2.0 APPROACH AND METHODOLOGY

2.1 Single Family Residential Curbside

Waste Sampling Process

AET Group Inc. collected garbage and recycling material from 240 single family residential curbside households over a two week sampling period. The residential areas were selected in consultation with the County to represent the various collection zones and demographics across the service area. All the garbage and recycling material set out was collected at each of the selected households and brought back to a centralized location where each stream and sample area was sorted separately. The 240 households were segregated into 24 sample areas of 10 households each, as summarized in Table 2.1 below. Note that each sample area was classified as either rural or urban, to assist with data analysis.

Table 2.1 Single Family Residential Curbside Sample Areas

Sample Areas		
Street	**Municipality**	**Sample Area Classification**
35th Line	Zorra	Rural*
John Street	Zorra	Urban/Village
Totten Place	Woodstock	Urban/Village
Cross Place	Woodstock	Urban/Village
King Street (Woodstock)	Woodstock	Urban/Village
Tunis Street	Ingersoll	Urban/Village
Laurel Crescent	Ingersoll	Urban/Village
Carnegie Street	Ingersoll	Urban/Village
Henderson Court	Ingersoll	Urban/Village
Three Wood Drive	Woodstock	Rural
Daniel Road	South-West Oxford	Rural
Gibson Drive	Tillsonburg	Urban/Village
Parkside Drive	Tillsonburg	Urban/Village
King Street (Tillsonburg)	Tillsonburg	Urban/Village
Hamilton Road	Ingersoll/South-West Oxford	Urban/Village
Thistle Court	Tillsonburg	Urban/Village
Iroquois Crescent	Woodstock	Urban/Village
Springbank Avenue	Woodstock	Urban/Village
Clyde Street	Norwich	Urban/Village
Pleasant Valley Road	Norwich	Rural*
River Road/Young Street West/Fennel Street	Blandford-Blenheim	Urban/Village
Oxford Road 8	Blandford-Blenheim	Rural*
16th Line	East Zorra-Travistock	Rural*
Liebler Street	East Zorra-Travistock	Urban/Village

*Adjacent or atttached farmland on properties

Collection Logs

Collection logs were maintained during the single family residential curbside collection of each of the 240 households. Specific data was recorded on collection logs, including quantity and fullness of setouts. Information recorded in the log for further analysis and discussion included: the number and size of garbage and recycling cart/bin/container/bag items set out by residents, combined fullness equivalent of items in each stream, time of AET team arrivals and if any haulers were observed in the area.

Upon analysis, collection log data provided an understanding for the total number of households sampled with total number of households with setouts, number of items each resident set out, average full container equivalents, and participation rates. Analysis was completed for rural and urban/village areas separately and combined.

Material Sorting Process

All collected materials were physically sorted and weighed separately (into individually tared bins) into approximately 6 primary (Paper, Plastic, Metal, Glass, Organics, and Other) and 35 secondary categories (e.g. Newsprint, Recyclable Glass Containers, Clean Wood, Textiles, etc.) at the Oxford County Waste Management Facility located at 384060 Salford Road in Oxford County. The full list of sort categories can be found in Appendix B 1. AET made every reasonable effort to separate multi-material items and to separate food waste from their packaging.

Prior to weighing the sorted material, AET compiled photos of any substantial or unusual material categories and items found in the samples. All sorted material was weighed for each sample using a digital scale (0.01 kg precision up to 40kg +/- 1% of true weight). Tare weights of the bins used for sorting were verified prior to the audit and checked regularly throughout the study to maintain accuracy. Light materials were weighed directly on the scale. The weight of each individual material category was recorded on a waste sort worksheet. Any unusual materials/items which may have not been representative, or which may have significantly affected the overall composition of the sample was also noted on the worksheet. Additional notes were also made on the worksheet describing the contents of categories labeled "other" (e.g. other plastic would be identified – blister packaging, toothpaste tubes, etc.).

Once all the waste material was classified and weighed, non-divertible material was placed in a large roll-off bin that was emptied of by Oxford County Facility staff when needed. Likewise, post-audited recyclable material was placed in designated recycling totes in which Oxford County staff transferred to the appropriate facility area. Organic material disposal was not provided and placed with garbage waste.

2.2 Inbound Waste Management Facility (Physical)

Waste Sampling Process

Based on annual landfill records provided by Oxford County for 2016, AET developed an inbound sampling plan to target an appropriate number of inbound vehicles by material source type that was closely proportional to each source's actual contribution to inbound material landfilled by percentage of inbound source types from 2016. This was to include material from the following sources: Mixed Solid Waste (MSW), Non-Hazardous Solid Industrial, Demolition, Residual Domestic Waste, and C&D Residual. Over the course of the 3-week audit period, no Residual Domestic or C&D residual loads were received at the landfill, and therefore were not represented in the audit.

Other material source types do enter the waste management facility but were not targeted as part of this study, (e.g. Freon items, C&D, bio-solids, brush, compost site materials, etc.). A total of seventy five (75) inbound vehicle samples of approximately 100 kg per sample were audited over the course of a 3-week audit period (15 audit days, 25 samples per week).

The inbound vehicles were selected randomly on a next available basis. For example, at the beginning of the day once the first sample had been obtained that met the sample criteria and sub-sampling had been completed to the desired weight, AET randomly selected from the next available vehicle load that met the sample criteria.

AET and landfill staff worked together to coordinate sample collection. As material entered the waste management facility's inbound scale, the scale house operator determined the source of the material in the vehicle (i.e., Demolition, Mixed Solid Waste, etc.). If the material in the vehicle met the desired material source that was to be sampled from that day, the scale house operator notified AET's onsite Team Leader via radio and the inbound material was delivered to the designated tipping area for sampling.

Collection Logs

Upon arrival of the inbound load, the following data was gathered from the vehicle's driver by AET staff:

- Material Source Verification
- License Plate Number
- Hauling Company (if applicable)
- Vehicle Type (Roll Off - Uncompacted, Cube Van, Front End - Tandem Axle etc.)
- Any observations or anomalies within the load

With the acquired vehicle and material information, AET staff completed a waste collection log sheet for each inbound vehicle sampled. The log sheet included such information as sample

number, date, time, material source, license plate number, hauling company, and net weight of load (obtained from scale house operator at end of each sampling day) and any additional observations about the sample.

Material Sorting Process

The detailed composition audits included sample extraction from the loads selected for auditing. After a load tipped in the sampling area, AET staff would extract a representative sample from each of the selected inbound loads. A sub-sample of approximately 100 kg was randomly collected from each sample, weighing the selected material before sorting to ensure that the target weight has been achieved before physically auditing. If a load contained a considerable proportion of large/bulky materials (e.g. furniture, wood, etc.), these materials were noted, but not included in the sub-sample collected for detailed auditing. The proportion of the load attributable to large/bulky items was accounted for in the final analysis of the composition of that load.

All sub-samples were physically sorted and weighed separately (into individually tared bins) into approximately 6 primary (Paper, Plastic, Metal, Glass, Organics, and Other) and 34 secondary categories (e.g. Newsprint, Recyclable Glass Containers, Clean Wood, Textiles, etc.) at the Oxford County Waste Management Facility located at 384060 Salford Road in Oxford County. The full list of sort categories can be found in Appendix B 2. AET made every reasonable effort to separate multi-material items and to separate food waste from their packaging. Any bags or containers found to contain highly hazardous materials (e.g. sharps) were set aside, weighed and noted on the waste sort worksheet.

Prior to weighing the sorted material, AET compiled photos of any substantial or unusual material categories and items found in the samples. All sorted material was weighed for each sample using a digital scale (0.01 kg precision up to 40kg +/- 1% of true weight). Tare weights of the bins used for sorting were verified prior to the audit and checked regularly throughout the study to maintain accuracy. Light materials were weighed directly on the scale. The weight of each individual material category was recorded on a waste sort worksheet. Any unusual materials/items which may have not been representative, or which may have significantly affected the overall composition of the sample was also noted on the worksheet. Additional notes were also made on the worksheet describing the contents of categories labeled "other" (e.g. other plastic would be identified – blister packaging, toothpaste tubes, etc.).

Once all the waste material was classified and weighed, it was disposed of with the assistance of facility staff by pushing material away from sorting area and into the designated tipping area.

2.3 Inbound Waste Management Facility (Visual)

Waste Sampling Process

The sampling and sorting methodology described in the single family residential curbside and inbound waste management facility (physical) is best suited for waste from sources such as Residential Curbside and most mixed ICI sources. However, loads which contain more bulky waste (e.g. Demolition, junk cleanouts, etc.) are better characterized using a visual volumetric auditing approach. With this said, AET conducted a number of visual audits on inbound waste material.

AET stationed a Team Leader on the tip face of the Oxford County Waste Management Facility to visually audit as many inbound loads during a six (6) hour auditing period each day. Each load was given a volumetric estimation for the different material types (i.e. 5% corrugated cardboard, 20% treated wood, etc.). No specific inbound material source or vehicle type was to be targeted. A total of two hundred and twenty two (222) inbound vehicle samples were visually audited over the course of a 3-week audit period (15 audit days). All inbound vehicles were audited on a next available basis.

Collection Logs

Upon arrival of the inbound material, the following data was gathered from the vehicle's driver by AET staff:

- Material Source Verification
- License Plate Number
- Hauling Company (if applicable)
- Vehicle Type (Roll Off - Uncompacted, Cube Van, Front End - Tandem Axle etc.)
- Size of bin (i.e. 40 cubic yard, 12 cubic yard, etc.)
- Fullness of bin
- Any observations or anomalies within the load

With the acquired vehicle and material information, AET staff completed a waste collection log sheet for each inbound vehicle sampled. The log sheet included such information as sample number, date, time, material source, license plate, hauling company, bin size and net weight of load (obtained from end of day scale reports) and any additional observations about the sample.

Material Evaluation Process

The AET Team Leader completed a walk around of the entire material pile. During this time, a visual volumetric assessment of the material composition was completed. As inbound loads were visually audited, the percentage of materials by volume was recorded. The estimated

volumes were later converted into weights based on truck size and fullness, up to date standard material bulk density conversion factors, and the net weight of each individual inbound material load.

After sampled material was visually audited, AET's Team Leader would inform the compactor operator that the material could be removed or pushed away.

Following the completion of the visual field work, all collected data was entered electronically into spreadsheets which converted inbound material samples from volumetric composition to weight equivalents. This was completed using the net weights of each load, the size and fullness of each truck, and bulk up to date density conversion factors for each material type. The annual quantity of each material type received at the facility was also calculated based on the annual landfill records provided by Oxford County for 2016.

The accuracy of each sample's bulk density conversion was calculated relative to the actual net weight of the load, as reported on the scale ticket. For example, if the bulk density conversion resulted in an estimated total weight of 9,500 kg for a particular sample, and the scale ticket indicated the load was 10,000 kg, then the accuracy for that sample was -5%. The "other" category used in the visual audits had a high variability of material densities (e.g. bagged material for which visual audit can not identify contents). Due to this factor, adjustments were made to the material category weight conversion upon analysis of each load type and truck net weight. Conversion factors utilized for the analysis of the visual auditing data can be viewed in Appendix D. The full list of material categories can be found in Appendix B 3

2.4   Assumptions, Limitations & Calculations

Single Family Residential Curbside

This audit assumes that the selected households are representative of the composition of waste generated by single family households in Oxford County. Sampling areas were defined as either urban/village or rural based on the spread or density of the households within the area and any attached/adjacent land use such as agricultural farming.

This audit assumes that setout behaviour in rural areas was reflective of normal conditions by residents. Many rural areas had little to no setouts and it is assumed that waste generated by these households is collected by private haulers.

The audit occurred over a 2-week period in March, which best represents waste generation and composition at that time of year. Further seasonal audits would be required to gain a more accurate picture of waste generation and composition over time.

Annual household generation rates were estimated by extrapolating the kg/household/week audit results to a full year equivalent. Overall estimated annual waste generation was estimated

by multiplying the kg/household/year weight by the number of single family residential households in the County (proportionally weighted between urban/village and rural areas), excluding multi-family residences.

This audit assumes that number of households statistics provided by Oxford County are accurate. The number of households per township was determined by the 2016 Municipal Property Assessment Corporation (MPAC) dataset.

The following calculations were used to calculate the overall generation of waste. The results were averaged to calculate the overall results displayed in this report.

Weekly Waste Generation (kg/hh/wk):

$$\left(\frac{\dfrac{weight \quad of \quad material \quad generated \quad over\ two \quad week \quad audit \quad period}{\#\ of\ hhlds \quad sampled}}{14\ days} \right) \times \left(7\ days \right)$$

Yearly Waste Generation (kg/hh/yr):

$$\left(\frac{weight \quad of \quad material \quad generated \quad over\ two \quad week \quad audit \quad period}{14\ days} \right) \times \left(365 \quad days/year \right)$$

It should be noted that calculations for samples collected from Southwest Oxford were adjusted to account for the 8-day collection cycle there.

Diversion Rate:

$$\left(\frac{weight \quad of \quad material \quad diverted}{total \quad weight \quad of \quad material \quad generated} \right) \times 100\%$$

Capture Rate:

$$\left(\frac{weight \quad of \quad recyclable \quad /compostab \quad le\ material \quad diverted}{weight \quad of \quad recyclable \quad /compostab \quad le\ material \quad generated} \right) \times 100\%$$

Inbound Waste Management Facility (Physical)

Assuming that each sub-sample of approximately 100 kg was a representative sample of the overall entire inbound vehicle load, the physical material composition audit that was completed for each of the 75 samples when extrapolated by composition percentage and vehicle net weight, is accurately expressed when extrapolated by annual total inbound weights by source type as per provided by the County.

Inbound Waste Management Facility (Visual)

Assuming that each vehicle load that was visually analysed, similarly represented a typical example of that type of material inbound by specific material source, then the volumetric observations when converted will closely predict annual material compositions when extrapolated.

All collected data was entered electronically into spreadsheets which converted truck loads from volumetric composition to weight equivalents. This was completed using the net weights of each load, the size and fullness of each truck, and bulk density conversion factors (found in Appendix D) for each individual material type. The annual quantity of each material type received at the facilities was calculated based on the results of the converted volume to weight equivalents and the provided annual total weight of specific material source inbound at the County's facility for 2016.

Factors such as compaction, wetness and size of materials can affect the volume density of various materials, which may not always be reflected in the visual audit results, due to the use of standard volume density conversion factors.

Contents of bagged waste are not identifiable when visually assessing a load. Bagged waste was classified as part of the "Other" waste category.

It was observed that a small number of vehicles directed to the tipping face had offloaded divertible materials at the waste management facility's public drop off area (e.g. scrap metal, C&D waste, cardboard) before tipping their garbage at the landfill tipping face. Typically, these vehicles do not make a 2nd pass over the landfill scale to obtain a net weight of just the portion of their load that was landfilled. When extrapolating audit results to the total reported load weights provided by the scale house, it was not possible to determine what proportion of the weight might have been offloaded prior to arriving at the tipping face.