YorkU & City of Barrie Final report

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Table of Contents

List of Tables

List of Figures

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Purpose

The purpose of this report is to provide guidance to the City of Barrie (the City) by way of a five year waste auditing strategy for single and multi-family households. Barrie, like many other municipalities in Southern Ontario, is undergoing continuous demographic and infrastructural change. The city is growing (both up and out) and the population is changing (GTA commuters), necessitating that any waste auditing strategy be able to adjust to these changes, and provide a credible foundation to inform waste management policy and tonnage projections.

This report provides a step by step approach to determining optimal sample sizes and allocations, across multi-residential and single family households, in order to acquire representative waste composition and generation statistics for the City.

Funding to complete this study was provided by the Continuous Improvement Fund (CIF).

Comments on existing audits

York University did not have an opportunity to review existing audit data – while it is a better practice for a municipality to review historical data to inform future audits, it was determined that this report should focus on developing an auditing strategy moving forward. Anecdotally, comments provided by City staff indicated that there was inconsistency in the methodology used in past audits (i.e. deliberately targeting specific areas to account for stratification etc.), and that past data may not be extremely useful.

It is an objective of the recommendations of this report, that the proposed waste auditing strategy deliver the consistent collection of data such that meaningful historical comparisons can be made between study periods in order to determine changes in the waste stream.

Overview of the City service area

The City can be separated into 10 distinct wards. Table 1, on the following page, summarizes some of the vital statistics for each ward (provided by Statistics Canada), while Figure 1 on page 4 (Source: Watson and Associates) shows types of land use in each ward.

It should be noted that median income levels (observed to be a significant predictor of waste disposal behavior) were not available as an average at the ward level. Statistics Canada only provides the total number of respondents that correspond to each census category, and not the average of those responses. As such, a supplementary data source (Environics) was used to provide median income levels by postal code, but not by ward boundary. Using this information, the university averaged income data points for multiple postal codes in each ward and used this information as a proxy.

Table 1: Summary Statistics by City Ward

Ward #	Population[1]	Private Dwellings[2]	Median Age	Median Household Income[3]	Education[4]	Apartment buildings[5]
1	14,639	6,266	38.2	$92,097	2,412	490
2	15,663	8,401	40.1	$91,880	2,150	2,425
3	12,423	4,574	36.9	$90,573	1,673	0
4	13,300	5,116	38.7	$92,446	1,752	720
5	12,689	4,679	39.9	$91,203	1,188	160
6	15,267	5,366	40.3	$81,176	2,345	5
7	15,798	5,351	37.6	$89,847	1,740	0
8	16,636	6,211	39.4	$90,456	2,146	5
9	11,077	3,639	37.4	$92,154	1,327	175
10	14,942	4,664	37.7	$90,898	2,709	0

[1] 2016 statistic

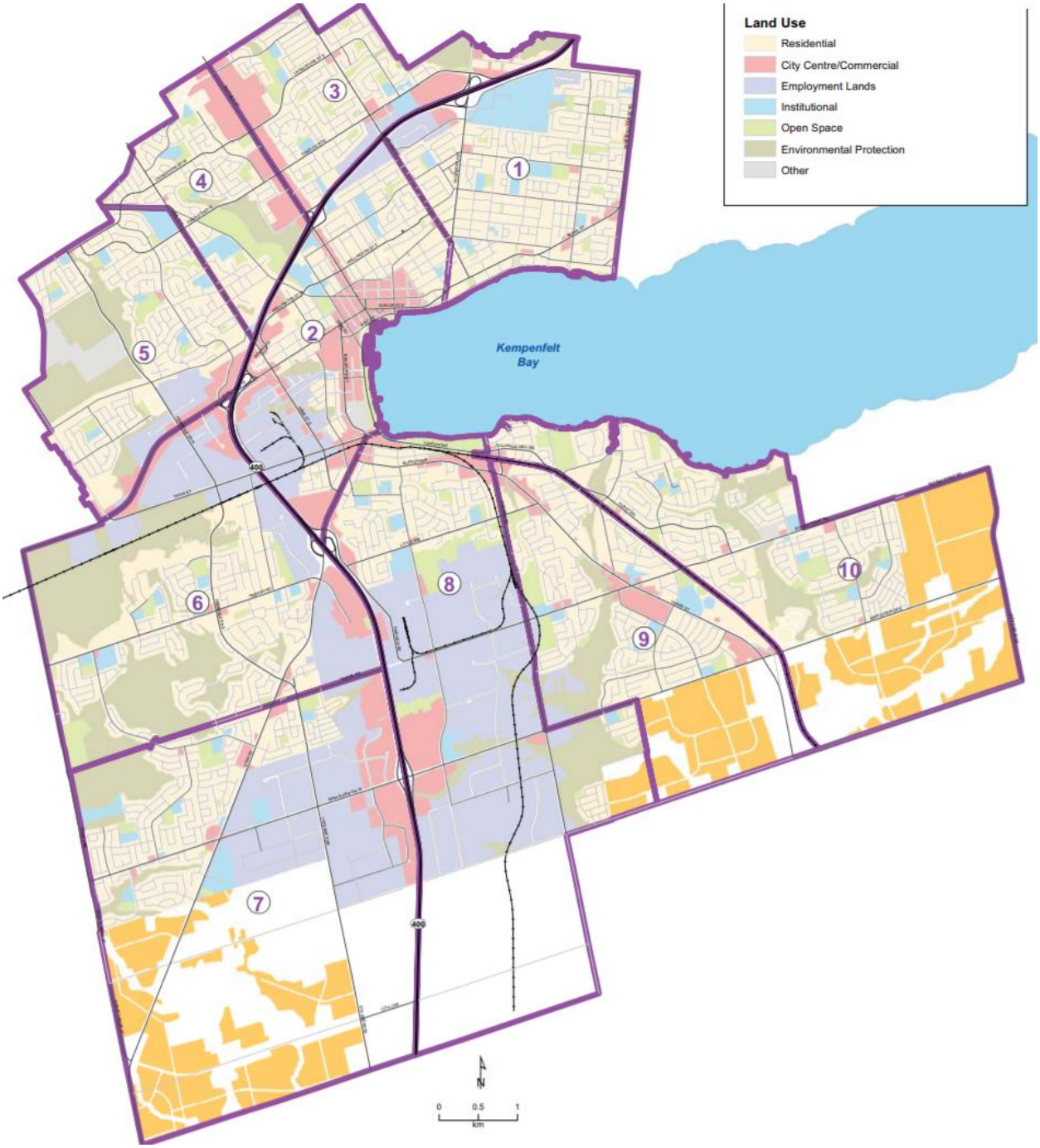
[2] Total private dwellings

[3] Averaged using Environics dataset by postal code

[4] University certificate, diploma or degree at bachelor level or above

[5] Apartment in a building that has five or more stories

Figure 1: Land use by ward



Overview of Strategy development

The strategy development followed a step by step framework to stratifying and allocating samples across the City service area.

1. Stratification based on key factors and analysis of socio-demographics (such as multi-residential vs single family) to determine sample areas
2. Calculation of number of samples per area and dwelling type

Care has been taken to thoroughly document the assumptions, or decisions, made in completing each step of the framework in developing the strategy.

Analysis to determine sampling areas

In order to ascertain whether the City wards are sufficiently different from one another, an analysis of variance (ANOVA) test was conducted using the following variables:

- Income
- Population
- Proportion of Single Family to Multi Residential households

This is done to determine whether demographic and / or infrastructural characteristics indicate each ward (or area) of the city should be treated:

- Separately: as wards are sufficiently different , or
- Grouped: as there are sufficient similarities.

This represents a limited subset of factors that potentially affect household waste/recycling generation. As a better practice, an ANOVA should be conducted using all relevant sociodemographic variables that affect waste generation (as shown in Table 2). This analysis should be conducted separately for both single family and multi-family households, as a municipality should treat multi-family and single family audits as being separate.

Anecdotally, based on the university's own research, income, dwelling type, access to curbside recycling and presence of bag limits/PAYT significantly affect waste generation/recovery rates. However, due to limited data available by Statistics Canada for each of Barrie's wards, a decision was made to limit our analysis to income, population and dwelling type. This is a limitation to the analysis.

The results of our analysis, as shown in Table 3, suggest some wards be grouped.

Table 2: Factors affecting waste generation

Factor	Relevant to City Strategy	Consensus Impact on Waste Generation and/or Composition ***City and Strategy context***
Income *	Yes	Positively correlated with waste generation and recovery. ***Included in in ANOVA. Average income levels were approximated by ward.***
Pay as you throw/Bag limits *	No	Presence of bag limit/PAYT decreases waste generation per capita, but increases recovery. ***Not included in ANOVA. Consistent requirements for waste programming across wards.***
Immigration *	Yes	First generation immigrants are less likely to participate in source separation programs, resulting in lower diversion rates. ***Not included in in ANOVA. Primary language spoken is available through Statistics Canada. This information was not used as a proxy for quantifying the immigration factor, as there is a paucity of evidence to justify doing so.***
Locality *	Yes	Urban households generate and recovery more waste than rural households. ***Not included in in ANOVA. Population density by ward data not available.***
Access to Curbside Collection *	No	Positively correlated with waste generation and recovery ***Not included in in ANOVA. City provides access to waste collection across wards.***
Dwelling Type *	Yes	Single family households generate and recover more waste than MF households ***Included in in ANOVA***.
Age	Yes	Positively correlated with waste generation and recovery (until age 65, where generation per capita decreases and recovery per capita increases) ***Not included in in ANOVA***
Gender	Yes	Men Generate more waste per capita, while woman divert more waste per capita ***Not included in in ANOVA***
Population Density	Yes	Positively correlated with waste generation (and recovery) ***Not included in in ANOVA***
Education	Yes	Positively correlated with diversion and participation in source separation programs ***Not included in in ANOVA***
Bin type	Yes	Households with access to curbside carts generate and recover more waste per capita ***No included in in ANOVA***

* Variables denoted with an asterisk indicate "high impact" variables – it is difficult to rank these ordinally, as there is no consistent evidence in the broader literature that suggests one variable as being clearly more important than others.

Table 3: Results of ANOVA

Ward Number	Total Population	Relative Single Family Population Distribution	Relative Multi Family Household Distribution
Wards (3,6,7,8,10)	76,282	53%	28%
Wards (9,5,4,1)	51,705	41%	18%
Ward 2	15,663	5%	64%

Developing the City's sampling strategy

Implications of stratification on sample size

When it comes to conducting waste audits, one of the fundamental tenants of long term audit planning is to consistently sample the same areas, such that patterns/trends can be identified. However, what is more important than this time series analysis, is ensuring that you have reasonably, or justifiably, stratified the sample (to the best of one's abilities, subject to resource/time constraints).

Conventional statistical procedure would be to develop a sampling strategy that achieves a confidence interval of between 90 and 95% (i.e. we are 95% confident that the samples taken in our study approximate for the broader community).

As an empirical exercise, estimating the number of samples for the City of Barrie, using all 10 wards, to achieve a 95% confidence interval would require 3,747 unique samples. We specify unique, as that 3,747 refers to unique audit areas, and not individual households (assuming you follow the 10 households per audit sample). In comparison, if the City were not to be stratified by wards, it would require far fewer samples – 380 in total.

Determining and defining sample size

There is some confusion in the recycling world when it comes to explaining the sample size of a study. A common methodology used by Ontario municipalities is to sample 10 households in 10 neighborhoods for a total of 100 households. The actual number of samples collected in this type of study is actually only 10, not 100, as the combined pile of neighborhood materials is what ends up being sorted, measured and used for analysis.

The proposed auditing strategy included in this report uses the same protocol outlined above to generate 10 samples per $10,000 (estimated) spent on sampling single family waste generation.

Sample distribution across City wards

The results of the ANOVA indicate the City should complete waste audits in three areas. Given that the City's estimated audit budget for 2019 is $27,000 for recycling audits and $50,000 for garbage audits, it would be impossible for the city of Barrie to conduct sufficient audits to meet statistical significance thresholds. Even if we are to reduce our confidence level to 50%, 460 samples would be required. It should be noted that this problem is not unique to Barrie– the time and resources required to meet statistical significance are prohibitive to virtually all municipalities.

This ultimately necessitates the question – how should future audits be conducted (and where)?

Standard convention would be to continue to sample the same households and buildings as previous audits, such that a time series analysis can be conducted (evaluating how compositions and trends change over time). Generally, the same audit areas would be repeatedly sampled every year, for a five year period – at the end of this period, the municipality would conduct a review of the data (to ascertain patterns or trends) and then re-run an ANOVA to identify new sample areas.

Valuing audit frequency

The City's existing schedule of conducting audits semi-annually exceeds best practices employed by other large urban municipalities in North America. Generally speaking, bi-annual audits are preferred as it allows municipalities to monitor and evaluate how the waste stream is changing over time, without posing onerous resource and administrative requirements. Conducting audits on an annual basis is typically only observed in situations where a) resources are not constrained or b) the region is planning to implement a significant programmatic change (i.e. transition to automated carts), and wants to conduct a pre and post change evaluation. The current CIF and Stewardship Ontario protocol incorporates a seasonal audit approach to capture variations in the generation and composition of the waste stream changes throughout the year.

Based on an evaluation of single family audits conducted in Southern Ontario (which accounted for seasonality) – the waste stream does vary significantly throughout the year. As such, as a better practice, seasonality should be accounted for. There is a caveat to this statement however, as it assumes there are sufficient resources to sample both a wide range of areas, and at multiple times throughout the year.

Given the relative paucity of houses/buildings the City is able to sample, provided its existing budget for doing so, it is actually likely more worthwhile to sample a broader range of areas, as opposed to accounting for semi-annual seasonality. While seasonality is certainly an important consideration when conducting waste audits, the most important consideration is that the

sample areas approximate the broader region as closely as possible statistically and in terms of socio-demographics.

Calculator used to distribute samples across wards

An excel spreadsheet, as a companion document to this report, was developed to act as a calculator in distributing the samples across the sampling areas presented in Table 2. The calculator relies on various assumptions to generate the sampling allocation across the sampling areas. The assumptions used within the calculator at the time of writing this report are as follows:

- Given that audits generally include both the waste and recycling stream, it is assumed that the budget can be combined for a grand total of $74,000
    - Recycling Audit Budget: $24,000
    - Garbage Audit Budget: $50,000
- Budget allocation: The allocation between dwelling types has been determined based on the proportion of each relative to the total number of households (The City can choose to allocate their budget differently, based on their own needs).
    - 60% of the auditing budget is allocated to single family samples
    - 40% of the auditing budget is allocated to multi-residential samples
- Study cost assumptions included:
    - Average Single Family Audit Cost: $10,000 ($10,000 per 2 week generation season to audit 100 households using the 10 samples of 10 households worth of materials protocol)
    - Average Multi-residential Audit Cost: $12,500 (per 1 week generation season to audit 5 buildings)

Using the existing budget/resource constraints, a potential auditing strategy that is weighted against relative population distribution is shown below in Table 4, below.

Table 4: Samples allocated across sample areas per annual budget

Study Block	Ward Number	# SF HH Sampled
SF – A	Wards (3,6,7,8,10)	213 SF HH
SF – B	Wards (9,5,4,1)	164 SF HH
SF – C	Ward 2	21 SF HH
	Ward Number	# MF Buildings Sampled
MR – A	Wards (3,6,7,8,10)	4 Buildings
MR – B	Wards (9,5,4,1)	2 Buildings

MR – C	Ward 2	9 Buildings

Proposed 5 year waste auditing strategy

High level recommendations

The proposed auditing strategy is presently constructed using the following three overarching recommendations:

1. Stratification and sample allocation be first made by dwelling type;
    a. With the budget allocated based on the proportion of dwelling type;
2. Three sample areas be utilized based on the results of the ANOVA test; and
3. Audits be completed on an annual basis;

Sample allocations across the three waste study sampling areas are presented in table 5 on the following page. The sample allocations over the five year period have been estimated using the assumptions noted earlier in this report. Included within the table, are suggested 'check-in' points for City staff to revisit the assumptions utilized in the allocation process.

Additional considerations to the Strategy

Earlier in this report, sample size was discussed in reference to single family waste generation. The protocol of measuring 10 households worth of waste to generate a single sample point of data is the most often observed protocol for Ontario municipalities. Consideration should be given to investigating the value (cost) per sample in terms of reducing the number of households included within each sample. For example, while the costs of sampling each individual household may increase a 100 household study size by 2 – 3 times, the actual cost per sample would decrease by 70 – 80%.

While the curbside program for single family uses a consistent container type, and size, the multi-residential program provides buildings with either carts or front end loading containers. The CIF multi-residential working group, and previous CIF reports, have identified variations in the recycling behaviors of residents when using different types of containers. For example, the restricted access of some slotted OCC bins have been effective in reducing contamination. Further, bin wraps (decals surrounding FEL bins) have recently been reported to improve recycling behaviors both in capture and contamination. As such, City staff may consider further stratification of the multi-residential study areas by bin type to get a clearer picture of the waste streams.

Table 5: Waste audit allocation for 2020 - 2025

Year	Single Family	Multi-Residential	Notes
Year 1	• A: 213HH • B: 164HH • C: 21HH	• A: 4 B • B: 2 B • C: 9 B	Annual audits (i.e., single season)
Year 2	• A: 213HH • B: 164HH • C: 21HH	• A: 4 B • B: 2 B • C: 9 B	Annual audits (i.e., single season)
Repeat ANOVA test to evaluate impacts of socio demographic changes.			
Year 3	• A: 213HH • B: 164HH • C: 21HH	• A: 4 B • B: 2 B • C: 9 B	Same number of households/buildings, but potentially different households in the same ward (based on results of ANOVA)
Year 4	• A: 213HH • B: 164HH • C: 21HH	• A: 4 B • B: 2 B • C: 9 B	Same number of households/buildings, but potentially different households in the same ward (based on results of ANOVA)
Repeat ANOVA test to evaluate impacts of socio demographic changes.			
Year 5	• A: 213HH • B: 164HH • C: 21HH	• A: 4 B • B: 2 B • C: 9 B	Same number of households/buildings, but potentially different households in the same ward (based on results of ANOVA)
Review auditing strategy and inherent assumptions related to stratification, allocation, and ANOVA. Utilize results of studies to inform this analysis.			

Regularly review the auditing protocol and making adjustments as needed

Every 2 years, a review of audit data should be conducted to ascertain any trends or patterns within the data. In the unlikely event that neighborhoods in the City experience a sudden demographic/infrastructural shift in a short period (i.e. construction of a car plant spurs residential development in the surrounding area), then additional audit areas, or changes to the groupings, should be considered. However, the general expectation is that the characteristics of communities don't change significantly in the short term, and thus, future audits should primarily be focused on developing a data time series.

At the end of the 5 year period, an ANOVA should be re-run based on the sociodemographic characteristics of each ward, to determine whether ward groupings should be changed. This will provide justification in either using these, or creating new, assumptions in developing the next iteration of the auditing strategy.

It is an inherent assumption the City will consistently audit the same neighborhoods and households within the three sample areas proposed. If following the second or fourth years of data acquisition, City staff identify consistent homogeneity within the study areas, it may be prudent for Barrie to rotate sample sites every other year (choosing new sample areas in years 3 and 5), until a sufficiently stratified baseline is established. In this particular case, the better practice may be to capture as many "permutations" as possible (different audit areas), to account for the variability of waste generation/composition that occurs within the sampling area.

As a final consideration, the city should provide enough latitude and flexibility to change audit areas, target communities, material categories etc. in the event of unforeseen events or changing priorities. While prescriptive approaches to audits are useful in terms of providing structure and guidance, audits are ultimately designed to help inform decision making, and as

such, depending on the question being asked and the data required, auditing plans may change.

Limitations

The proposed waste strategy was developed utilizing a step by step framework to optimally allocate samples using either a fixed budget or target confidence level. While care has been taken in completing this process, there are limitations in the methodology utilized in determining the stratification, sample size, and other important factors.

- ANOVA Factor Selection: This represents a limited subset of factors that potentially affect household waste/recycling generation. As a better practice, an ANOVA should be conducted using all relevant sociodemographic variables that affect waste generation (as shown in Table 3, page 6).
- Selecting sample size based on budget: Budget limitations significantly impact ones ability to achieve confidence levels typically observed in other types of studies.

Conclusion

This report lays out the considerations given in determining the proposed 5-year waste auditing strategy for the City of Barrie. Significant effort has been made to describe, justify, and clarify the limitations to the assumptions utilized in creating the strategy.

The objective of the strategy presented, is to:

1. Empirically determine waste study areas (sample allocation)
2. Create representative waste generation and composition study datasets (sample size)

The sampling strategy proposed will help support City staff in achieving these objectives, but will require regular critical review of the inherent assumptions used to ensure the methodology holds true with the passage of time.

Waste Wiki Team.

Appendix: General Municipal Waste Auditing Considerations

General Auditing Guidelines for Municipalities

When considering developing an auditing methodology, a municipality should consider the following questions:

1) What is the goal of my audit?
    a. Will these audits be used to project how much waste is currently being generated/recovered?
    b. Will these audits be used to project waste generation/recovery into the future?
    c. Better understand differences in what is generated/recovered across areas?
    d. Used to evaluate the effectiveness or impact of programs or policy?
2) What data do I already have?
    a. Organize and review waste audits that you have completed to date.
        i. When were these audits conducted (both year and seasonality)
        ii. Where were these audits taken?
        iii. What was the methodology for selecting sample sites?
        iv. Was there a consistent methodology used to conduct audits? (Same auditors, same instructions when measuring samples etc.)
        v. Have you implemented any major programmatic changes in your municipality since conducting the waste audits?
    b. Analyze historical data set
        i. Historical data should be reviewed to examine overall composition (waste/recycled), generation per HH (by waste stream) and participation rates. If you have waste audits that have been taken over multiple years from the same locations, determine how these factors have changed over time
        ii. Determine whether audit areas are statistically different from one another. Consider the following scenario – your city is largely divided into four “wards” (North, South, East and West). Under normal circumstances, you would need to take audit samples from each of these wards to ensure your sample is stratified. However, if a review of historical waste audit data shows minimal variation in waste composition/generation rates, then all four areas are considered “one/same” from a statistical perspective. An analysis of variance test is used to determine whether there is statistically significant variation across audit areas. If there is a statistically significant variation, each audit area needs to be treated separately.

3) What can I afford to sample?

One of the foremost issues with auditing approaches is the erroneous use of the term statistical significance. This term is often used to describe achieving a sufficient number of samples to enable meaningful/credible analysis. However, calculating statistical significance is a mathematical exercise that denotes collecting enough samples such that unexplained variance falls below a confidence interval threshold (i.e. stated alternatively, statistical significance implies that we have collected enough samples such that the sample has a 95% probability of approximating for the actual population as a whole).

While it may not seem particularly important to make this distinction, incorrectly using the term statistical significance implies a level of precision/accuracy that is not possible through waste auditing. The number of samples required to achieve true statistical significance can number in the thousands, which is neither feasible, nor practical for a municipality/province. It is absolutely critical that any auditing methodology stress the limitations of what can and cannot be done with respect to sampling, and provide guidance regarding how to interpret/analyze the data. The goal of an audit should never be precision – rather, a sound methodological approach would be premised on "what's the best I can do with the resources that I have"

4) Deciding between "automated" sample selection and "informed" sample selection.

Many municipalities have requested that quantitative tools be developed that will automatically suggest the number of samples required given a fixed budget.

While this is technically possible, the only guidance that an automatic calculator can provide is distributing samples based on relative population weighting, subject to a series of constraints inputted by the user of the tool.

The following variables are required to "automatically" distribute samples using a calculator tool:

- Recycling Audit Budget
- Garbage Audit Budget
- Average Audit Cost Single Family
- Average Audit Cost Multi Family
- # of Single Family Households Per Sample
- # of Single Family Samples Afforded Per Audit
- # of Multi Family Buildings Per Sample
- # of Multi Family Samples Afforded Per Audit

Presently, there is no guidance in the broader literature to suggest what the above values should be. As an example, the Stewardship Ontario Auditing Guidelines suggest that a single family audit sample 10 blocks of 10 households (100 total households). This would represent 10 unique single family samples, as an individual sample, is comprised of 10 households.

However, a municipality may want to collect more unique samples, by reducing the number of households per sample, but increasing the total # of samples taken. Using the same 100 total household example provided above, reducing the # of Single Family households per sample to 3 (meaning that only three households are sampled per block), increases the total # of unique samples to 33.

The above may seem confusing, and that's largely because it is. What constitutes a unique sample, or how many households an auditor is able to sample per audit, are site and situation specific. There is no mathematical guidance that will inform these decisions.

A more meaningful approach to developing an audit plan is to include "qualitative" factors. This goes back to Step # 1: What is the goal of my audit? Depending on a municipalities needs, you may want to forego mathematical distribution, and rely on judgement that specifically informs the questions that you have.

5) Other factors that should be considered when selecting an audit area? (Accounting for demography and income)

The demographics and housing infrastructure of a city varies significantly, particularly in large urban areas such as the City of Toronto and Region of Peel. Auditing areas in the Downtown's affluent financial district will yield significantly different waste characterization results compared to a single family suburb in Scarborough.

What households generate/recover, both with respect to composition and quantity, is very much a function of infrastructural and socio-demographic factors that need to be accounted for when developing an audit strategy.

Table 1 below summarizes factors most likely to influence waste generation/diversion that should be considered. Variables denoted with a star indicate "high impact" variables – it is difficult to rank these ordinally, as there is no consistent evidence in the broader literature that suggests one variable as being clearly more important than others.

Table 1: Factors affecting waste generation

Factor	Impact

Income ***	Positively correlated with waste generation and recovery
Age	Positively correlated with waste generation and recovery (until age 65, where generation per capita decreases and recovery per capita increases)
Gender	Men Generate more waste per capita, while woman divert more waste per capita
Population Density	Positively correlated with waste generation (and recovery)
Education	Positively correlated with diversion and participation in source separation programs
Immigration***	First generation immigrants are less likely to participate in source separation programs, resulting in lower diversion rates per capita
Locality ***	Urban households generate and recovery more waste than rural households
Access to Curbside Collection (waste/recycling) ***	Positively correlated with waste generation and recovery
Dwelling Type ***	Single family households generate and recover more waste than MF households
Bin type	Households with access to curbside carts generate and recover more waste per capita
Pay as you throw/Bag limits ***	Presence of bag limit/PAYT decreases waste generation per capita, but increases recovery per capita

Anecdotally, based on the university's own research, income, dwelling type, access to curbside recycling and presence of bag limits/PAYT significantly affect waste generation/recovery rates.

If we were to solely rely on statistics to inform how a municipality should distribute its samples, none of the variables below would be accounted for. In many ways, statistical distribution is a

“brute force” exercise that relies on fairly limited set of criteria (# of sample relative to total population).

Qualitative judgement is equally as important when developing an auditing strategy, as it provides context and purpose to what a municipality is trying to achieve.

As such, when developing your audit strategy, once you have figured out the # of audits you can afford to undertake, prioritize your sampling in a way that captures how sociodemographic and infrastructural heterogeneity will affect your results.

As an example, if we know that City “X” is expected to grow by 15% over the next 5 years, but that growth is going to occur almost exclusively in specific regions of the city (characterized by certain demographic and infrastructural factors), then audits should be prioritized in those high growth areas.

Once again, relying solely on a “calculator” to tell you what to do will not provide any insights into how your city is actually changing. That requires a municipality to gather this contextual information using data sources from Statistics Canada and Environics to make informed decisions.

Nice to haves vs. Must Haves

It is not uncommon in most auditing methodologies to try and account for seasonality. Four audits conducted at four different times in the year, premised on the belief that waste generation is a function of seasonality. This is true, particularly for multi residential buildings, and green bin programs.

However, accounting for seasonality is a “nice to have”, when you have sufficient samples to account for the various areas in the city you would like audit. It should never be done in a resource constrained situation, where the trade-off is accounting for seasonality in lieu of taking additional samples from priority areas.

Remember that in order to use waste audits to make credible predictions about the future, there are three “must have” criteria:

1) Review all historical audit data to establish potential trends/patterns, and develop your baseline data set (from which future audits will subsequently build upon, or compliment)
2) Subject to budgets, a municipality has allocated as many samples as can be afforded in audit areas characterized as being a high priority. Ideally, these samples are sufficiently

"stratified" meaning that they have been placed in such a way that it approximates for the broader city/region as a whole

3) As you conduct audits every year (or every other year), you continue to sample the same areas to develop a data time series (repeated observations of the same sample area over time). A time series is required to do any sort of forecasting/projections*

*There is an exception to these three must haves for municipalities who do not have, or do not trust prior year data. If auditing budgets do not allow for samples to be taken in all of the desired target areas, it is better to build up a "critical mass" of samples, before attempting to establish a time series.

As an example, in Year 1, if a municipality could only afford to sample 5 of the 10 priority areas. In Year 2, they should focus on the remaining 5 sample areas, and not attempt to re-sample the areas sampled during Year 1.

Establishing that "critical mass" or "baseline" data is will be the first step for municipalities who are starting from scratch.