

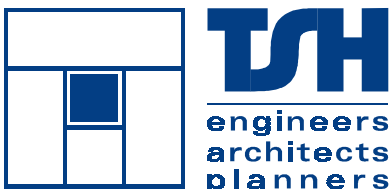
City of Sault Ste. Marie

ORGANIC WASTE DIVERSION REPORT

Final
April 2001

Prepared with funding by the Ontario Waste Diversion Organization

Prepared by:



Sault Ste. Marie, Ontario

In Association With
Russell Environmental Services (RES)

CITY OF SAULT STE. MARIE

ORGANIC WASTE DIVERSION REPORT

TSH Project No. 38-60219

April 11, 2001

Mr. Damien Bassett

Ontario Waste Diversion Organization
26 Wellington Street East, Suite 601
Toronto, Ontario
M5E 1S2

Dear Mr. Bassett:

**Re: City of Sault Ste. Marie
Waste Management Plan
WDO Project Number: ORG-R1-10
TSH Project No. 38-60219**

On behalf of our client, the City of Sault Ste. Marie, we are pleased to submit the Final Organic Waste Diversion Report dated July, 2001.

Should you have any questions, please do not hesitate to contact the undersigned at 1-800-668- 1983 or Mr. Jim Elliott at the City 705-759-5378.

Yours very truly,

Michael Cant
Project Manager

MC/wb

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Encl.

pc: Mr. J. Elliott, City of Sault Ste. Marie
Ms. S. Hamilton, TSH Sault Ste. Marie
Ms. P. Russell, RES
Mr. H. Kresin, KEC

CITY OF SAULT STE. MARIE ORGANIC WASTE DIVERSION REPORT

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LIST OF ABBREVIATIONS

EPA	Environmental Protection Agency
HSW	Household Special Waste
IC&I	Industrial Commercial and Institutional
kg	kilogram(s)
m ³	cubic metre(s)
OCC	Old Corrugated Cardboard
OCWA	Ontario Clean Water Agency
RES	Russell Environmental Services
TSH	Totten Sims Hubicki
WDO	Waste Diversion Organization
WPCP	Water Pollution Control Plant

EXECUTIVE SUMMARY

The City of Sault Ste. Marie retained Totten Sims Hubicki Associates (TSH), in association with Russell Environmental Services (RES) and Hydroterra Limited to provide the City with direction on all aspects of its solid waste management for the next 25 to 40 years. Following the completion of the Residential Waste Composition Study and the report entitled “Current Waste Management System Summary” it was recognized that a significant portion of the waste stream is organics.

The purpose of this report is to establish the quantities and characteristics of the organic waste stream generated in the City of Sault Ste. Marie and identify potential options for managing the organic wastes. In order to achieve this objective, the following steps have been taken:

1. Quantified the organic waste stream;
2. Further characterization the organic wastes; and
3. Determined potential options for managing the organic waste stream.

The municipal waste stream in the City of Sault Ste. Marie is estimated at 70,073 tonnes for the year 2000 with 22,752 tonnes of this total amount being organic waste. The organic component quantity represents approximately 32% of the total municipal waste stream.

Further examination of the overall waste generation within the City of Sault Ste. Marie has determined that there are several other significant contributors to the organic waste stream, including:

- Two wastewater treatment plants i.e. sewage sludge;
- St. Mary’s Paper biosolids; and
- Wood wastes.

These contributors are responsible for an additional estimated 53,300 tonnes (minimum) annually.

The breakdown of both the Municipal organic waste stream and other organic components is summarized in Table 1.

TABLE 1 TOTAL ORGANIC WASTE QUANTITIES		
Organic Material Category	Annual Quantity (tonnes)	Percent
1. Molded Paper	111	0.1%
2. Tissue/Towelling	868	1.1%
3. Vegetable Food Waste	8,637	11.4%
4. Animal Food Waste	3,915	5.1%
5. Grass	2,823	3.7%
6. Woody Yard Waste	2,202	2.9%
7. Other Yard Waste	3,381	4.5%
8. Animal Waste	732	1.0%
9. Wood Ashes	83	0.1%
Total Municipal Organic Waste Stream	22,752	29.9%
10. WPCP Biosolids	13,000	17.5%
11. St. Mary's Biosolids	7,300	9.9%
12. Wood Waste	33,000	43.4%
Total Organic Waste Stream	76,052	100.0%

The first nine material categories are “typical” organic wastes that can be managed through various options of reduction, reuse and composting.

Both the water pollution control plants and St. Mary's Paper biosolids require further characterization prior to determining appropriate methods of management.

The wood waste quantity in Sault Ste. Marie is difficult to determine since certain companies manage their “waste” within their own operations.

It must be recognized that Table 1 is indicative of the possible organic waste material categories and quantities that are potential waste streams for an organic waste management system in the City.

A number of potential organic waste management systems are outlined in the report and include:

Reduction of Organic Waste

- Grasscycling;
- Landfill bans;

Reuse of Organic Waste

- Feed for farm animals;
- Direct land application;
- Treatment and land application;

Composting (Recycling of Organic Waste)

- Backyard composting;
- Centralized aerobic composting;
- Centralized aerobic composting of leaf and yard waste;
- In-vessel composting of entire organics waste stream;
- Centralized anaerobic digestion of entire organic waste stream; and
- Vermi-composting (portion of household waste stream).

Each of the above organic systems is discussed in greater detail in the report, including the potential diversion that could be achieved if the component was implemented.

In summary, it is estimated that the organic waste quantities are a total of approximately 76,000 tonnes annually, with the municipal organic waste stream representing only 30% of the total organic waste quantities for the City of Sault Ste. Marie. In order for the City to properly evaluate organics within its Master Plan, all sources must be taken into consideration.

CITY OF SAULT STE. MARIE ORGANIC WASTE DIVERSION REPORT

1. INTRODUCTION

1.1 General

The City of Sault Ste. Marie (“City”) retained Totten Sims Hubicki Associates (“TSH”), in association with Russell Environmental Services (“RES”) and Hydroterra Limited to provide the City with direction on all aspects of its solid waste management for the next 25 to 40 years. A four-phased study is being undertaken over the next 18 months with the goal to develop a practical, economically feasible, environmentally acceptable and technically competent long-term waste management system for the City.

The four phases of the study include:

- Phase 1: Identification of a Preferred Waste Diversion System
- Phase 2: Identification of a Preferred Waste Disposal System
- Phase 3: Development of an Implementation and Business Plan
- Phase 4: Development of an Environmental Assessment Terms of Reference

The purpose of this report is to establish the quantities and characteristics of the organic waste stream generated in the City of Sault Ste. Marie and identify potential options for managing this waste. In order to achieve this objective, the following steps have been taken:

1. Quantified the organic waste stream;
2. Further characterization the organic wastes; and
3. Determined potential options for managing the organic waste stream.

1.2 Background

Municipal solid waste generally falls into one of the following three categories:

1. Dry non-hazardous waste, which includes paper products and containers;
2. Organic non-hazardous waste, which includes kitchen and yard wastes; and
3. Household Special Waste (HSW).

This study focuses on the organic non-hazardous waste that is generated in the City. By definition, organic materials contain atoms of the elements carbon and hydrogen; carbon, hydrogen, and oxygen; or carbon, hydrogen, oxygen, and nitrogen.¹ Organic materials are capable of being broken down by plants, animals and decomposers through the process of respiration and decay.

¹ Source: *Living in the Environment*, G. Tyler Miller, Jr., 1988

Plant and animal life are organic in nature and therefore paper fibres, such as newsprint, cardboard and boxboard, are organic substances because they are made from trees and other plants. Paper fibre products are, however, typically included in the dry non-hazardous waste stream because they are easily recycled into high value commodities. For the purpose of this study, high grade paper fibres are not included in the organic waste stream. Low grade paper fibres, such as molded pulp, paper tissues, napkins and paper towels that have little potential for recycling are included as part of the organic waste stream.

In addition to the typical organic wastes such as food scraps and yard wastes that are generated in most municipalities, the City has other organic wastes that are generated in large quantities, including sewage sludge, paperfibre sludge, and wood waste. Although some of these waste streams are currently being managed through other means, there is no certainty as to whether the other markets and disposal systems will be available in the long term. For this reason, it is important to include these wastes in a strategy to manage the organic waste from the City.

On January 31, 2001, City officials met with representatives from the Ontario Clean Water Agency (OCWA) to discuss an organics management plan. OCWA is currently setting up a northern team to evaluate alternative methods of dealing with sewage sludges and other organic wastes generated by municipalities in northern Ontario. This team will focus on implementing sludge handling systems that produce a Class A compost. The City will work with OCWA in order to evaluate options for organic waste diversion and determine a preferred system.

This report will assist both the City and OCWA to determine the preferred waste management system for the organic waste stream, by quantifying and characterizing the organic wastes that are expected to be generated in the City in coming years.

2. ORGANIC WASTE QUANTITIES

In the City, organic wastes are generated from a number of sources. The main sources of organic waste generation are:

- Municipal waste;
- St. Mary's biosolids;
- Sewage treatment plant biosolids; and
- Wood waste.

2.1 Municipal Wastes

Municipal wastes include the residential and Industrial, Commercial and Institutional (IC&I) wastes that are currently managed in the municipal waste management programs. Based on records of the waste managed by the City in 2000, the total municipal waste stream is assumed to be 70,073 tonnes, which consists of the following:

- 18,689 tonnes of residential garbage collected in the municipal collection program;
- 2,133 tonnes of recyclables processed in the Sault Ste. Marie blue box program;
- 27,985 tonnes of IC&I waste accepted at the Sault Ste. Marie landfill;
- 1,565 tonnes of waste from municipal departments accepted at the landfill;
- 7,055 tonnes of public drop off waste accepted at the landfill;
- 10,125 tonnes of special materials accepted at the landfill;
- 300 tonnes of OCC collected in the OCC depot program;
- 1,245 tonnes of organic waste processed at Lemieux Composting; and,
- 976 tonnes of waste currently going to backyard composting.

In order to better determine the quantity of organic waste generated in the City, the total municipal waste stream was broken down into single family residential, multi-family residential, public drop off, IC&I, and special materials. These classifications were further broken down into material categories as shown in Table 2.1.

The **single family residential waste stream** was determined by undertaking a comprehensive waste composition study. The garbage and recyclables placed at the curb of approximately 380 households in the City during a two-week period in August 2000 was sorted into 58 different material categories as shown on Table 2.1. The results of this audit are contained in the report "City of Sault Ste. Marie Residential Waste Composition Study - Summer/Fall 2000". The total quantity of single family residential waste is 20,822 tonnes, which consists of the waste currently being collected in the municipal waste collection program and the blue box recycling program.

**TABLE 2.1
COMPOSITION OF MUNICIPAL WASTE FOR THE CITY OF SAULT STE. MARIE**

Material Category	Description	Single Family Residential Waste		Multi-Family Residential Waste		Public Drop Off		IC&I Waste		Special Materials		Total	
		% Waste	tonnes	% Waste	tonnes	% Waste	tonnes	% Waste	tonnes	% Waste	tonnes	% Waste	tonnes
1. Paper Fibres													
Newspaper	ONP, Inserts	9.18	1,912	10.62	482	6.43	454	3.60	844			5.27	3,692
Magazines/Paperbacks	OMG, Catalogues, Soft Covers	1.83	382	1.36	62	1.28	90	2.30	539			1.53	1,073
Phone Books	OTB	0.16	34	0.12	5	0.11	8	0.20	47			0.13	94
Cardboard	OCC	3.09	644	3.70	168	2.17	153	6.60	1,548	1.78	300	4.01	2,813
Boxboard/Rolls	OBB	5.00	1,041	3.72	169	3.5	247		0			2.08	1,457
Mixed Papers	Junk mail, Fine Papers, Office Paper	3.86	804	2.87	130	2.7	190	7.50	1,759			4.12	2,883
Molded Pulp	Egg Cartons, Drink Trays	0.38	79	0.28	13	0.27	19		0			0.16	111
Books	Hard Covered	0.19	40	0.14	6	0.13	9		0			0.08	55
Kraft paper	Paper Bags	1.19	248	0.89	40	0.83	59	0.70	164			0.73	511
Spiral Wound	Frozen Juice, Pringles Type Packaging	0.19	40	0.14	6	0.13	9		0			0.08	55
Tissue/Towelling	Tissues, Napkins, Paper Towels	2.98	620	2.21	100	2.09	147		0			1.24	868
Other Paper	Multi-layered, Waxed, Wrapping	0.32	67	0.24	11	0.22	16	18.10	4,245			6.19	4,338
Gable Top Cartons	Milk, Juice	0.45	94	0.37	17	0.32	23					0.19	133
Aseptic Containers	Tetra Type Packaging	0.03	6	0.10	5	0.02	0					0.02	12
Subtotal		28.87	6,010	26.76	1,213	20.20	1,425	39.00	9,146	1.78	300	25.83	18,095
2. Plastics													
PETE Bottles	#1	1.27	264	0.96	44	0.89	63	0.40	94			0.66	465
HDPE Bottles	#2	0.78	162	0.84	38	0.55	39	0.70	164			0.58	403
PVC	#3 Bottles, Packaging	0.25	52	0.14	6	0.18	13		0			0.10	71
LDPE & PP Bottles	#4 and #5, Squeezable	0.28	58	0.16	7	0.2	14		0			0.11	80
PS	#6, Trays, Cups, Packaging	1.14	237	0.64	29	0.8	56		0			0.46	323
Recyclable Film	Shopping Bags, Milk Pouches	1.76	366	0.98	45	1.23	87	4.50	1,055			2.22	1,553
Non-recyclable Film	Garbage Bags, Chip Bags, Shrink Wrap	4.98	1,037	2.78	126	3.49	246		0			2.01	1,409
Wide Mouth Tubs & Lids	#2, 4, 5 and 6	0.77	160	0.43	19	0.54	38		0			0.31	218
Other Containers	#7, Trays, Bottles, Unmarked Plastics	0.36	75	0.20	9	0.25	18	0.70	164			0.38	266
Other Plastics	Non-Packaging, VCR Tape, Toys, Etc.	0.67	140	0.38	17	0.47	33	3.50	821			1.44	1,011
Subtotal		12.26	2,553	7.52	341	8.60	607	9.80	2,298	0.00	0	8.28	5,799
3. Metals													
Aluminum Cans	Food and Beverage Cans	1.12	233	0.72	33	0.78	55	0.20	47			0.52	368
Aluminum flow Trays	Pie Plates, Etc.	0.43	90	0.31	14	0.3	21	0.20	47			0.25	172

**TABLE 2.1
COMPOSITION OF MUNICIPAL WASTE FOR THE CITY OF SAULT STE. MARIE**

Material Category	Description	Single Family Residential Waste		Multi-Family Residential Waste		Public Drop Off		IC&I Waste		Special Materials		Total	
		% Waste	tonnes	% Waste	tonnes	% Waste	tonnes	% Waste	tonnes	% Waste	tonnes	% Waste	tonnes
Steel Cans	Food and Beverage Cans	1.77	369	1.81	82	1.24	87	0.90	211			1.07	749
Aerosol Cans	Empty	0.26	54			0.18	03		0			0.10	67
Paint Cans	Empty	0.32	67			0.22	16		0			0.12	82
Other Metal	Scrap Metal, Other Containers, Bikes	0.76	158			0.53	37	4.7	1,102	3.41	575	2.67	1,873
Subtotal		4.66	970	2.84	129	3.25	229	6.00	1,407	3.41	575	4.72	3,310
4. Glass													
Clear	Food and Beverage Containers	3.88	809	3.20	145	2.72	192	1.30	305			2.07	1,451
Coloured	Food and Beverage Containers	1.28	267	1.11	50	0.9	63	0.6	141			0.74	522
Other Glass	Light Bulbs, Window Glass, Ceramics	0.56	117	0.42	19	0.39	28	0.5	117			0.40	280
Subtotal		5.73	1,193	4.73	214	4.01	283	2.40	563	0.00	0	3.22	2,253
5. Household Special Waste													
Batteries	All Types	0.05	10			0.04	3	0.1	23			0.05	37
Paint	Mostly Half to Full Containers	0.04	8			0.03	2		0			0.01	10
Motor Oil	Used Oil, Filters	0.25	52			0.18	13	0.1	23			0.13	88
Flammables	Starter Fluid, Solvents	0.02	4			0.01	1		0			0.01	5
Other HSW	Sharps, Drugs, Acids, Antifreeze	0.20	42			0.14	10	0.1	23			0.11	75
Subtotal		0.56	117	0.00	0	0.40	28	0.30	70	0.00	0	0.31	215
6. Compostables													
Vegetable Food Waste	Vegetable and Fruit Peelings	18.12	3,772	28.67	1,300	12.68	895	10.00	2,345	1.93	325	12.33	8,637
Animal Food Waste	Metals, Fats, Oils	4.13	859	6.53	296	2.89	204	10.90	2,556	0.00		5.59	3,915
Grass	Grass Clippings	5.31	1,106			3.72	262	3.90	915	3.21	540	4.03	2,823
Woody Yard Waste	Brush, Branches, Wood Chips	2.81	585	1.01	46	1.97	139	1.10	258	6.97	1,174	3.14	2,202
Other Yard Waste	Leaves, Soil, Garden Wastes	3.37	702			2.36	166	3	704	10.74	1,809	4.83	3,381
Animal Waste	Faeces, Animal Litter and Bedding	2.57	535			1.8	127	0.3	70	0.00		1.05	732
Wood Ashes	Fireplaces and Wood Stoves	0.23	48			0.16	11	0.1	23			0.12	83
Subtotal		36.53	7,606	63.21	1,642	25.58	1,805	29.30	6,871	22.85	3,848	31.08	21,772
7. Other Waste Materials													
Textiles	Clothing, Shoes	3.73	715			2.4	169	2.1	492			1.97	1,377
Building Renovations	Drywall, Lumber, Carpeting	2.25	468			7.57	534	4.2	985	0.00		2.84	1,988
White Goods	Large Appliances, Computers, Radios	0.00	0			4.5	317		0	0.00		0.45	317
Sanitary Products	Diapers, Napkins	2.80	583			1.96	138		0	0.00		1.03	721

**TABLE 2.1
COMPOSITION OF MUNICIPAL WASTE FOR THE CITY OF SAULT STE. MARIE**

Material Category	Description	Single Family Residential Waste		Multi-Family Residential Waste		Public Drop Off		IC&I Waste		Special Materials		Total	
		% Waste	tonnes	% Waste	tonnes	% Waste	tonnes	% Waste	tonnes	% Waste	tonnes	% Waste	tonnes
Electronics/Appliances	Small Appliances, Computers, Radios	0.39	81			3.27	231		0	0.00		0.45	312
Rubber	Tires, Mats, Tubing	0.07	15			1.55	109	0.4	94	0.06	10	0.33	228
Furniture	Sofas, Chairs, Cabinets	0.00	0			9	635	2.4	563	0.00		1.71	1,198
Inert Material								1.2	281	2.90	488	1.10	769
Shingles									0	7.11	1,197	1.71	1,197
Asbestos									0	0.26	43	0.06	43
Contaminated Soil									0	46.03	7,750	11.06	7,750
Other	Materials Not Classified Elsewhere	2.45	510	21.94	995	7.71	544	2.90	680			3.89	2,729
Subtotal		11.39	2,372	21.94	995	37.96	2,678	13.20	3,096	56.35	9,488	26.59	18,629
Total		100.00	20,822	100.00	4,534	100.00	7,055	100.00	23,451	84.40	14,221	100.01	70,073

- Notes:
1. Residential waste composition as the City of Sault Ste. Marie Residential Waste Composition Study (Summer/Fall 2000)
 2. Multi-family waste composition from Report to the Environment, Achieving Sustainable Municipal Waste Diversion Programs in Ontario, WDO, September 1, 2000
 3. Public drop-off composition as per visual inspection.
 4. IC&I composition based on the California Statewide Waste Composition Study
 5. Special Materials based on actual weights
 6. Quantities exclude sewage sludge that is currently being landfilled

There are approximately 7140 **multi-family** apartment units and the City has a contract with Canadian Waste to provide waste collection to these residents. This waste stream is included in the IC&I waste quantities. Multi-family units typically generate less waste than single family units and have a slightly different waste composition. In particular, the waste from multi-family residents contains a very small component of yard waste.

The Provincial average of waste generated per multi-family unit is 635 kg per year², therefore the City would generate approximately 4,534 tonnes of waste from multi-family units each year. The composition of this waste is indicated separately in Table 2.1.

The quantity of waste that is brought to the landfill by residents and deposited at the **public drop off** area is available through landfill weigh scale records. Approximately 70% of this waste is typical residential waste that was not set out for the municipal collection but instead brought to the landfill by the residents. The remaining 30% of the public drop-off waste are specific materials which were identified by a visual inspection of the drop off area.

IC&I waste is delivered to the landfill by a number of individual waste generators and private hauling companies. Although the quantity of this waste is available from landfill records, the composition of this waste stream is difficult to determine. It is extremely difficult to audit this waste as it is generally not consistent across the City but varies greatly depending on the waste generator. For the sake of this study, the composition of the IC&I waste stream was based on an audit done in California of the waste generated by 1207 establishments from 26 different industry groups, including financial institutions, the retail trade, construction, health services, hotels, and manufacturing.³ The overall results of this audit were used to determine the composition of the IC&I waste stream for the City.

The **special materials** category includes a number of wastes that are relatively well defined as to their composition, such as:

- Segregated wastes that are weighed separately at the landfill (shingles, metal, brush);
- Waste brought in by the Public Works Department;
- Old corrugated cardboard collected in the OCC depot collection program;
- Organic wastes processed at Lemieux Composting; and,
- Waste going to backyard composters.

The full breakdown of the municipal waste that is generated in the City is shown in Table 2.1. From the material categories listed, both the paper fibres and compostables categories would be considered organic wastes. For the sake of this analysis, however, it has been assumed that newspaper, magazines, phone books, cardboard, mixed papers, kraft papers, gable top cartons and aseptic containers, which are part of the paper fibres category would be better allocated to the recycling program which creates a higher value product. Books, spiral wound paper, and the other paper categories may contain materials that could contaminate the organic stream and will not be included in the organic waste quantities. The organic waste stream therefore, includes all of the materials in the compostables category in addition to the molded pulp and the tissue/towelling materials from the paper fibre category.

² Source: Report to the Minister of the Environment, Achieving Sustainable Municipal Diversion Programs in Ontario, WDO, September 1, 2000.

³ Source: California Integrated Waste Management Board, Statewide Waste Characterization Study Results and Final Report (December 1999)

Table 2.2 includes the quantities of organic wastes that are included in the municipal waste stream.

Based on this analysis, it can be determined that the organic component of the municipal waste stream generated in the City each year is 22,752 tonnes, or 30% of the total municipal waste stream.

TABLE 2.2 MUNICIPAL ORGANIC WASTE QUANTITIES	
Material Category	Annual Quantity (tonnes)
Molded Pulp	111
Tissue/Towelling	868
Vegetable Food Waste	8,637
Animal Food Waste	3,915
Grass	2,823
Woody Yard Waste	2,202
Other Yard Waste	3,381
Animal Waste	732
Wood Ashes	83
Total	22,752

2.2 Wastewater Treatment Plant Biosolids

The City has two wastewater treatment facilities that process all of the sewage. The West End Water Pollution Control Plant (WPCP) processes approximately 8000 m³ per day and has a capacity of 20,000 m³ per day. The East End Water Pollution Control Plant (WPCP) has a current capacity of 54,000 m³ per day. An expansion of the East End WPCP is planned for 2002 which will increase the capacity of that facility to approximately 91,000 m³ per day.

The WPCPs are conventional systems with a primary settling tank/basin and a secondary clarifier. The two facilities combined generate approximately 10,000 tonnes per year of biosolids that is currently being landfilled. When the East End WPCP expansion is complete, it is anticipated the quantity of sewage sludge will increase to approximately 13,000 tonnes per year.

2.3 St. Mary's Biosolids

St. Mary's Paper has manufactured paper products in the City since 1911. The paper that is produced is called 'supercalendered', which is a smooth glossy sheet that is primarily used for advertising inserts in newspapers and catalogues.

Effluent is produced during the four stages of the paper manufacturing process:

- Cleaning;
- Screening;
- Forming; and,

- Pressing the paper product.

The effluent passes through a primary and secondary treatment process prior to being discharged.

The goal of the primary level of treatment is to reduce the amount of suspended solids, mainly the pulp fibre, found in the mill effluent. This is accomplished by the use of a primary clarifier where the suspended solids (mainly pulp fibres and clay) settle to the bottom and become *primary sludge*.

The secondary level of treatment involves the use of micro-organisms, or naturally-occurring “bugs”, to reduce the amount of polluting compounds in the effluent. The effluent is mixed with activated sludge (bugs), urea and phosphoric acid. Air is added as a source of oxygen to stimulate the growth of the bugs and to keep the basin well mixed. The retention time for the effluent in the aeration basin is approximately 12 hours. Approximately 85-90% of the bugs are recovered and returned to the treatment process as activated sludge. The remaining 10-15% of the bugs become waste activated sludge or secondary sludge.

The primary and secondary sludges are combined in a sludge blend tank where certain additives, mainly polymers, are added to improve the dewatering process. Wood waste and boiler ash is also added at this point. The sludge mixture is a combination of:

- 30% primary sludge;
- 65% secondary sludge;
- 4.5% wood wastes; and,
- 0.5% boiler ash.

The sludge is then pumped to a drum filter where the dewatering process takes place, resulting in a sludge that contains about 70% water and 30% solids. Once dewatered, the sludge is mixed with wood waste at a ratio of 2 parts wood waste to 1 part sludge. The resulting biosolids have the consistency of peat moss and smell similar to organic fertilizer.

St. Mary's Paper produces approximately 7,300 tonnes of biosolids each year. In the past this waste has been used as a final cover material on landfill sites and for the rehabilitation of mine sites in the Elliot Lake area.

2.4 Wood Waste

As the forest products industry is a major economic force in northern Ontario, there are a number of sawmills and wood products manufacturers in the City that produce large quantities of wood waste. A portion of this wood is processed by And-Son Contracting, a local wood recycler. And-Son processes approximately 33,000 tonnes of wood chips annually that is sold to landscapers or to local industries for boiler “hog fuel”. In addition, a number of industries bring in their wood waste to the And-Son site for processing and then take it back for reuse in their process.

Current market demands for the wood chips and garden mulch are greater than the supply, however, there are a number of factors that could change that balance, and the City should be prepared if the market demands for the wood waste decrease.

3. CHARACTERIZATION OF THE ORGANIC WASTE STREAM

The total organic waste stream generated in the City is approximately 76,000 tonnes per year. The composition of this waste stream and its current end use is shown in Table 3.1.

Organic Material Category	Annual Quantity (tonnes)	Percent	Current End Use
1. Moulded Pulp	111	0.1%	Landfill; Backyard Composting
2. Tissue/Towelling	868	1.1%	Landfill; Backyard Composting
3. Vegetable Food Waste	8,637	11.4%	Landfill; Lemieux's Composting; Backyard Composting
4. Animal Food Waste	3,915	5.1%	Landfill; Lemieux's Composting; Backyard Composting
5. Grass	2,823	3.7%	Landfill; Lemieux's Composting; Backyard Composting
6. Woody Yard Waste	2,202	2.9%	Landfill; Lemieux's Composting; Backyard Composting
7. Other Yard Waste	3,381	4.5%	Landfill; Lemieux's Composting; Backyard Composting
8. Animal Waste	732	1.0%	Landfill; Backyard Composting
9. Wood Ashes	83	0.1%	Landfill; Backyard Composting
10. WPCP Biosolids	13,000	17.1%	Landfill
11. St. Mary's Biosolids	7,300	9.6%	Cover Material at Landfill Sites; Rehabilitation of Mine Sites
12. Wood Waste	33,000	43.4%	Hog Fuel; Landscaping; Industrial Processes
Total	76,052	100.0%	

The first nine material categories are 'typical' organic wastes that can be managed through various options of reduction, reuse and composting.

Both the WPCPs and St. Mary's Paper biosolids require further characterization prior to determining appropriate methods of management. As metals are not eliminated in the composting process, the level of metals in the feedstock material is a concern as high levels will result in a compost product that does not meet government standards. Initial testing of the WPCPs and St. Mary's biosolids indicate that these materials do not contain high metal levels. Additional analysis must be conducted in order to further characterize these materials and determine their suitability for composting.

The last organic material category, the wood waste category, is recognized as an important component of the organic waste stream, yet, the quantity noted in Table 3.1 is limited to that value provided by And-Son Contracting. The actual quantity of wood waste in the City is difficult to determine as certain companies manage their 'waste' within its own operations (i.e. GP Flakeboard Plant). A centralized compost facility would require a substantial amount of wood chips to act as a bulking agent in the processing of the organic wastes. The quantity of bulking agent that is needed varies from 20-100% of the remaining feedstock quantity depending

on its composition (i.e. dense, nitrogen-rich feedstocks, such as sewage sludge require the addition of a high volume of bulking material).

In summary, it must be recognized that Table 3.1 is indicative of possible organic waste material categories and quantities that are potential waste streams for an organic waste management system for the City. It is also important to note that some of the wastes are currently being managed independently by the generators and/or by existing alternative 'waste' processes (i.e. wood waste used as hog fuel).

4. POTENTIAL ORGANIC WASTE MANAGEMENT SYSTEMS

This section outlines a number of potential waste diversion system components that may be implemented by the City in order to manage the organic waste stream. Further evaluation will be conducted as part of the Waste Management Planning Process to determine the preferred option for the municipality.

The components are divided into the 3Rs hierarchy as follows:

- **Reduction of Organic Waste:**
 - Grasscycling;
 - Landfill bans;

- **Reuse of Organic Waste:**
 - Feed for farm animals;
 - Direct land application;
 - Treatment and land application;

- **Composting (Recycling of Organic Waste):**
 - Backyard composting;
 - Centralized aerobic composting;
 - Centralized aerobic composting of leaf and yard waste;
 - In-vessel composting of organics;
 - Centralized anaerobic digestion; and
 - Vermi-composting.

4.1 Reduction of Organic Waste

Grasscycling involves leaving grass clippings on the lawn as opposed to collecting them. Besides reducing the amount of grass waste generated, grasscycling is beneficial for the lawn because it returns the nutrients contained in clippings back to the lawn, thereby reducing the need for fertilizers and pesticides. Many communities encourage grasscycling by subsidizing mulching mowers for the residents. Grasscycling is not feasible for all residents because many households use mowers with a grass collection bag. If 50% of grass waste was reduced by grasscycling in the City, the organic waste stream would be reduced by 1411 tonnes annually.

Landfill Bans on particular waste streams require both businesses and residents to find alternatives to generating certain wastes. Some jurisdictions have banned the disposal of other recyclable materials or organic waste, for example the Province of Nova Scotia has banned organic waste from all landfills.

In order for landfill bans to be effective there must be alternative methods for managing the waste streams that are banned. The enforcement of bans at landfills is also very difficult as adequate staffing is required to monitor each load of material entering the site. Another difficulty is that often the waste hauler is not aware that there is a banned material in the load that is being delivered to the site, and therefore the hauler is penalized for the actions of the waste generator. It is also typical that the hauler has picked up waste from many locations and is unable to determine from which generator the banned material originated. If the banned material has been mixed with other waste, it will also possibly be contaminated and therefore not acceptable for recycling or composting.

Considering all of the disadvantages of implementing landfill bans, they do have the potential to increase diversion of specific materials. The Province of Nova Scotia was able to achieve a 50% waste diversion rate following a ban on landfilling organic material. This is particularly significant as the organic material generates the most leachate in a landfill and; therefore, it is the most beneficial waste stream to divert.

Realistically, it is not feasible to expect that 100% of banned materials will be diverted from the landfill. Table 4.1 indicates the estimated quantity of waste diversion that could be achieved should yard waste or all of the organic material be banned from the landfill in the City, assuming that the ban had a 60% success rate. It is important to note that a ban of material requires the development of a system that is able to divert the organic waste from the landfill.

Material	Estimated Quantity (100% Diversion) (tonnes)	Estimated Quantity (60% Diversion) (tonnes)
Yard Waste Ban	8,406	5,044
Total Organics Ban	22,752	13,651

Based on Table 4.1 and a 60% success rate, approximately 5,000 tonnes of yard waste would be diverted from landfilling with a yard waste ban and a total organics ban would result in over 13,000 tonnes being diverted.

4.2 Reuse of Organic Waste

Feed for Farm Animals is a method of using organic waste, typically from the IC&I sector, to replace or supplement farm animal feed.

Food wastes from some IC&I sectors, particularly restaurants, food producers and grocery stores, may be acceptable for use as feed for farm animals. Some farmers express concern about the quality of waste generated for animal feed and in some areas waste generators have experienced problems when their organic wastes are not taken away in a regular or timely manner. Based on the quantity of IC&I food waste generated in the City and a 50% participation rate, it is estimated that approximately 2,450 tonnes of waste could be diverted from the landfill each year with this type of program.

Direct Land Application of biosolids on farmland is a practice that has been used by municipalities for hundreds of years as a means of managing sludge from sewage treatment facilities. There are increasing concerns about the public health and safety of this practice, due to the fact that biosolids typically contain pathogens, which will accumulate in the soil. Approvals for direct land application of biosolids are required on a site specific basis, and it must be proven that the application is of benefit to crop production or soil health and the process will not degrade the natural soil. Direct application of biosolids has not been practised historically in the City as the area of farmland within its municipal boundary is limited significantly.

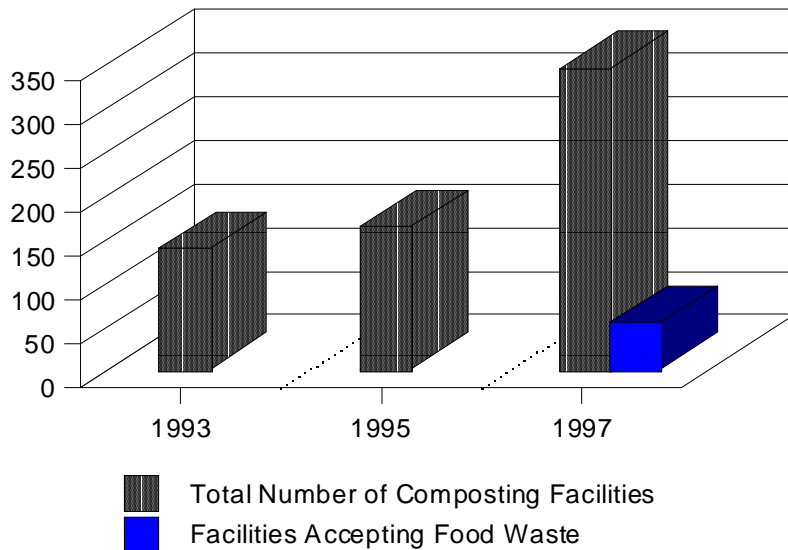
Treatment and Land Application is a process that stabilizes and pasteurizes wastewater sludge prior to land application. N-Viro Systems Canada Inc. has a process that dewateres the sludge to between 18 - 45% solids, then mixes the dried sludge with an alkaline admixture, usually

cement-kiln dust, lime-kiln dust, flyash or steel making fines. The mixture is then dried to 60 - 64% solids in a rotary drum dryer, and then exposed to a heat pulse for at least 12 hours in order to kill any harmful bacteria or odours. The resulting material is a marketable soil amendment conditional upon meeting government criteria for compost. The quantity of material produced is approximately double the quantity of sludge going into the process, therefore it should be determined if sufficient local markets exist for the product.

4.3 Composting (Recycling of Organic Waste)

Organic materials, such as food and yard wastes, when biologically decomposed, form compost that can be used directly as a soil amendment or blended with other soil products for use as growing media. In Ontario, centralized composting of organic waste is a relatively new but is becoming a growing component of an integrated waste management program. Many communities now have compost operations set up to divert yard waste, which accounts for a large portion of waste in some areas of the country, and an increasing number of composting operations in Canada also accept food waste and other organic materials. The growth of composting is shown in Figure 1.

Figure 1: Centralized Composting Facilities in Canada (1993-1997)



Source: *Composting Council of Canada*

In other areas of the world, particularly the Netherlands and Germany, composting facilities have been in operation for many years. Initially, many facilities processed the entire municipal solid waste stream. While some of these are still operational, the focus recently has been to separate and redirect the organic stream to a composting facility. This helps to ensure a uniform and useful product as well as minimize contamination.

There are two main types of composting methods that can be used to process organic wastes:

- aerobic composting that takes place in the presence of oxygen; and
- anaerobic digestion which takes place in the absence of oxygen.

4.3.1 Backyard Composting

Backyard Composting is an effective method of reducing the quantities of waste which require collection and processing or disposal. This on-site approach diverts waste from disposal and reduces waste management costs.

Certain types of organic wastes generated by householders can be effectively separated from other forms of waste. Appropriate feedstock for home composting units includes kitchen organics (except meat, dairy products, bones or fats), grass clippings, leaves, and small pieces of brush and twigs. These materials can then be placed into backyard composting units.

Household composters and digesters are designed to accept the quantity of food and yard waste that would be produced by a single-family household. They have the capacity to hold approximately one cubic yard of material and typically manage 100 to 300 kg of waste per year.

Units are placed above ground, with the bottom exposed to the earth to allow transfer of organisms which are necessary to the composting process. Home composting units require some maintenance, including watering to ensure that moisture levels are kept about the same as a well-wrung-out sponge, and turning to add the oxygen necessary for aerobic decomposition. Depending on the quantity of waste placed in the unit and the level of maintenance the unit has received, compost can be harvested in three to twelve months. The decomposition process slows down considerably in cold temperatures; therefore, reducing the efficiency of a home composter during winter months.

Municipal governments can encourage backyard composting by distributing backyard composting units free of charge or at a discounted rate to residents, and by providing education on how to effectively use the units.

One of the main advantages of backyard composting is that the waste is managed completely by the residents that generate it. There is no involvement of the municipality in the collection, processing or disposing of the waste. One of the disadvantages of backyard composting is that because it is somewhat inconvenient for the homeowner (taking organics to the composter, turning the material, and harvesting the compost), many residents do not use their composters to full advantage, particularly in the winter months. In the past, municipalities assumed that backyard composting would achieve diversion rates of 120 - 200 kg/composter/year. Recent studies indicate that these estimates were overly optimistic and that 110 kg/composter/year is a more accurate number.⁴ Therefore, if the City distributed backyard composters to all of its residents free of charge, and assuming that 80% of the residents actually use the composter, the annual expected waste diversion would be 1,268 tonnes a year as indicated in Table 4.2.

⁴ Source: *Achieving Sustainable Municipal Waste Diversion Programs in Ontario, WDO Report to the Minister of the Environment, September 1, 2000.*

TABLE 4.2 WASTE DIVERSION FROM BACKYARD COMPOSTING	
Number of Households	24,412
Number of Households Expected to Use Backyard Composters (805)	19,530
Households Currently Using Backyard Composters	8,000
Households that May Start Backyard Composting	11,530
Diversion per Composter	110 kg
Quantity of Material Diversion (Annual)	1,268 tonnes

4.3.2 Centralized Aerobic Composting

Centralized Aerobic Composting involves the processing of organic wastes that are generated from a number of different locations. The centralized aerobic composting system can process a wide variety of organic waste, from leaf and yard waste to food scraps, including those excluded from backyard composting units (e.g. meats, dairy products, bones, and fat).

There are three major technologies for aerobic composting:

- Windrow;
- Aerated static pile, and
- In-vessel.

Windrow is the oldest technology, whereby organic material is arranged in piles or "windrows." These piles measure roughly 6-10 feet high and 15-25 feet wide at the base. The only intervention in these piles is the occasional turning, which can be done by a machine. This type of composting is typically used for leaf and yard waste only, since the composting of other organic waste typically requires more controlled conditions.

Aerated Static Pile composting is similar to windrow composting except that each pile is placed over a system of aeration pipes with a blower attached, and the piles are usually only 7-8 feet tall. Facilities using this technology can be covered or enclosed to minimize odours. Both windrow and aerated static pile composting typically take a minimum of 12 to 15 weeks to process the waste.

In-vessel composting is just as the name implies; composting occurring inside an enclosed container of any shape. Because the organic material fills the container or vessel, there is less space required for in-vessel composting. Mixing and aeration of the organic material typically occurs within the container. This type of composting allows for maximum odour control, requires less labour and has faster throughput. In-vessel composting generally takes place in 21 to 28 days.

All three aerobic composting methods require a four to twelve week curing period before the compost is ready for use.

Some centralized aerobic composting operations have resulted in odour problems. Enclosures, biofilters, wet scrubbers, and mixing systems help to reduce and control odours. Also important, is the control of temperature, moisture, and the carbon:nitrogen ratio. Deodorizers, or other chemical agents, can also be sprayed on or around a facility to minimize odours.

Windrow Composting of Leaf and Yard Waste is currently being done in many communities in Ontario, including the City of Sault Ste. Marie (Lemieux Composting). Due to the low potential for odours or other problems from yard waste, this material is typically composted in an outdoor windrow facility, which has low capital cost investment and low operating costs. The capital cost for a windrow composting operation is typically \$1.00 - \$3.50 per tonne of annual throughput, depending on the amount of site work to be done and the surface of the compost pad (gravel, asphalt, or concrete) and the type of turning equipment purchased.

Lemieux Composting is a private company in the City that runs an outdoor aerobic composting operation. Lemieux does not charge a tipping fee to accept the yard wastes, but obtains revenues to cover the cost of the operation from the sale of the finished compost.

Approximately 15% of the available leaf and yard waste material that could be diverted from a landfill at the Lemieux facility is currently being captured. The City may want to increase the capture rate of yard waste by providing more frequent yard waste collections and by providing more public education on the yard waste program.

Aerated Static Pile composting operations were popular in Europe and the United States in the early 1990's, with facilities being developed in the Netherlands, Denmark, Minnesota and California. The aerated static piles are typically covered over or enclosed in a silo. The capital costs of these facilities vary greatly (\$2 to \$8 million) depending on the enclosure used and the processing equipment utilized.

In-vessel Aerobic Composting of Organics can incorporate a number of different systems. Some of the most common in-vessel systems are:

- Ebara Wide Bed Composting System;
- Huws Biocells;
- Stinnes Containerized Composting System;
- WCI Containerized Composting System; and
- Wright Compost Tunnels.

An in-vessel composting system is typically equipped with a biofilter to filter the air prior to release into the atmosphere, thus reducing the potential for odour problems.

If the City develops an in-vessel composting facility, they will be able to process not only yard waste, but other organic materials, such as food waste, soiled tissues and possibly sewage sludge. Based on the "City of Sault Ste. Marie Residential Waste Composition Study - Summer/Fall 2000", the total acceptable feedstock for an in-vessel composting facility would include the materials shown in Table 2.2 as well as the WPCP sludge and other organic wastes. Although the City could ensure that all of the sewage sludge would be delivered to the composting facility, it can be expected that only 60% of the other organic wastes will be separated and sent for composting. It is therefore expected that an in-vessel composting plant would divert approximately 25,000 tonnes of organic waste a year. Consideration could also be given to include St. Mary's biosolids and woodchips.

The capital cost for a facility of this size is in the range of \$4 to \$7 million.⁵

4.3.3 Vermi-composting

Vermi-composting is the process of using worms to help in the biodegradation of organic wastes. A particular type of worm called the 'red wiggler' is introduced into bedding material in the unit. As food wastes are buried in the bedding, the worms consume the food waste, producing castings, a particularly rich form of compost. Every few months, castings must be separated from the worms so that capacity remains for the addition of fresh food waste.

A large-scale Vermi-composting system would be able to handle organic kitchen waste from residents and businesses. Yard waste is not a suitable feedstock for vermi-composting worms

Vermi-composting can divert food waste from landfill. Yard waste, ashes, and sewage sludge are all unacceptable feedstocks for a vermi-composting operation. Although vermi-composting has been proven on a small scale, there are no large-scale facilities currently operating in Canada.

Table 4.3 indicates the quantities which may be diverted with the implementation of vermi-composting at both 100% and a 60% rate of capture.

Material	Annual Tonnes
Vegetable Food Waste	8,637
Animal Food Waste	3,915
Total	12,552
Total Diversion at 60% Capture	7,531

Therefore, 7,500 tonnes could be diverted through vermi-composting.

⁵ Capital cost of similar facilities (WCI, Ebara, Corcan)

5. CONCLUSIONS

The **total** organic waste stream generated in the City is approximately 76,000 tonnes per year or 968 kg per person per year. The composition of this waste stream is shown in Table 5.1.

TABLE 5.1 TOTAL ORGANIC WASTE QUANTITIES		
Organic Material Category	Annual Quantity (tonnes)	Percent
1. Molded Pulp	111	0.1%
2. Tissues/Towelling	868	1.1%
3. Vegetable Food Waste	8,637	11.4%
4. Animal Food Waste	3,915	5.1%
5. Grass	2,823	3.7%
6. Woody Yard Waste	2,202	2.9%
7. Other Yard Waste	3,381	4.5%
8. Animal Waste	732	1.0%
9. Wood Ashes	83	0.1%
Total Municipal Organic Waste Stream	22,752	29.9%
10. WPCP Biosolids	13,000	17.5%
11. St. Mary's Biosolids	7,300	9.9%
12. Wood Waste	33,000	43.4%
Total Organic Waste Stream	76,052	100.0%

The municipal organic waste stream consists of 22,752 tonnes, or 30% of the total organic waste stream.

The potential organic waste management system that should be considered by the City include:

Reduction of Organic Waste

- Grasscycling;
- Landfill bans;

Reuse of Organic Waste

- Feed for farm animals;
- Direct land application;
- Treatment and land application;

Composting (Recycling of Organic Waste)

- Backyard composting;
- Centralized aerobic composting;
- Centralized aerobic composting of leaf and yard waste;
- In-vessel composting of organics;
- Centralized anaerobic digestion; and
- Vermi-composting.

All of which is respectfully submitted,

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