recovery program in NWT and suggest priority next steps to be followed to facilitate program implementation.

9.2 KEY FINDINGS

9.2.1 Legislative and regulatory framework/ Cost internalization

The ability of the GNWT to mandate the establishment of an EPR program needs to be confirmed with NWT legal services. A regulatory framework to allow an establishment of a Directed EPR program will need to be developed by GNWT and it would need to include the service requirements acceptable to the GNWT that will ensure communities across the NWT's five regions are provided with an appropriate level of e-waste recycling service and an appropriate level of public access. A directed EPR model could also make possible the use of existing infrastructure where possible

and thus build on the positive social and economic impact in the different regions represented by the existing successful beverage container program.

Visible point of purchase fees to support the operations of an e-waste collection program applied only on purchases made in the NWT through internet sales and from NWT retailers may not be sufficient to cover the entire cost of such program in the NWT given the significance of electronic equipment purchased outside the NWT. It is recommended that a cost internalization approach, as adopted in Quebec and in New Brunswick for paint and for electronics in Quebec be considered for a waste electronics program in NWT. Cost internalization prevents program costs being passed directly and explicitly on to consumers and instead builds the cost of end-of-life management into the retail price of the electronics purchased. Producers should be allowed, as they are in Quebec, to inform consumers that the advertised, posted and cash register price does include the cost of end-of-life management.

9.2.2 Product category phase in

As seen in Section 8.3.7, it is recommended that a new end-of-life electronics program be implemented in at least two phases. The ESABC experience suggests two phases for the product categories identified by ENR in their Request for Proposal. Phase 1 and 2 equipment categories are listed in the left column of Table 22 below, while Phase 1 products could be collected in Year 1, Phase 2 equipment would start being collected 3 or 4 years later.

Table 22 Units and weights expected for Phase 1 and Phase 2 products

CATEGORY	UNITS / KG	2012		2016		2020	
		MIN	MAX	MIN	MAX	MIN	MAX
Phase 1 Display devices, Desktop computers, Laptop computers, Printers/Fax machines/Peripherals	Phase 1 (units)	14,227	26,485	15,643	29,121	17,199	32,019
	Phase 1 (kg)	115,858	206,057	127,388	226,562	140,064	249,108
Phase 2 Portable Audio/Video and Recording, Home Audio/Video Systems, Home Theatre in a Box, Cellular phones, Non-cellular phones, After-market vehicle audio/video systems	Phase 2 (units)	18,853	37,643	20,730	41,389	22,792	45,508
	Phase 2 (kg)	56,538	112,250	62,164	123,420	68,351	135,702
Total e-waste to manage	Total Units	14,227	26,485	36,372	70,510	39,992	77,526
	Total kg	115,858	206,057	189,552	349,982	208,415	384,810

Taking the list of electronics described at the outset of the study and looking at the phasing described in Section 8 and using the quantitative data developed by the study, table 22 presents, by phase, quantities of electronic equipment which are recommended to be managed in an e-waste program. In the first year (2012), only Phase 1 material is considered while equipment of both phases is considered in the fourth year (2016). Note that while the majority of the units to be

managed are in Phase 2, most of the weight expected to be collected and recycled would be in Phase 1.

It is recommended that discussions be initiated with public institutions, businesses and communities who may have significant stockpiles of waste electronic equipment in order to reduce and schedule the quantities of end-of-life electronics prior to implementation of any recovery program. It is recommended as well that a Directed EPR e-waste program make provisions to handle extra volumes at the beginning of the program.

9.3 COLLECTION, TRANSPORTATION AND PROCESSING OF MATERIALS

Collection

Managing e-waste in all NWT communities appears feasible. However, because of wide variations in community size, facilities and local resources variations in the level of collection service will need to be developed and offered. While larger communities could easily sustain a year-round drop-off depot, medium-size communities might only need a depot with limited operating days whereas drop-off events or other collection options would address smaller remote communities' needs for e-waste management. Depending on the program model chosen or mandates required by the GNWT, existing infrastructure, such as Beverage Containers Depots, and return to retail may be used in an e-waste collection program. It is recommended that goals or mandates be set in the regulations and/or stewardship plan requirements for the overall level of public access. Under the Directed EPR model the GNWT would be in a position to be more prescriptive regarding the use of the existing recycling network in the NWT and the desired level of service and public access.

It is suggested as well that depot standards, operational and management terms, and conditions to operate a depot be developed based on EPRA's Collection Site Approval Program (CSAP).

Transportation and processing

Transportation will be an important part of program expenditure. Means to mitigate transportation costs include preferred backhaul rates, which exists with some shipping companies, sufficient volumes, proper materials handling and careful shipment planning. Under the Directed EPR model producers would be entirely responsible for transportation costs and logistics. It is recommended that companies qualified to provide transportation services and that options to combine shipment of waste electronic equipment with collected beverage containers be investigated.

The closest and most immediately accessible e-waste processors are located in Alberta. Existing highway linkages between the NWT and Alberta would allow for materials to be consolidated in NWT before being shipped to processors in that province.

Standards for reuse, refurbishing and processing

Any stewardship plan required by the GNWT should address reuse, refurbishment, and recycling in a similar way as the current approach in Ontario, and using a similar facility approval approach as the EPSC standards for processors. This approach would ensure that standards for occupational health and safety are met by refurbishers. It is recommended that such standards be used as the benchmark for selecting e-waste processors for all materials collected in the NWT.

9.4 ROLES AND RESPONSIBILITIES

In a Directed EPR program the following are the core elements and requirements that must be addressed by producers in a producer responsibility program:

- Full producer responsibility for program management and operation costs so that costs are not borne by government or taxpayers;
- Follows the 3R hierarchy, i.e. reuse the material before it is recycled;
- Respects environmental objectives and requirements;
- Consumers are offered equitable opportunities to participate in the program regardless of their location with service and access standards set by the GNWT;
- Orphan and historic products are managed by the program in the same fashion as all waste electronics;
- Reporting based on CCME's CAP for EPR performance indicators;
- Communication initiatives to ensure public awareness and support participation.

Under a Directed EPR program the following are the key responsibilities for GNWT:

- Develop a clear regulatory framework and requirements for stewardship plans;
- Provide staff resources to support the program's development and implementation and, subsequently provide for the continuing program oversight;
- Ensure NWT communities have reasonable access to collection without charge;
- Ensure environmental objectives and program performance measures and targets are met;
- Provide guidance on stewardship plans and EPR program elements as set out in the CCME Canada-wide Action Plan for EPR.

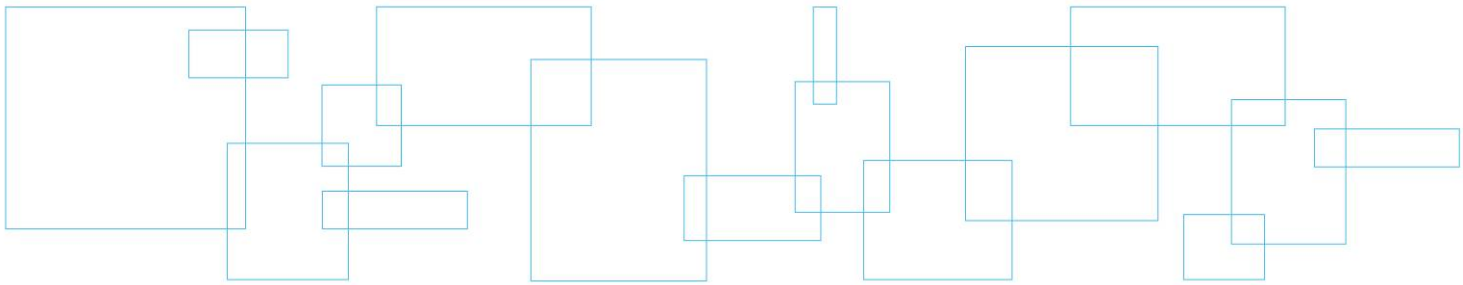
9.5 RECOMMENDATION FOR PRIORITY NEXT STEPS

In conclusion the following priority next steps for program implementation, drawing on the discussion in Section 8, are presented for consideration:

- Verify legal authority and initiate any of the changes that might be necessary;
- Review GNWT's existing resource and staff capacity to develop, implement and oversee an e-waste program and determine if any additional capacity is required;
- Undertake a detailed review of the existing capacity and potential for the beverage container depot and processing network to be used as the foundation for an e-waste collection program;
- Investigate companies for transportation and haulage opportunities and prices;
- Initiate discussions with Electronics Product Recycling Association (EPRA) regarding possible development of an NWT EPR e-waste program;
- Investigate and set service and public access standards for collection;
- Initiate discussions with Alberta Environment and ARMA regarding fees paid on products sold in Alberta but used and recycled in the NWT.

DESSAU

Appendix 1 Detailed Quantitative Methodology



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APPENDIX 1 - DETAILED QUANTITATIVE METHODOLOGY

1.1 ESTIMATION OF SALES OF EE FOR CANADA AND NWT

As mentioned in the report, the data collection process has underlined the fact that data on the sales of electronics and the availability of end-of-life electronics for collection and recycling are not specifically available for the NWT.

Despite these recognized challenges the following sources have been used to estimate the amount of electronic equipment sold in NWT through all origins:

- Statistics Canada's 2011 Census;
- Statistics Canada Survey of Household Spending 2009;
- Electro-Federation of Canada (ElectroFed) 2005 to 2011 National Annual Sales Reports which include sales to residential, commercial, industrial and public sectors from 2005 to 2011 were used as database for home and personal audio-visual systems, home theatre-in-a-box systems, vehicle audio/video systems, and cordless phones. It is important to note that equipment purchased in the USA is not taken into account in this database;
- Units sold in Saskatchewan as shown in the Saskatchewan Waste Electronic Equipment Program (SWEEP) 2011-2012 Annual Report along with Statistics Canada, 2010, Gross domestic product (GDP) were used to estimate the national sales figures for computers, computer peripherals, printers (desktop) and display devices (including TVs and monitors);
- Data on average market share figures for laptops and desktops and average price per unit in Canada for 2008 and 2011;
- Ontario Electronics Stewardship (OES) discard model for the weight of each categories of EE.

Table A1-1 presents the source of data, limitations and potential impacts on the results of the estimations. It should be noted that impact on the estimations doesn't necessarily mean impact on the options assessment results which are discussed in Chapters 6 and 8.

Table A1-1 Source of data and limitation for the estimation of EE sales

SOURCE	UTILIZATION	LIMITATION	POTENTIAL EFFECT ON RESULTS
Statistics Canada 2011 census – population and private dwellings occupied by usual residents	Population and number of households for Canada (CanHHld) and NWT (NWTHhld)	Official statistics	None
Statistics Canada. Survey of Household Spending 2009. Average total expenditure per household for the following categories: computer Hardware; Computer equipment and material; Computer supplies and other equipment; Digital cameras and accessories; Audio equipment; Other home entertainment equipment; Televisions; VCRs, DVD players, DVD writers; digital video camera; Other video and television components	Estimation of the total household expenditures for EE in order calculate ratio CanHhld x Summation of the average total expenditure per household = Total household expenditures for EE	Survey categories may not be representative of all the categories of e-waste targeted by the report. The Survey is based on year 2009.	None, EE expenditures ratio is not use for the next steps.
Electro-Federation of Canada (ElectroFed) 2012 Consumer electronics markets trends and forecast	EE units sold in Canada for the following categories : Personal or portable audio/video systems, Vehicle audio/video systems, Home theatre in a box systems, Home audio/video systems, Non-cellular phones	Electro-Federation Canada is an industry association that represents over 330 majors EE manufacturers. Some manufacturers of EE may not be member of ElectroFed. Some categories may not match exactly the categories of e-waste targeted by the report.	Limited, may underestimate the total sales for the specified categories.
Saskatchewan Waste Electronic Equipment Program (SWEEP) 2011-2012 Annual Report. Sales figures for computers, computer peripherals, printers (desktop) and display devices (including TVs and monitors).	Basis for extrapolation of the sales in Canada for the specified categories.	The sales in Saskatchewan may not be representative of those throughout Canada.	Unknown, no other data available.
Statistics Canada, 2010, Gross domestic product (GDP) for Canada and Saskatchewan	Share of Saskatchewan's GDP in Canada used to extrapolate sales figures for computers, computer peripherals, printers (desktop) and display devices (including TVs and monitors) for Canada	GDP doesn't exactly reflect the sales of the specified categories.	Unknown, GDP is the most generic economic indicator available distinctly for provinces and Canada.

Table A1-1 (Cont'd) Source of data and limitation for the estimation of EE sales

SOURCE	UTILIZATION	LIMITATION	POTENTIAL EFFECT ON RESULTS
The Globe and Mail. Jan. 25, 2012. *Is it time to proclaim the death of the desktop computer?* Average market share figures for laptops and desktops for 2011	Share of desktop/Laptop in computers sales for Canada	May not represent the market share in NWT	Limited, affects only two categories of EE representing app 15% of the total
OES discard model	Some categories were mixed in order to reflect the targeted categories of e-waste. Averages (weight and ages) per aggregate categories were calculated by an arithmetic mean of the subcategories.	OES discard model uses data from 20005/06, weights of the units may have changed since the preparation of the model. Especially for monitors and TVs, arithmetic mean of the kg/unit may not be representative of the market share. No data available for the market share.	Unknown, effects on the total weight of EE
No data available – sales figures for cell phones and wireless devices	EE units sold in Canada – Cells phones and wireless devices	No data available	Limited, the production of e-waste for this category is estimate using the number of cell phones currently in use.

1.2 ESTIMATION OF THE TOTAL FUNCTIONAL AND NON-FUNCTIONAL EE IN NWT

The estimation of the functional and non-functional EE was primarily based of three calculation methods based on different assumptions:

- Method based on historic sales data and EE lifespan;
- Method based on ENR Survey;
- Method based on Statistics Canada Survey of household spending – percentage of household reporting.

The three methods cannot be used as a direct method of estimation because the EE categories are not exactly the same and for some categories, data were not available or were not targeted by the survey.

1.2.1 Method 1 - Method based historic sales data and EE lifespan

This method is based on an estimation of the historic sales of EE from 2001-2011 and the EE lifespan extracted from the OES discard model.

1.2.1.1 Estimation of 2001-2011 sales

The historic sales of EE were calculated using the variation of the ElectroFed actual sales figures from 2005 to 2011. Table A1-2 shows the annual variation based on actual sales of ElectroFed members.

- Assumption : ElectroFed sales figures variation from 2005 to 2011 is representative of entire EE sales figures from 2001 to 2011

Table A1-2 Actual sales and sales variation for ElectroFed 2005-2011

	2005	2006	2007	2008	2009	20010	2011
ElectroFed Actual sales – all categories (000s units)	17,858	22,637	23,096	21,617	20,428	21,711	20,473
Annual growth (decrease)	n.a.	27%	2%	(6,4%)	(5,5%)	6,3%	(-5,7%)

For year 2001—2005, the annual variation is considered to be the same than the average annual variation from 2005 to 2011.

1.2.1.2 Utilization of OES discard model for the estimation of functional and non-functional EE

The adapted OES discard model presented in Table 4 of the final report indicated the theoretical ages of first life and age at end of life for each category of EE. It also indicate which percentage of EE is reuse, store or discard after its first life.

- Assumption: EE within age of first life and % of items stored or reuse are considered to be functional or non-functional EE and all EE are considered discard at the age at end of life.

Based on the discard model and this assumption, the quantity of functional and non-functional EE in NWT for 2011 was estimated using the following method:

A. Summation of sales of the current and preceding years within the age at first life of the specified category

- For example, summation of the desktop computer sales from 2006 to 2011 and half of 2005 (summation of 6.5 years of desktop computer sales)

B. %of stored or reused sales multiplied by the summation of the sales the years before the age at first life up to the age at end of life

- For example, according to the discard model, 50% of desktop computers are stored or reused after first age. Thus 50% of the desktop computers sold from second half of 2002 to first half of 2005.

C. All items sold before the age at end of life are no longer in circulation

- For example, in the case of desktop computers, all sales before the second half of 2002 (9.5 years) are considered to be discarded and not calculated in the functional and non-functional units.

The estimation is made individually for each category of EE considered in the study. The result of this estimation is presented in Table 6 of the final report, method 1.

1.2.2 Method 2 - Method based on ENR Survey

This method is mostly based on the extrapolations presented in Table 1 of the report produced by ENR in July 2012, *E-waste: A survey of household Electronic Products in the Northwest Territories*. Although the survey is not representative of the population of NWT, the results of the survey offer an indicator to compare existing data and complete some data gaps.

ENR extrapolation was used directly for the calculation of functional and non-functional items except for cell phones and pagers categories. In that case, a direct extrapolation using population was not consider relevant since the cell phone services in NWT are not available on the entire territory.

In order to estimate the number of functional and non-functional cell phones and wireless devices in NWT, the extrapolation was based on the proportion of the population that lives in communities with cellular service.

These communities were identified with the Canadian Cellular Towers Map[1]. According to this map, the following communities are covered by a cellular tower:

- Inuvik
- Tuktoyaktuk
- Fort Liard
- Fort Smith
- Hay River

[1] http://www.ertyu.org/steven_nikkel/cancellsites.html

- Yellowknife

These communities represent 29,876 people, based on the average cell phone and pager per individual estimate in ENR Survey report (1.023). The total number of functional and non-functional cell phones and pagers is 30,557.

1.2.3 Method 3 - Method based on Statistics Canada Survey of household spending – percentage of household reporting

Statistics Canada's Survey of Household Spending 2009 contains data on % of households reporting spending on different equipment, such as electronic items. This data is available for NWT and were used to extrapolate for the entire NWT.

The categories of equipment and the extrapolation are presented in Table A1-3.

Table A1-3 Method 3 – estimation of functional and non-functional items in NWT

EQUIPMENT	%HOUSEHOLD REPORTING (2009)	TOTAL ITEMS (14,700 HOUSEHOLD)
Households which have one telephone (including a phone used for business)	41.9%	6,159
Households which have 2 telephones (including phones used for business)	19.3%	5,674
Households which have 3 telephones (including phones used for business)	19.5%	8,600
Households which have a cell phone	52.7%	7,747
Households which have a compact disc (CD) player	73.5%	10,805
Households which have one VCR	41.2%	6,056
Households which have 2 VCRs or more	14.8%	4,351
Households which have a home computer	73.3%	10,775
Households which have one colour TV set	38.6%	5,674
Households which have 2 colour TV sets	35%	10,290
Households which have 3 colour TV sets	26.4%	11,642
Households which have a DVD player	85.1%	12,510
Households which have a CD writer	49.6%	7,291
Households which have a DVD writer	43.5%	6,395
Total		113,969

Table A1-4 presents the source of data, limitations and potential impacts on the results of the estimation of functional and non-functional EE in NWT.

Table A1-4 Source of data and limitation for the estimation of total functional and non-functional EE in NWT

SOURCE	UTILIZATION	LIMITATIONS	POTENTIAL EFFECT
OES discard model .	Estimation of functional and non-functional EE – method 1 Some categories were mixed in order to reflect the targeted categories of e-waste Average ages of first life and age at end of life were calculated by an arithmetic mean of the subcategories.	Average age at first life and at end of life may not be representative of the market share in some categories Life span and % to discard of EE may have varied since the development of the discard model	Limited, changes of life span doesn't necessarily affect all categories,
ENR e-waste survey	Estimation of functional and non-functional EE – method 2	Not representative of all the population of NWT May overestimate electronics users and over-representative of Yellowknife residents relative to other communities that may not have cell service).	Overestimates the number of functional and non-functional devices
Statistics Canada's 2009 Survey of household spending - % of household reporting	Estimation of functional and non-functional EE – method 3	Survey categories may not be representative of all the categories of e-waste targeted by the report. The Survey is based on year 2009.	Limited but no impact on programs assessment methodology
ElectroFed variation from 2006 to 2011 (for all categories of EE)	Historic sales data	Annual Growth varies for each categories of EE Electrofed data are not representative of computers, monitors and cells phones sales	Unknown but no impact on programs assessment methodology
Government of Canada. Update of Economic and Fiscal Projections – 2011. Department of Finance March 2011 and September 2011 surveys of private sector economists.	Real GDP growth projections for 2011-2015 were used to project sales data for 2012-2020 period	Canada's GDP growth projections may not be representative of NWT nor of EE sales.	Unknown but no impact on programs assessment methodology

1.3 ESTIMATION OF THE QUANTITY OF HISTORIC AND FUTURE E-WASTE

The estimation of the historic and future e-waste presented in tables 8 and 9 of the final report are based on the following sources:

- The estimation of minimum and maximum functional and non-functional EE for 2011;
- Historic and future minimum and maximum quantity of functional and non-functional EE are following the same annual variation as the EE sales;
- Canadian real GDP growth forecast for 2011-2015 (2.4% per year)[2] is used to estimate EE sales from 2012 to 2020.
- OES discard model average discard rate on an annual basis

The estimation of minimum and maximum functional and non-functional EE for 2011, presented in Table 7 of the final report were projected to provide an estimation from 2008 to 2020 using the historic sales and the forecast of the GDP growth.

As shown in Table A1-6, a rate of discard per year was calculated using OES discard model assumptions on the age at first life and at end of life. The rate was applied to the functional and non-functional item each year to calculate the quantity of e-waste generated.

Table A1-5 Average %discard per year from OES discard model

EQUIPMENT	AGE AT FIRST LIFE (A)	% TO DISCARD (B)	ANNUAL %DISCARD AFTER 1ST LIFE (B/A)	AGE AT END OF LIFE (C)	%REUSE AND STORE (D)	ANNUAL %DISCARD AFTER 2ND LIFE (D/C)	AVERAGE %DISCARD /AN (B/A)+(D/C)
Desktop computers	6.5	50%	7.7%	9.5	50%	5.3%	13.0%
Portable computers	2	50%	25.0%	5	50%	10.0%	35.0%
Printers/Fax Machines/Peripherals	3.5	15%	4.3%	5.3	85%	15.9%	20.3%
Display devices	7.0	22%	3.1%	10.0	78%	7.8%	10.9%
Personal or portable audio/video systems	3.9	10%	2.6%	5.4	90%	16.8%	19.4%
Vehicle audio/video systems (aftermarket)	7.0	10%	1.4%	8.5	90%	10.6%	12.0%
Home theatre in a box systems	7.0	10%	1.4%	8.5	90%	10.6%	12.0%
Home audio/video systems	6.5	10%	1.5%	8	90%	11.3%	12.8%
Non-cellular phones	5.3	10%	1.9%	6.8	90%	13.2%	15.0%
Cellular phones and wireless devices	1.5	10%	6.7%	3	90%	30.0%	36.7%

[2] Government of Canada. Update of Economic and Fiscal Projections – 2011. Department of Finance March 2011 and September 2011 surveys of private sector economists.

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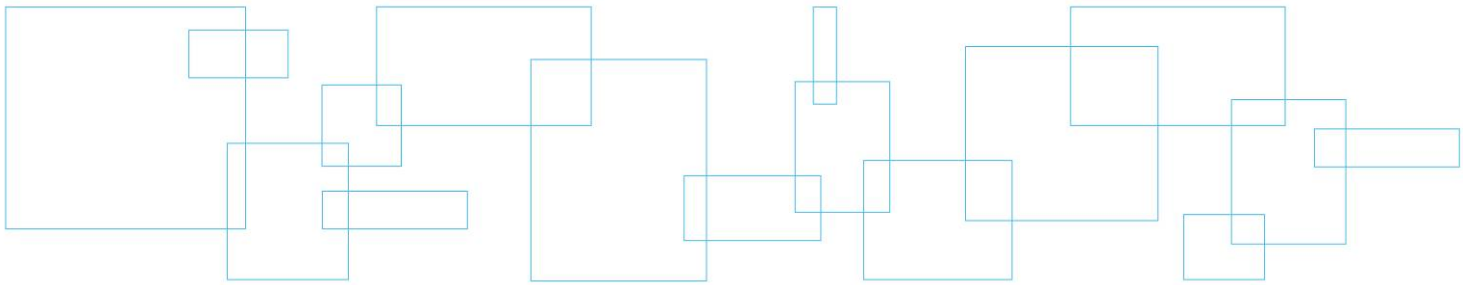
Appendix 2 Ontario Electronic Stewardship 2009 Discard Model



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ONTARIO ELECTRONIC STEWARDSHIP 2009 DISCARD MODEL

(EXTRACT FROM OES. FINAL REVISED WEEE PROGRAM PLAN. JULY 10, 2009)

	kg/ unit	Age at First Life	% to Second Life Reuse	% to Second Life Storage	% to Discard	Age at End of Life	Years in Storage
Monitors	7.7	5.0	0.40	0.10	0.50	8.0	3
TV < 18”	6.0	7.5	0.70	0.15	0.15	10.5	3
TV ≥18”-29”	21.0	7.5	0.70	0.15	0.15	10.5	3
TV >29”-45”	35.0	7.5	0.70	0.15	0.15	10.5	3
TV >45”	45.0	7.5	0.70	0.15	0.15	10.5	3
Desktop Computers	7.4	6.5	0.40	0.10	0.50	9.5	3
Portable Computers	2.9	2.0	0.40	0.10	0.50	5.0	3
Computer peripherals	1.1	5.2	0.40	0.10	0.50	8.2	3
Modem and networking devices	0.5	1.5	0.40	0.50	0.10	3.0	3
Hard drive – DAS	0.5	1.5	0.40	0.50	0.10	3.0	3
Desktop Printers	9.4	3.5	0.40	0.50	0.10	6.5	3
Electric typewriter	5.0	4.0	0.40	0.50	0.10	5.5	3
Laser printers	6.2	4.0	0.40	0.50	0.10	5.5	3
Ink-Jet/Dot Matrix	6.2	4.0	0.40	0.50	0.10	5.5	3
Handheld printers	2.5	4.0	0.40	0.50	0.10	5.5	3
Fax Machine	7.0	4.0	0.40	0.50	0.10	5.5	3
Floor-standing printers	50.0	4.0	0.40	0.50	0.10	5.5	3
Desktop or portable scanner	5.1	4.0	0.40	0.50	0.10	5.5	3
Desktop Multifunction Device	10.2	4.0	0.40	0.50	0.10	5.5	3
Floor-standing photocopiers	100.0	4.0	0.40	0.50	0.10	5.5	3
Telephones (Wire line)	1.0	7.0	0.40	0.50	0.10	8.5	3
Telephones (Cordless)	1.1	3.0	0.40	0.50	0.10	4.5	3
Telephone Answering Machines	1.5	6.0	0.40	0.50	0.10	7.5	3
Personal Digital Assistant, Pagers	0.2	1.5	0.40	0.50	0.10	3.0	3
Cellular Phones	0.2	1.5	0.40	0.50	0.10	3.0	3
Converged Mobile Devices	0.2	1.5	0.40	0.50	0.10	3.0	3
Digital Cameras	0.3	3.0	0.40	0.50	0.10	4.5	3
MP3 Players	0.2	1.5	0.40	0.50	0.10	3.0	3

	kg/ unit	Age at First Life	% to Second Life Reuse	% to Second Life Storage	% to Discard	Age at End of Life	Years in Storage
Solid state voice recorders	0.1	1.5	0.40	0.50	0.10	3.0	3
Video Cameras/ Camcorders	2.5	6.0	0.40	0.50	0.10	7.5	3
Speakers - Docking Speakers	2.3	1.5	0.40	0.50	0.10	3.0	3
Audio Player (tape) Portable Stereo	3.1	4.0	0.40	0.50	0.10	5.5	3
Audio Player - Personal CD Player	0.4	4.0	0.40	0.50	0.10	5.5	3
Audio Player - CD Player single/multi	4.8	7.0	0.40	0.50	0.10	8.5	3
Audio recorder/ Portable Tape/ Radio players	0.5	4.0	0.40	0.50	0.10	5.5	3
Speakers - Home Theater	22.9	7.0	0.40	0.50	0.10	8.5	3
Speakers - Home Speakers	22.9	7.0	0.40	0.50	0.10	8.5	3
Data Projectors	14.4	7.0	0.40	0.50	0.10	8.5	3
Speakers - Multimedia	2.4	7.0	0.40	0.50	0.10	8.5	3
Clock Radios	6.0	4.0	0.40	0.50	0.10	5.5	3
Amplifiers/Receivers	2.3	4.0	0.40	0.50	0.10	5.5	3
VCRs, DVD and HD-DVD Players	2.3	7.0	0.40	0.50	0.10	8.5	3
Aftermarket Vehicle	2.3	7.0	0.40	0.50	0.10	8.5	3
Home Theatre Systems	22.9	7.0	0.40	0.50	0.10	8.5	3

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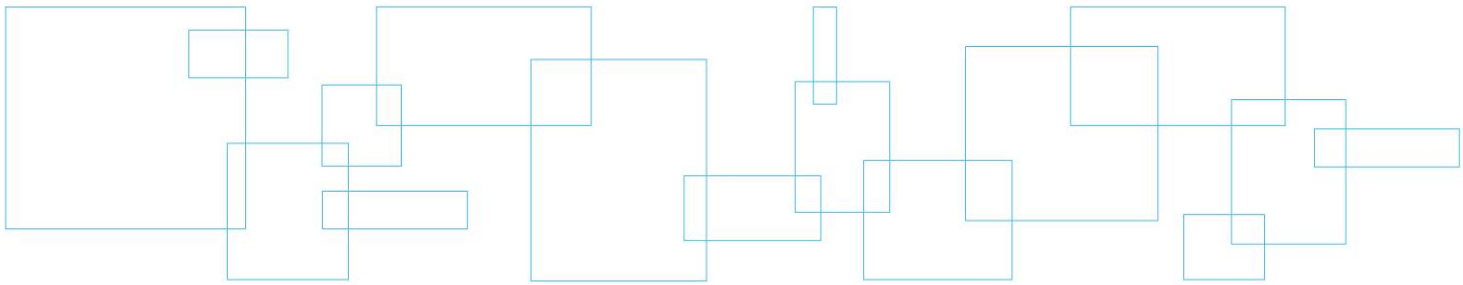
Appendix 3 Beverage Container Collection Depot Operators



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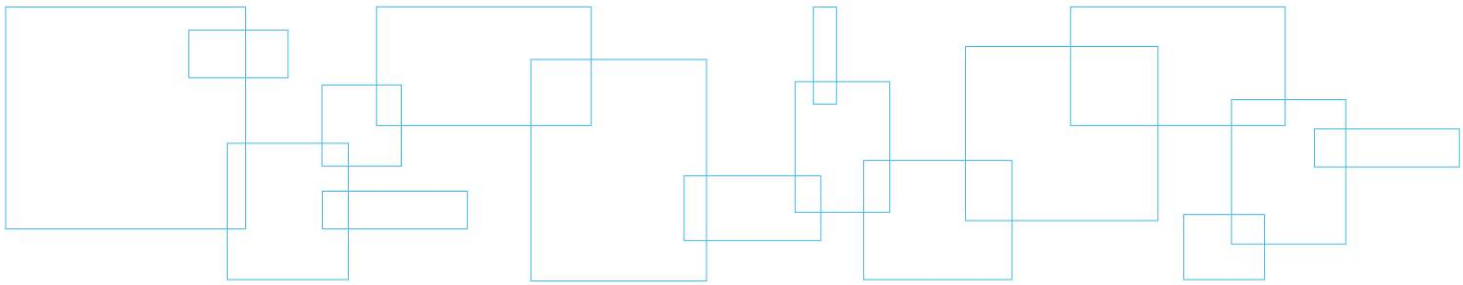
BEVERAGE CONTAINER COLLECTION DEPOT OPERATORS

COMMUNITY	OPERATOR	DEPOT LOCATION	PHONE
NORTH SLAVE REGION			
Behchoko	FC Services	FC Services on Main Street	867.392.6955
Gameti	Gameti Development Corporation	Gameti	867.997.3202
Wekweti	Tli Cho Community Government	Band Office	867.713.2010
Wha Ti	Alex's Confectionery	Alex's Store	867.573.3241
Yellowknife	The Bottle Shop	#7 Old Airport Road	867.873.4449 or 867.873.1017
SOUTH SLAVE REGION			
Enterprise	Armella Mercredi	237 Robin Rd.	867.984.3000
Fort Providence	Deh Gah Secondary School	School	867.699.3131
Fort Resolution	Frank Lafferty	Frank Lafferty's House	867.394.4503
Fort Smith	RTL Recycling	Highway #5 and York Crescent, next to dog pound	867.872.2153 or 867.872.0806
Hay River	Tri R Recycling	36 Industrial Drive	867.874.3737
Kakisa	Use Hay River Depot		
Lutselk'e	Satellite Depot - Contact ENR Head Office at 867.873.7654		
DEH CHO REGION			
Fort Liard	Satellite Depot - Contact ENR Head Office at 867.873.7654		
Fort Simpson	Rowes Recycling	Past Midnight Petroleum bulk plant	867.695.2600 or 867.695.2601
Jean Marie River	Louie Norwegian School	School	867.809.2030
Nahanni Butte	Satellite Depot - Contact ENR Head Office at 867.873.7654		
Trout Lake	Sambaa K'e Development Corp'	Band Office	867.206.2025 Fax 2032
Wrigley	Chief Julian Yendo School	School	867.581.3401
SAHTU REGION			
Colville Lake	Colville Lake School	School	867.709.2300
Deline	Ehtseo Ayha School	School	867.589.3391
Fort Good Hope	Chief T'Selehye School	School	867.598.2288
Norman Wells	Norman Wells Recycling	47 Mackenzie Drive	867.587.2870
Tulita	Tulita Dene Band	Youth Centre	867.588.3341 or 867.588.3302

COMMUNITY	OPERATOR	DEPOT LOCATION	PHONE
INUVIK REGION			
Aklavik	Satellite Depot - Contact ENR Head Office at 867.873.7654		
Fort McPherson	Telit Gwichin Recycling Depot	Fort McPherson Tent & Canvas Warehouse	867.952.2559
Inuvik	Wrangling River Supply	#31 Distributor Street	867.777.3011 Fax 2023
Paulatuk	Satellite Depot - Contact ENR Head Office at 867.873.7654		
Sachs Harbour	Satellite Depot - Contact ENR Head Office at 867.873.7654		
Tsiigehtchic	Use Inuvik or Fort McPherson Depots		
Tuktoyaktuk	Tuktoyaktuk Community Corporation	Community Recycling Depot	867.977.2390 or 867.977.2363
Ulukhaktok	Satellite Depot - Contact ENR Head Office at 867.873.7654		

Appendix 4 Reference Documents



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