# Determinants of Municipal Waste Diversion in Ontario

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**Abstract**

Waste diversion is the act of shifting waste from one 'waste stream' to another, usually implying that the end result is the re-use or recycling of that material. For municipalities, waste diversion provides a method of reducing the amount of garbage dumped in landfills, freeing up expensive landfill space. As well, certain materials that are diverted from the landfill such as glass, paper, plastic, metals or organic waste, can be sold for a profit to companies looking to save on raw resource costs by re-processing materials.

In Ontario, there is a minimum standard established by legislation for waste diversion programs, however, the data shows that the rate of diversion is different in each municipality. Why is this the case? Studies examining waste diversion in municipalities across the world attribute variance among waste diversion rates to one of three categories of factors: pricing of service, program design, or socio-economic characteristics of the community. Specifically focusing on socio-economic characteristics and waste diversion, this study uses income, education, population density, and location of the municipality in Ontario in a statistical model to determine how much of the variance can be explained by socio-economic factors.

Using 2006 data from Waste Diversion Ontario (WDO) and Statistics Canada, this paper questions how much of an impact socio-economic characteristics have on the rate of waste diversion in municipalities across the province of Ontario. Looking specifically at the percentage of rented households in the municipality, the percentage of individuals who hold a university degree, the density of the population (essentially the level of urbanization), and the region in which the municipality is located, the model provides a list of variables that can tell a lot about a municipality. With a total of 196 municipalities and waste authorities in the data set, broad trends are visible. Weak to weak-moderate correlations lead to the conclusion that socio-economic characteristics explain only a portion of what determines the rate of waste diversion in Ontario municipalities.

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## 1.0 Introduction and Overview

Archaeological records show that the Minoans, an ancient civilization, had an interesting system for managing their garbage: it was found that in approximately 1500 BCE, the Minoans were dumping their waste in large pits which were then covered with earth.[1] Fast-forward over three and a half millennia and it is clear that the human civilization's method of dealing with garbage has changed very little. What is different in the present era is that the garbage sent to a landfill would look nothing like the heap of mainly food scraps brought to an ancient Minoan pit. Unlike organic waste, materials such as plastic can take thousands of years to decompose. At the same time, today's growing populations enjoy consuming goods and end up producing large amounts of landfill-bound waste, putting a premium price on the expansion of any dumping sites.

Some argue that the modern recycling movement was based in the mass drive for collection of materials during the two World Wars for re-use as ammunitions and supplies, as well as the energy crisis and environmental movements of the 1970s.[2] Without a war requiring scrap metal collection and hippies roaming the streets rampantly for the environment, what is the incentive for recycling? Certainly one reason is that markets exist for used plastics, metals, glass and paper products, providing potential revenues for municipalities that collect and then sell them. The act of recycling also diverts waste from landfills, saving expensive land from becoming virtually worthless. Regardless of its origins or the intentions for its implementation, recycling still exists (and is arguably flourishing) in many communities. The major question seems to be, what motivates people to recycle, and why some more than others?

The term 'waste diversion' is the act of shifting waste from one 'waste stream' to another, usually implying that the end result is the re-use or recycling of that material. A 'waste stream' is a categorical separation of waste into like-groups with different end results, for

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[1] Martin Medina, *The World's Scavengers: Salvaging for Sustainable Consumption and Production* (AltaMira Press: Lanham, MD: 2007), 19.

[2] C.C. Sullivan, "The three Rs for facility managers: re-engineer, recycle, and reuse," *Buildings* 88, no. 7 (1994): 86.

example, plastics are separated from paper/wood fibre products into two different waste streams because they require different processing to be re-used. For the purpose of this paper, 'waste diversion' will refer to the act of recycling plastics, metals, paper/wood fibres, and glass. It can also refer to the processing of organic waste, however the term recycling does not encompass this. Waste streams can vary, however, and generally include the following product categories: plastics and metals, paper/wood fibre, organic waste, hazardous/toxic waste, and non-organic (landfill-bound) waste. While variations undoubtedly exist across the world, the focus here is on the province of Ontario and the ways in which waste is dealt with within the province at the municipal level.

As municipal budgets tighten in tough economic times, the allocation of service costs becomes a central focus. Considering the high costs associated with the disposal of waste in a landfill (property costs, depressed surrounding land values, environmental considerations), there was the realization that the diversion of waste from the landfill would be a cost savings for cash-strapped local governments. This is precisely because some post-consumer goods provide revenue for municipalities, who then use it to offset waste collection and disposal costs. As well, municipalities can then avoid the expensive hassle of acquiring and developing land for landfill space.

While most Ontarians would be familiar with the recycling of plastics, metals, glass and paper, many may not have yet experienced centralized municipal organic waste programs. The program collects items such as food scraps, soiled paper products, and yard waste with some even accepting soiled baby diapers.[3] Properly processed organic waste can be turned into fertilizer that can be sold for profit. The introduction of the 'green bin' for organic waste in some communities has allowed local governments to make significant progress with their waste diversion rates. Where some municipalities had collected yard waste (leaves, branches etc.) prior to the

[3] City of Toronto, "What goes in the Green Bin?" Accessed at: http://www.toronto.ca/garbage/greenbin.htm.

introduction, the full green bin program involves the separation of food scraps, soiled paper products (etc.) that could not be placed in recycling, but can be processed in facilities into commercial fertilizer or for municipal uses in parks, gardens etc.

Organic waste processing, while seemingly non-controversial, is a highly contentious issue in some locations. Because the processing essentially quickens the rotting of waste, the odours that emanate from the facilities are much more pungent than what is found in backyard composters. In addition to this, because curbside green bins accept meat scraps, the smell of rotting meat is also present. A good example of this issue occurred in Welland, Ontario, a lower-tier municipality in the Niagara Region where an overpowering odour spread kilometres from the organic waste processing plant, making hot, humid summer days unbearable. The plant later closed because it was unable to control the odours.[4]

Forming the basis of municipal waste diversion programs is Ontario's *Waste Diversion Act*, 2002 which recognized the importance of waste diversion and made recycling ('blue box') programs mandatory for municipalities over 5,000 in population.[5] This program, named for the bright blue plastic bins put at the curbside for collection, can accept a wide variety of post-consumer goods depending on what the municipality decides to accept.[6] The *Act* promotes the use of disposal methods other than landfills and incinerators.[7] At a minimum, the municipality must provide for the recycling of glass, metal, paper, plastic and certain textiles,[8] with up to 50% of the cost of the program being provided to the municipality by Waste Diversion Ontario (WDO), a non-crown corporation created by the *Act*. WDO collects money from product producers and

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[4] Dianne Saxe, "Waste diversion, odour, and climate change," *Municipal World* 121, no. 9 (2011): 41-2.

[5] *Waste Diversion Act*, 2002, S.O. 2002, Chapter 5, accessed at: http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_02w06_e.htm.

[6] *Ibid.*

[7] *Ibid.*

[8] *Waste Diversion Act*, 2002, S.O. 2002, Chapter 5, Ontario Regulation 273/02 "Blue Box Waste," accessed at: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_020273_e.htm.

brand owners for this purpose,[9] a recognition that the packaging they create for products directly contributes to the costs that municipalities endure for waste management. WDO is also responsible for the collection of waste management data from each municipality and waste authority in the province that has some sort of diversion program.

[9] Anonymous, "Essentials about Bill 90 [Ontario Waste Diversion Act]," *Canadian Plastics* 60., no 8 (2002): 18.

## 2.0 Literature Review

Determining why and how some municipalities have different diversion rates is the focus of many studies, including this paper. However, the question of why a city such as Toronto, which had a diversion rate of 42.3% in 2006 while the Municipality of Chatham-Kent was diverting only 29.27% the same year,[10] is not a question easily answered. As there are variations among cities and towns, there also is in the approach to explaining the driving forces behind greater (or lesser) waste creation and diversion.

A review of literature on the subject of waste diversion reveals two major dimensions of each study. The first, level of focus, is the level of analysis at which the study takes place. The second, approach, identifies the angle from which the study is examining the question. Both dimensions are important to discuss here as there are benefits and challenges that arise within each.

### 2.1 Levels of Focus

The four levels of focus that were present in the collection of studies were household/neighbourhood; single city/town/community; several cities/towns communities; and central government (national, provincial or state). It would be incorrect to say that one is superior to another, mainly because each serves its own purpose in looking at waste diversion in different ways. Of thirteen studies looking at waste diversion and the potential for it in communities, five fell into the household/neighbourhood level, five into the single city/town/community level, one that looked at a collection of cities and towns, and two that looked at the question from a central government level.

It is clear that studies at each level of focus have different intentions. When studies are focused at the household level, they tend to be looking for localized trends with a very local

[10] Waste Diversion Ontario, "2006 Residential GAP Diversion Rate Datacall Report," accessed at: http://www.wdo.ca/files/domain4116/2006%20Residential%20GAP%20Diversion%20Rate%20March%205%2008.xls.

application. This is in contrast to studies at the central government level of focus which look at broad trends with obviously much broader implications than those at the household level. For example, a study written by Hong and Adams,[11] used household-level data in Portland, Oregon to determine how the pricing of waste services affects the way people recycle. Another study, by Van Houtven and Morris,[12] used a combination of household and community data to look at the same pricing issue in Marietta, Georgia. Using this level of detail is quite important for the respective communities and their future policy development. At the same time, it would be hard to make general conclusions from data that is so specific to only a small region with poor applicability elsewhere.

In contrast, data from the central government level can reveal broad trends but at the expense of nuance and high variation due to averaged data. The two studies that focused at this level were much more concerned with the variation that existed from one municipality/province to another. The first, by Mazzanti, Montini and Zoboli,[13] is a study that takes waste and income data from the Italian provinces to examine the relationship between the two over time (1999-2005). The second study looked at policy instruments across local governments in the state of Massachusetts over the course of 1994-1995.[14] Both of these studies clearly intended to discover a broader answer to the question of what determines how much waste municipalities are able to divert.

The rest of the studies fall into the middle two categories and try to pull on both ends of the spectrum by gathering lower-level data and using it to explain broader trends. Ferrara and Missios' study on Ontario municipalities is one example that attempts to explain broader trends

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[11] Seonghoon Hong and Richard M. Adams, "Household Responses to Price Incentives for Recycling: Some Further Evidence," *Land Economics* 75, no. 4 (1999).

[12] George L. Van Houtven and Glenn E. Morris, "Household Behaviour under Alternative Pay-as-You-Throw Systems for Solid Waste Disposal," *Land Economics* 75, no, 1 (1999).

[13] Massimiliano Mazzanti, Anna Montini and Roberto Zoboli, "Municipal Waste Generation and Socioeconomic Drivers: Evidence from Comparing Northern and Southern Italy*," The Journal of Environment & Development* 17, no. 1 (2008).

[14] Scott J. Callan and Janet M. Thomas, "The impact of state and local policies on the recycling effort," *Eastern Economic Journal* 23, no. 4 (1997).

with data collected from a sample of households in twelve municipalities,[15] and the study by Márquez, Ojeda and Hidalgo which attempts to predict waste diversion behaviour after studying household data from Mexicali, México is another.[16]

## 2.2 Approaches to Waste Diversion Analysis

A review of the literature reveals three general approaches from which the main question can be examined: pricing, programs, and socio-economic characteristics. While this paper will be approaching the explanation for waste diversion from the third angle, it is important to discuss the first two to understand the whole picture. A brief overview of literature on the first two is followed by a more in-depth analysis of literature for socio-economic characteristics.

## 2.3 Pricing of Waste Management Services

The first angle looks at waste diversion from the point of view that the way in which waste management services are charged to households affects how much they throw away, how much they recycle, and how much they divert waste.

A study done by Van Houtven and Morris suggests that the most efficient way to charge households for waste management services is to charge directly for each and every unit of waste produced. It theorizes that people, when faced with immediate and frequent fees for garbage disposal, will produce less waste. This approach places great faith in economics and capitalism, essentially advocating for the creation of a market for garbage, where the full cost is charged to residents for every piece of garbage put out at the curb. When costs are real and tangible, the study found that this is, to a certain extent, very true.[17]

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[15] Ida Ferrara and Paul Missios, "Recycling and Waste Diversion Effectiveness: Evidence from Canada," *Environmental & Resource Economics* 30 (2005).

[16] Ma. Ysabel Márquez, Sara Ojeda and Hugo Hidalgo, "Identification of behaviour patterns in household solid waste generation in Mexicali's city: Study case," *Resources, Conservation and Recycling* 52 (2008).

[17] George L. Van Houtven and Glenn E. Morris, "Household Behaviour under Alternative Pay-as-You-Throw Systems for Solid Waste Disposal," *Land Economics* 75, no, 1 (1999): 515-6.

Hong et al. are highly cited for their findings on unit pricing of waste in Portland, Oregon. They found that by charging residents for garbage, it would encourage them to recycle more, with further increases in price for service leading to a further increase in recycling. Overall, however, it seems as though people continued to put out the same amount of garbage.[18] This is interesting as it suggests that there is more going on here than just pricing that is affecting the amount of waste that is being produced.

Some municipalities have opted to move towards a user-fee model, where residents are charged for every bag of garbage that is put out, usually by affixing a sticker or a tag, though other variations exist. The idea here is that when residents are forced to purchase access to the service out of everyday funds instead of hidden in lump sum payments of property tax, residents might think twice before putting out or producing another bag of garbage, which means it has ultimately affected their behaviour. Ferrara and Missios have said that the last decade has seen a large increase in the number of municipalities that have imposed user fees at the curb, but also an increase in the number that offer curb side recycling.[19]

In trying to promote the reduction of waste, the City of Toronto adopted a modified version of the user fee model and began to charge separately for the costs of waste management. Instead of hiding the waste management services fee within the lump sum property tax, the city introduced mandatory garbage carts that each household would purchase, with escalating costs as the sizes of carts got larger. The amount of recycling that one could put out was unlimited under the rules of the new system, but the amount of landfill-bound garbage was restricted to what fit in the cart that was purchased. Those households that opted for the cheapest cart would be restricted to an amount equal to one bag of garbage while those who purchased the largest cart would be

[18] S. Hong, R.M. Adams, and H.A. Love, "An Economic Analysis of Household Recycling of Solid Wastes: The Case of Portland, Oregon," *Journal of Environmental Economics and Management* 25, no. 2, 144.

[19] Ferrara and Missios, 221.

allowed up to an amount equal to approximately 4.5 bags of garbage.[20] By giving residents an incentive to restrict the amount of garbage they put out each week, Toronto aimed to reduce the amount of waste going to landfills. The thought was that people would be possibly more inclined to buy the cheapest bin, thus restricting their waste output. As of 2010, Toronto stood at a strong 46.18% diversion rate, an increase from 42.29% in 2006.[21] In another study, the mandatory carts did not work. Portland, Oregon attempted a similar program as Toronto and found that people actually paid for the bigger carts and filled them up regularly, lowering the diversion rate in some instances.[22]

Another highly cited study, "Recycling and Waste Diversion Effectiveness: Evidence from Canada," by Ferrara and Missios, found that "user fees significantly increase the intensity of recycling." Looking at twelve Ontario municipalities, the study found that the implementation of user fees on garbage led to a greater rate of recycling, though only if all landfill-bound garbage required bag tags to be purchased and no 'free bags' were allowed.[23] One important point raised here is the suggestion that user fees on garbage could encourage illegal dumping of waste by those who do not wish to purchase tags.[24] This could be a real problem for municipalities who implement bag tags, essentially eliminating a good portion of the benefits if illegal dumping is rampant.

Another study by Fullarton and Kinnaman argued that households viewed garbage collection as free if the charge for it was included in the property tax.[25] Instead, like other studies, it was found that by introducing user fees, households would "re-allocate their time

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[20] Peter Gorrie, "Economic Realities of Funding Waste Diversion," *BioCycle* 50, no. 12 (2009): 21.

[21] Waste Diversion Ontario, "2006 Residential GAP Diversion Rate Datacall Report," accessed at: http://www.wdo.ca/files/domain4116/2006%20Residential%20GAP%20Diversion%20Rate%20March%205%2008.xls.

[22] Hong and Adams, 508.

[23] Ferrara and Missios, 235.

[24] *Ibid.*, 235.

[25] Don Fullarton, and Thomas C. Kinnaman, "Garbage, Recycling, and Illicit Burning or Dumping," *Journal of Environmental Economics and Management* 29, no. 1, 78-9.

toward recycling and alter their consumption habits to produce less non-recycled waste."[26] However, Reschovsky and Stone argue that it is not necessarily the user fees that affect recycling rates but is actually just the existence of a recycling program in the first place.[27] User fees for waste management services have an effect to a certain extent, however, in the Upstate New York cases that the two authors used, user fees did not have the effect that was intended by the municipality.[28] In the end, Reschovsky and Stone interestingly suggest that there is more than one factor or aspect at play in the motivations for creating and diverting waste.[29]

Another study that dealt with user fees was written by Callan and Thomas. While it did not say that user fees had no effect on the rate of waste diversion, it found through research that no study had been able to isolate the influence of user fees on waste diversion.[30] Essentially, it was very possible that many other factors could explain the variations observed.

Overall, the pricing-based literature is able to show some positive relationships between the concepts of pricing and waste diversion, though reservations exist. In this way, it seems the two are connected but there is 'more to the story' than just user fees and charging for waste in different ways.

### 2.4 Waste Management Program Design

The second angle from which studies looked at the subject of what affects waste diversion is from a program perspective. The studies that fall under this category are concerned with the design of the program, how it works, how frequent it runs, what waste they accept, what streams are offered etc. They are interested in depth, breath and frequency, and the theory is that variations between diversion rates of municipalities are due to the different programs

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[26] Ferrara and Missios, 226.

[27] James D. Reschovsky, and Sarah E. Stone, "Market Incentives to Encourage Household Waste Recycling: Paying for What You Throw Away," *Journal of Policy Analysis and Management* 13, no. 1, 137.

[28] *Ibid.*, 137.

[29] *Ibid.*, 137-8.

[30] Callan and Thomas, 417.

implemented in each. Since the possibilities for waste programs are numerous, it is believable that this could be a major factor in how much or how little households divert. These are decisions that are made by a municipality and affect the level of service a community receives, therefore theya ffect the waste management behaviour of residents, households and communities.

Fehr and Santos note that models and systems of waste management need to reflect the area in which they are being implemented.[31] Fehr notes in an earlier article (2006) that local realities, the composition of waste, and ultimately, local culture need to be taken into account in model design if there is to be a significantly positive outcome.[32] Using Brazilian municipalities as an example, Fehr and Santos liken citizens' view of the disposal of recyclables in a landfill to 'burying money'.[33] Families go into scavenging as a business and some have been observed to make much more than what they would have made working at the local minimum wage.[34]

In the study written by Ferrara and Missios, a strong relationship was found between the frequency of curb side pickups and the participation rate in the municipalities recycling program.[35] However, there is not always a strong correlation between program and diversion. While Toronto has a very open and wide collection program for recycling, its overall diversion is less than cities with a much more rigid and closed program. For example, while Toronto had a diversion rate of 42.29% in 2006 with a functioning green bin program and acceptance of virtually all forms of plastic, the Municipality of Thames Centre accepted only four of seven types of plastic and had no organic waste collection, though the diversion rate was 53.08%.[36] This

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[31] M. Fehr and F.C. Santos, "Landfill diversion: Moving from sanitary to economic targets," *Cities* 26 (2009): 281.

[32] *Ibid.*, 281.

[33] *Ibid.*, 281.

[34] *Ibid.*, 285.

[35] Ferrara and Missios, 230.

[36] City of Toronto, `Recycling Plastics – The ins and outs," accessed at: http://www.toronto.ca/garbage/bluebox/recycling_plastics.htm. See also: Municipality of Thames Centre, "Permitted Items," accessed at: http://www.thamescentre.on.ca/images/pdf/Enviroment_PDF/2012/2012PermittedItems.pdf. See also: Waste Diversion Ontario, "2006 Residential GAP Diversion Rate Datacall Report," accessed at: http://www.wdo.ca/files/domain4116/2006%20Residential%20GAP%20Diversion%20Rate%20March%205%2008.xls.

seriously calls into question whether program design has such a strong effect after all on waste diversion.

When a municipality has a uniquely tailored program that is measurably successful, it is clear, that to a certain extent at least, this program, and the policies surrounding it, played a significant role in bringing about success. For example in the Town (now City) of Markham, a redesign of their waste program took the needs, desires and potentials of the community into account to create a tailored program. They expanded paper/wood fibre recycling while eliminating the collection of organic waste, but instead promoted an aggressive campaign for backyard composting, 'grasscycling' and waste reduction.[37]

However, when policy and program are not tailored property to the community, it can be a problem. There is a stark difference between diversion in detached households and rented dwellings within the City of Toronto: the averages are 60% and 15% diversion, respectively.[38] In this case, the program clearly is tailored to those living in single homes rather than in dense developments. Arguably, a change in the way the program is administered might be the most effective method of increasing the diversion rate in apartment buildings. However, a strong focus on program might not work as effectively elsewhere.

Something that also became obvious after comparing studies is a difference in culture and the freedoms and restrictions as a result of it. Where in Ontario there is now a standardized minimum for recycling as it exists in the *Waste Diversion Act*, 2002, this is not the case in American states where the responsibility of having a recycling program is at the discretion of local governments, resulting in a patchwork of different programs and policies across the state.[39] Though the concept of culture is very intangible, especially in comparison to a hard number like a

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[37] Anonymous, "Higher diversion versus economic realities," *BioCycle* 36, no. 7 (1995): 56.
[38] Gorrie, 22.
[39] Amara Rozgus, "Taking a diversion: Improving your solid waste diversion plan," *PublicWorks*, July (2005): 47.

diversion rate, it is still important to discuss and attempt to understand the effects of culture on waste diversion.

Overall, programs and the design of them have a significant influence on the motivations behind waste diversion. From the discussion of pricing, however, it is also clear that program design cannot be the sole factor driving higher (and lower) waste creation and diversion rates.

### 2.5 Socio-economic Characteristics

Finally, the third angle from which studies looked at the question of what causes variation in diversion rates across municipalities is one that gives credit to socio-economic characteristics. The link between socioeconomic situation and behaviour is an interesting one that suggests, to at least a certain extent, that the situation in which an individual finds oneself, can largely affect the way one behaves in society.

But what are socio-economic characteristics exactly? For the purpose of this paper, socio-economic characteristics of a community refer to characteristics of the population that are linked to one's place in society both in terms of finances and education. As well, this includes the way one is able to interact with others in society. Together, these characteristics can tell a lot about a community in comparison to another.

Socioeconomics could have an influence on policy, program and pricing decisions or on the willingness and ability of people to follow the program. For example, a poorer community may only be able to afford so much investment in waste management and could choose to have the most economical program possible. A lower diversion rate coming out of this city could certainly be linked to the program it has implemented, however, it could very well be possible that the diversion rate is dependent itself on the socioeconomic characteristics of the community.

Socioeconomics could also explain why different communities could respond to the same waste program and policies differently. Recall the example used earlier, where different outcomes occurred as a result of implementing a mandatory garbage cart in Toronto, Ontario and Portland,

Oregon. Where Toronto has seen general success in increasing its diversion rate, deeming the program successful, the study of Portland found that the program did little in encourage residents to divert their waste. Could socio-economics explain this difference in result?

The study by Callan and Thomas argues that by studying the links between socio-economics and waste diversion, this isolates the influence of programs on people and determines how much actual control over rates of waste diversion exists for political leaders. For example, if in a specific municipality socioeconomics can explain a large proportion of the reasoning for the diversion rate, then perhaps local governments and politicians have less of a chance of being able to increase waste diversion through pricing or policies and programs. In fact, Callan and Thomas argue that knowing how much a municipality can and cannot control is essential for making decisions.[40] Essentially, they argue that by studying both programs and socio-economics in relation to waste diversion, then it is possible to identify the factors that are out of the direct control of government. The study also argues that government officials need to understand more than just program performance to determine success. In addition, they need to understand the shape of the community as well as how that shape has an impact on the program.[41]

Specifically looking at education as a characteristic, study Ferrara and Missios found that holding a university degree, whether undergraduate or graduate, is a major factor in recycling intensity of all materials. It did not say that all uneducated people do not recycle, but they found that only certain materials are highly recycled by those without a university education (i.e. glass).[42] The same study looked at income and homeownership as being strongly linked to the rate of waste diversion as well. Higher incomes and owning a home were positively correlated with a higher rate of diversion.[43] Ferrara and Missios also found that home ownership was also strongly linked to recycling intensity, a household was more likely to recycle if the home was

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[40] Callan and Thomas, 418.
[41] *Ibid.*, 414, 418.
[42] Ferrara and Missios, 231.
[43] *Ibid.*, 231.

owned, for reasons like "attachment to community" and "concerned with perceptions of neighbours."[44]

Another study that found strong links between income and waste diversion is "Municipal Waste Generation and Socioeconomic Drivers: Evidence from Comparing Northern and Southern Italy," written by Mazzanti, Montini and Zoboli. It looked at income variations across 103 Italian provinces over 7 years to see how linked waste diversion was to the average incomes of provinces and where the "delinking" occurred along the economic spectrum.[45] The hypothesis was that lower incomes would have lower recycling rates, and as incomes rose to middle-class, the more recycling rates would rise. However, as incomes rose to a certain point past middle-class, the rate of recycling would drop.[46] The study found evidence of this occurring as well as a positive relationship between population density and recycling.[47]

The study by Caplan, Grijalva and Jakus looked at the city of Ogden, Utah and found that certain groups of people were willing to pay more for enhanced waste services (a modest increase in fees). These groups included women, youth and newcomers, while less wealthy households preferred reduced services so the cost to the household would go down.[48] This is interesting as it directly suggests that who one is within society makes a difference in ones behaviour.

The study by Márquez, Ojeda and Hidalgo looked at "socioeconomic variables and population compositions" in the city of Mexicali, Baja California, Mexico. Commenting on Mexico as a whole, the study notes that there is a stark difference in waste composition between municipalities in northern Mexico and Southern Mexico. Where more organic waste would be found in poorer, southern municipalities, the opposite is true in more wealthy northern

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[44] *Ibid.,* 231.
[45] Massimiliano, Montini, and Zoboli, 51.
[46] *Ibid*., 56.
[47] *Ibid.*, 64.
[48] Arthur J. Caplan, Therese C. Grijalva, and Paul M. Jakus, "Waste not or want not? A contingent ranking analysis of curbside waste disposal options," *Ecological Economics* 43 (2002): 193-4.

communities. Using a cluster analysis and tree classifier, it was found that the socioeconomic status of a family and family structure made impacts on their household waste diversion.[49]

### 2.6 Issues

Some issues were encountered across the review of literature. The main concern was with survey response data – since garbage is something that can be measured, categorized and quantified, it seems inappropriate at times to be relying on households' opinions of what they believe they recycle and throw out. While this seems to be an ideal way to gather such information, that places a lot of trust on the judgement skills of ordinary citizens. Picking up a bag of garbage and tearing it apart to analyze it is much more reliable than asking households what is in the bag. The issue with self-reporting is two-fold. First, only those who already recycle and do it regularly could volunteer to respond.[50] Second, there could be a tendency to over-report the amount of waste diverted. Both are linked to feelings of pride as those who do not recycle could feel ashamed by participation while those who do could be eager to report how much they contribute. This is especially problematic when Likert scales are used to determine diversion rates and other measures that really should be precise since they are quantifiable.[51]

What is argued in Hong and Adams' study is that household level data is better than averaged community-wide data.[52] While this is certainly true if one is looking for localized trends, it is also the case that large sets of averaged data can be beneficial for identifying broader trends across populations. While individual behaviour is something that is important to study, looking at the greater picture and general societal trends can also provide useful information to influence policy.

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[49] Márquez, Ojeda and Hidalgo, 1299.

[50] Callan and Thomas, 412.

[51] Ferrara and Missios, 226. See also Chenyang Xiao and Aaron M. McCright, "Environmental Concern and Sociodemographic Variables: A Studey of Statistical Models," *The Journal of Environmental Education* 38, no. 2 (2007).

[52] Hong and Adams, 505.

## 2.7 Conclusions from Literature Review

What is clear from a review of the literature is that every researcher is on a 'different page of the story'. It seems as though there are many things that affect waste creation and diversion, as is also discussed in studies such as Callan and Thomas.[53] Changing prices or waste management policy will not necessarily affect the diversion rate in every single municipality each and every time. There are many factors that need to be taken into account, along with an understanding that culture and socio-economic characteristics also play a background role in shaping the rate. Similarly, two towns with the same socio-economic profile might have different programs and ways of charging for waste management services, resulting in different rates.

[53] Callan and Thomas, 411.

## 3.0 Research Question and Hypotheses

The research question being discussed in this paper is: How much do socio-economic characteristics of communities explain the variation in waste diversion rates in municipalities across Ontario?

## 3.1 Indicators

As has been identified in the literature review, income and education are very strong indicators of the socio-economic status of households. Therefore, it is essential to link the ideas of income and education to the chosen indicators to be used to measure socio-economic status.

In addition to income and education, population density and region (in Ontario) must also be taken into account. The population density (people per square kilometre) can tell a lot about a community when it is used with other indicators, specifically what the level of urbanization and the sense of 'community' are like. At the same time, the region in which ones lives can greatly affect the way a person goes about their daily life. Realizing that the way of life in Northern Ontario is different due to climate, geography, economy, and population, it seems very necessary to include this idea. Therefore, it is also essential to take these two concepts, population density and region, into account.

Four indicators that were identified as satisfying the four above concepts are as follows: *population density, region in Ontario, percentage of population (over age 15) with a university-level degree, and percentage of rental households in the municipality.* While *population density* and *region* are explained in a fairly straightforward fashion, *percentage of population with a university-level degree* provides the study with an interesting level of variance[54] and will help determine if the highest level of education makes a difference in waste diversion. Percentage of rental communities is meant to be an indirect measure of income. It is generally well known that

[54] (between 0.00% and 32.37%) See Waste Diversion Ontario, "2006 Residential GAP Diversion Rate Datacall Report," accessed at: http://www.wdo.ca/files/domain4116/2006%20Residential%20GAP%20Diversion%20Rate%20March%205%2008.xls.

those with a higher income strongly tend to own their own home, and those with lower incomes and who are more mobile tend to rent. In this way, percentage of rental households measures both income and mobility, two important factors that measure the socio-economic status of communities.

## 3.2 Hypotheses

Hypothesis 1: If *population density* (in people per square kilometre) rises in value, then *waste diversion rate* (%) will rise in value.

Hypothesis 2: If *region* is equal to 3, 4, or 5,[55] then *waste diversion rate* (%) will be higher than if the region equaled 1 or 2.[56]

Hypothesis 3: If *percentage of population over 15 with university degree* rises in value, then *waste diversion rate* (%) will rise in value.

Hypothesis 4: If *percentage of rental households* rises in value, then *waste diversion rate* (%) will decrease in value.

[55] Eastern Ontario (3), Central Ontario (4), Western Ontario (5)
[56] Northwestern Ontario (1), Northeastern Ontario (2)

## 4.0 Methodology

This study uses existing data collected from three sources: waste diversion rate data from Waste Diversion Ontario (2006 Residential Generally Accepted Principles (GAP) Diversion Rate Datacall Report), socio-economic data from Statistics Canada (2006 Community Profiles), and region categorization from Ontario's Ministry of Municipal Affairs and Housing.

## 4.1 Reliability of Data

The Residential GAP Diversion Rate Datacall Report is a report that compiles data in standardized form from every municipality in Ontario each year. Reporting is mandatory if municipalities wish to receive funding from WDO for their waste diversion programs.[57] While it is possible to conceive of many year-to-year consistency issues in collecting and reporting the data, complex calculations achieve the standardization necessary to make proper reporting possible.[58] The mandatory reporting and standardization make the Datacall Reports full of strong and highly reliable data. At the same time, Community Profiles from Statistics Canada which provide very detailed statistics at the municipal level, are also highly reliable due to the methods used to collect and report the data. Since there are various ways of dividing the province of Ontario into regions, it was decided that the Ontario Ministry of Municipal Affairs and Housing (MMAH) categorization of municipalities into five regions would be acceptable. Overall, there are no substantial issues with the reliability of the data used.

## 4.2 Significance of Data

Because the data that are gathered would be averaged across municipalities, some might have issue with the lack of the real variance that could possibly exist within municipalities. While this is a legitimate concern, the goal here is to reveal broader trends. Any trends that are revealed

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[57] Waste Diversion Ontario, "2006 Municipal Datacall Residential GAP Diversion FAQs," accessed at: http://www.wdo.ca/files/domain4116/Background%20information%20for%202006%20Residential%20GAP%20Diversion%20Rate%20March%205%2008.pdf.

[58] *Ibid.*

would be fairly significant since the strong local variance is not present. While it is understood that the averaged data will not provide the absolute greatest variance possible since it is collected at the municipal government level, it is felt that using it is important because, if broader trends exist, they will be revealed.

### 4.3 2006 Residential GAP Diversion Rate Datacall Report

While the WDO dataset includes very detailed information about the waste diversion rate of each municipality, the only information used is the *Total Residential Diversion Rate*, and the names of the municipalities. Because some municipalities join together and provide their residents with waste management services under a waste authority, some municipalities do not appear in name in the dataset. Instead, they are considered part of their waste authority and data is reported in this fashion.

### 4.4 2006 Community Profiles

There is an enormous amount of information in the Community Profiles and only data related to the variables the study is to explore were extracted (see Figure 1 below). For those communities that were included in the WDO report as part of a waste authority, the data were collected for all municipalities that were subject to the authority and were calculated accordingly[59] so that it was comparable to other municipalities.

[59] For example: Bluewater Recycling Association includes seventeen municipalities and data was collected for each. Because diversion rates are not available for each municipality and only for the waste authority itself, the data collected was proportionally combined to achieve a set for the association itself, allowing for comparison. See Appendix 2 for waste authority breakdowns.

| FIGURE 1 – Data lines extracted from 2006 Community Profiles (Statistics Canada) |
|---|
| Population density per square kilometre |
| Total private dwellings occupied by usual residents |
| Number of rented dwellings |
| Total population 15 years and over |
| Total population 15 years and over with university certificate, diploma, or degree |

### 4.5 Ontario Ministry of Municipal Affairs and Housing Region Categorization

The map in Figure 2 shows what this study relies on for determining boundaries of regions in Ontario. While arguments could be made for shifting or completely altering these boundaries, some authority for categorization is necessary, and MMAH fills this requirement. Each of the five regions was given a number, though this number has no value or weighting to it beyond identification of a category (see Figure 2 for details).

**FIGURE 2 – Regions of Ontario (Ministry of Municipal Affairs and Housing[60])**


| | |
|---|---|
| 1 | Northwestern Ontario (NW) |
| 2 | Northeastern Ontario (NE) |
| 3 | Eastern Ontario (E) |
| 4 | Central Ontario (C) |
| 5 | Western Ontario (W) |

[60] Government of Ontario, Ministry of Municipal Affairs and Housing, "Ontario Regional Are Municipal Portals," accessed at: http://www.mah.gov.on.ca/Page5869.aspx.

### 4.6 Additional calculations

To achieve a value for *percentage of rented dwellings* in each municipality, the *number of rented dwellings* was divided by *total private dwellings occupied by usual residents*. To achieve a value for *percentage of population 15 years and over with university certificate, diploma, or degree*, the *total population 15 years and over with university certificate, diploma, or degree* was divided by the *total population 15 years and over*.

After the data was compiled, it was necessary to eliminate a few municipalities from the data list for unsubstantial data. For example, the Township of Hilliard, which appears on the WDO report and has a population of 222, was eliminated because Statistics Canada reported the data unavailable, most likely because of its size. The final list of municipalities (and waste authorities) totaled 196. For the final data set, see Appendix 1

## 5.0 Analysis

### 5.1 Descriptive Statistics

Looking at the SPSS report of descriptive statistics for the four independent variables and rate of waste diversion (dependent variable), there seems to be only a few observations of note. (See Table 1) While the ranges seem to be acceptably wide, the mean for population density seem very low at 191.288 in comparison to the range of 3972.1 with a large standard error of 31.292. It is clear from this that population density data clusters near the lower end of the scale with some outliers dragging the range higher. The high standard deviation of 438.0886 is an indication that the data is not clustered highly around the mean. The high variance is also an indicator that there are strong outliers. Because the independent variable 'Region' is nominal, the mode is included instead, which is 3 (corresponds to Eastern Ontario).

**TABLE 1 – Descriptive Statisitcs**

**Descriptive Statistics**

| | N | Range | Min. | Max. | Mean | | Std. Deviation | Variance |
|---|---|---|---|---|---|---|---|---|
| | Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Statistic |
| Population Density | 196 | 3972.1 | .3 | 3972.4 | 191.288 | 31.2920 | 438.0886 | 191921.651 |
| Region | 196 | 4 | 1 | 5 | 3* | - | - | - |
| % Rental Households | 196 | 45.62% | 0.00% | 45.62% | 18.1603% | 0.73095% | 10.23331% | 104.721 |
| % of Pop'n Over 15 w/University Degree | 196 | 32.37% | 0.00% | 32.37% | 10.8816% | 0.38083% | 5.33157% | 28.426 |
| Total Residential Diversion Rate | 196 | 51.65% | 2.35% | 54.00% | 28.6649% | 0.89442% | 12.52193% | 156.799 |
| Valid N (listwise) | 196 | | | | | | | |

*This value is the mode.

## 5.2 Bi-Variate Analysis

An analysis resulting in Pearson correlation coefficients was used to show the relationship between each of the independent variables and the total residential diversion rate. There was a weak-moderate positive relationship between total residential diversion rate and population density, region and % of population over 15 with a university degree (See Table 2), at .344, .388, and .345, respectively. There is a weak relationship between % of rental households and the total residential diversion rate. All of the correlates are significant at the 0.01 level. These results are also summarized by scatterplot in Figures 3, 4, 5 and 6.

Looking at two other measures of association, the levels of relationship become a bit clearer. Kendall's tau b and Spearman's rho are both measures that identify relationships between the variables, however using different assumptions as a base. (See Table 3) While Kendall's tau b tends to have a lower value than Pearson correlates, Spearman's rho has higher values (with Population Density overtaking Region slightly). With values similar to Pearson correlates, this strengthens the assertion of relationship types mentioned earlier. All of the correlates are significant at the 0.01 level.

**TABLE 2 – Bivariate Analysis 1**

| | | Population Density | Region | % Rental Households | % of Pop'n Over 15 w/University Degree | Total Residential Diversion Rate |
|---|---|---|---|---|---|---|
| Total Residential Diversion Rate | Pearson Correlation | .344** | .388** | .251** | .345** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | |
| | N | 196 | 196 | 196 | 196 | 196 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

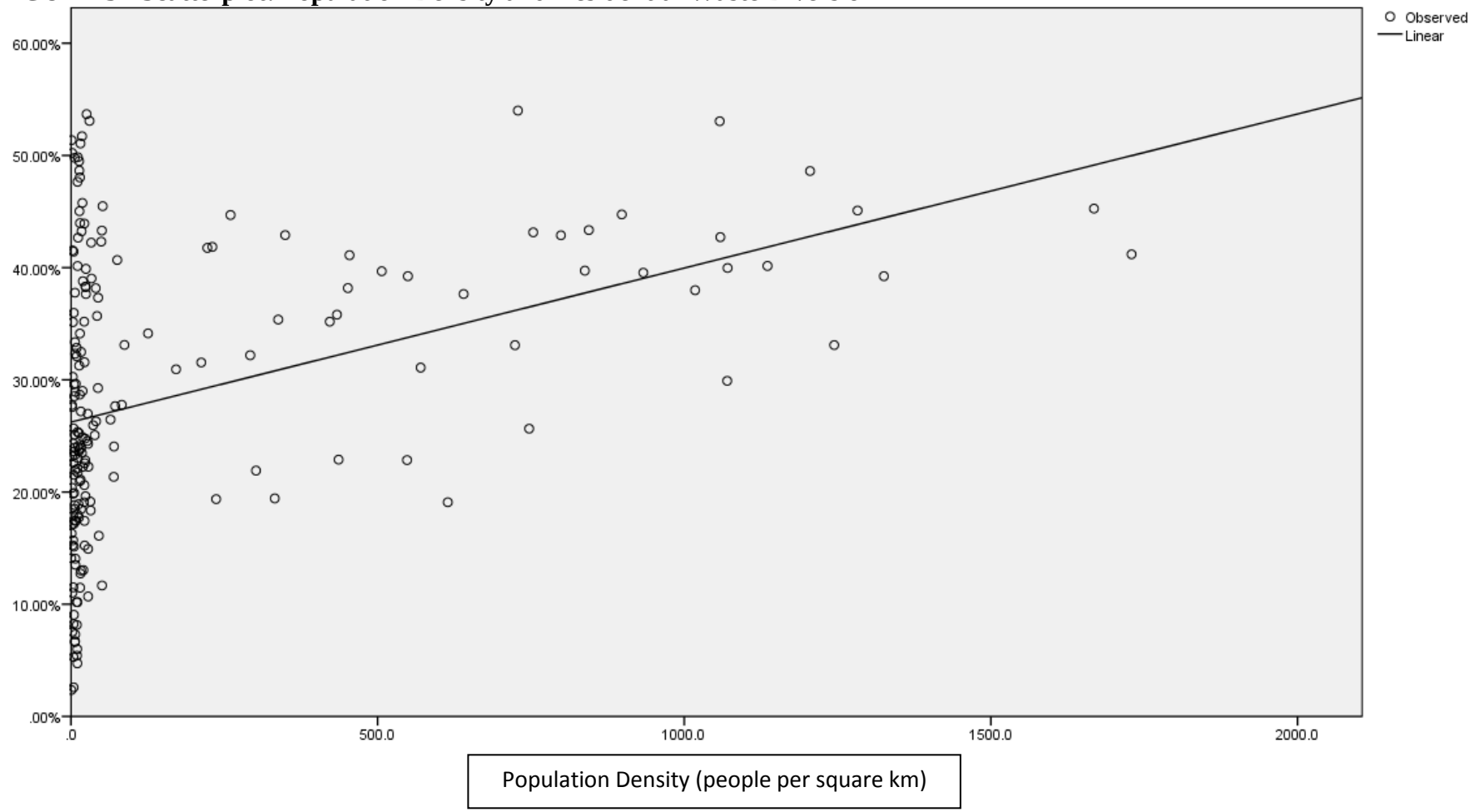
**TABLE 3 - Bivariate Analysis 2**

| | | | Population Density | Region | % Rental Households | % of Pop'n Over 15 w/University Degree |
|---|---|---|---|---|---|---|
| Kendallès tau_b | Total Residential Diversion Rate | Correlation Coefficient | .310** | .320** | .181** | .230** |
| | | Sig. (2-tailed) | .000 | .000 | .000 | .000 |
| | | N | 196 | 196 | 196 | 196 |
| Spearmanès rho | Total Residential Diversion Rate | Correlation Coefficient | .444** | .412** | .256** | .334** |
| | | Sig. (2-tailed) | .000 | .000 | .000 | .000 |
| | | N | 196 | 196 | 196 | 196 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

**FIGURE 3 - Scatterplot: Population Density and Residential Waste Diversion**[61]




[61] The City of Toronto has been removed from this scatterplot due to the extreme skewing of the data, which made it even more unreadable than what exists above.

**FIGURE 4 – Scatterplot: % of Population Over 15 w/University Degree and Total Residential Diversion Rate**

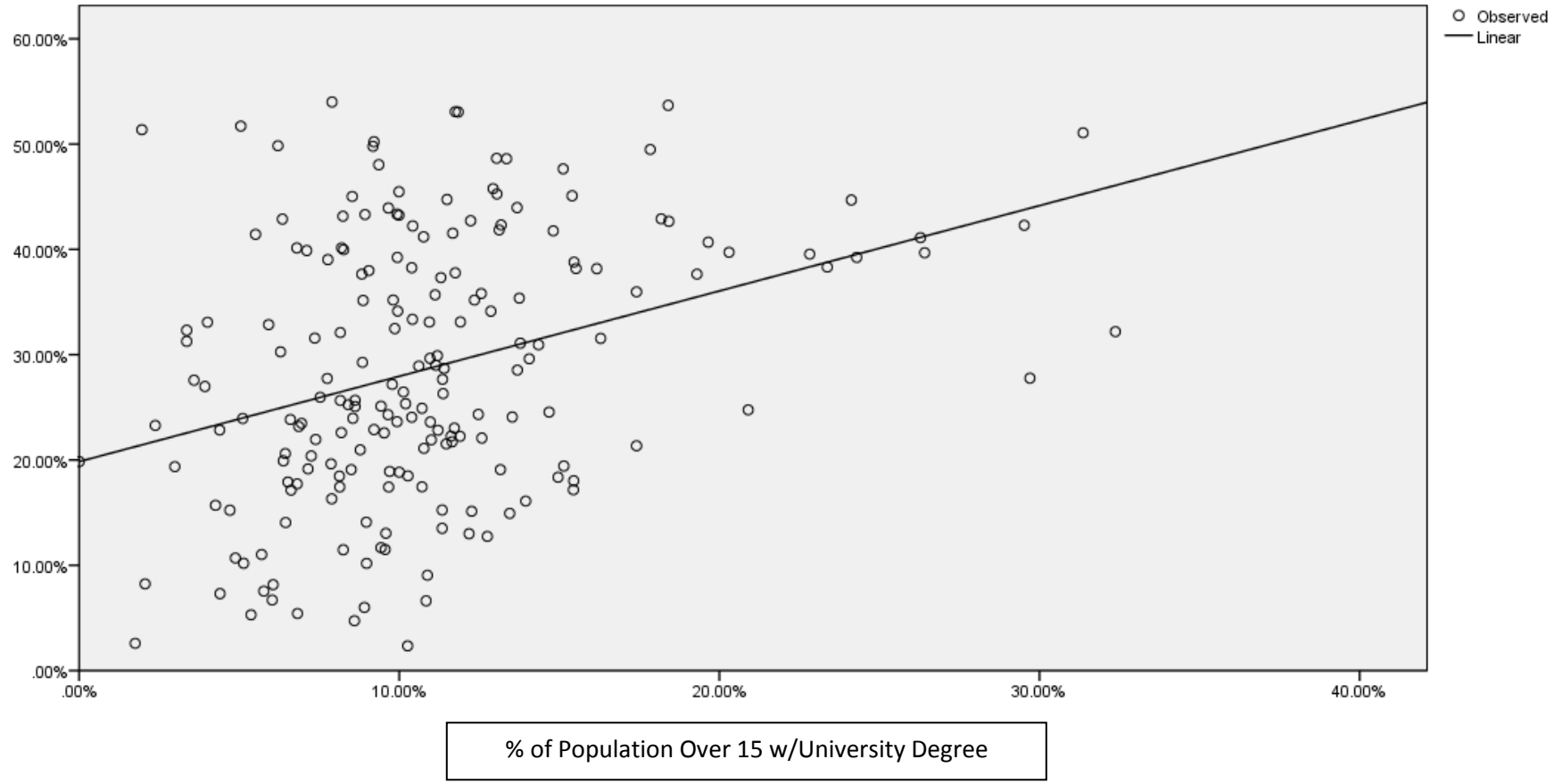


**FIGURE 5 – Scatterplot: % Rental Households and Total Residential Diversion Rate**

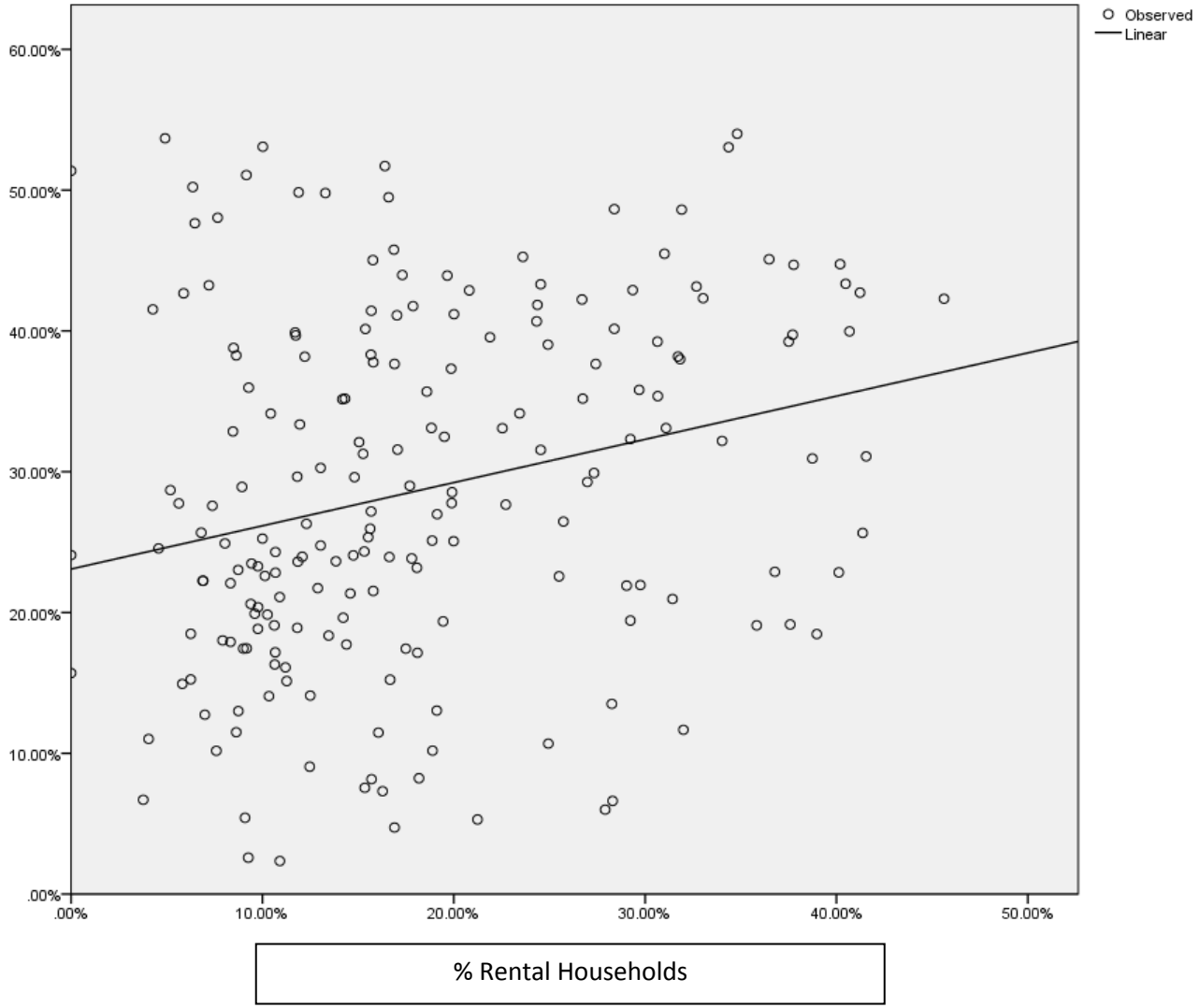


**TABLE 4 - Region in Ontario**

| Region | # of Municipalities Within Region |
|---|---|
| Northwestern Ontario – 1 | 14 |
| Northeastern Ontario – 2 | 52 |
| Eastern Ontario – 3 | 71 |
| Central Ontario – 4 | 13 |
| Western Ontario - 5 | 44 |

### 5.3 Multiple Regression

Multiple regressions were calculated for model which included the four independent variables (Region, % of Population over 15 with a University Degree, Population Density, % Rental Households) and the dependent variable, Total Residential Diversion Rate. The results can be found in Tables 5.1, 5.2 and 5.3 below.

**TABLE 5.1**

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .528[a] | .279 | .264 | 10.74238% |

a. Predictors: (Constant), % Rental Households, Region, % of Pop'n Over 15 w/University Degree, Population Density

**TABLE 5.2**

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 8534.618 | 4 | 2133.655 | 18.489 | .000[b] |
| | Residual | 22041.157 | 191 | 115.399 | | |
| | Total | 30575.775 | 195 | | | |

a. Dependent Variable: Total Residential Diversion Rate

b. Predictors: (Constant), % Rental Households, Region, % of Pop'n Over 15 w/University Degree, Population Density

**TABLE 5.3**

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 9.390 | 2.971 | | 3.161 | .002 |
| | Region | 3.177 | .642 | .314 | 4.950 | .000 |
| | % of Pop'n Over 15 w/University Degree | .572 | .152 | .244 | 3.767 | .000 |
| | Population Density | .004 | .002 | .136 | 1.714 | .088 |
| | % Rental Households | .129 | .092 | .106 | 1.410 | .160 |

a. Dependent Variable: Total Residential Diversion Rate

The results from Tables 5.1, 5.2 and 5.3 of the multiple regression calculations show that the four independent variables in this model explain 27.9% of the variance of the dependent variable ($R^2 = .279$). Using ANOVA, the F value is significant at the .000 level, meaning that the model is a better explanation than just relying on the means.

Looking at the coefficients, the y-intercept is 9.39, meaning that in the impossible scenario that no region was attached to a municipality, the percentage of the population over 15 with a university degree in that municipality was 0%, the population density was 0.00 people per square kilometre, and the percentage of rental households was 0%, the waste diversion rate would then be 9.39%. The strength of the % of population with a University Degree variable is seen here – for every percentage point gained in % of population over 15 with a university degree, the predicted overall waste diversion rate goes up by 0.572%. Likewise for every 1 unit increase in population density and % Rental Households, the corresponding change in waste diversion rate is 0.004% and 0.129% respectively. Using the Beta value, it is clear that the region is the most important predictor (.314), followed by % of population over 15 with university degree (.244), population density (.136), and % Rental Households (.106). While region and % of Population

over 15 with a university degree are significant at the .000 level, population density and % of rental households are not within a truly acceptable significance level.

### 5.4 Discussion

While clear results would have been welcome, the murky ones that resulted were expected. Two major factors were most likely the cause of this, the first being the fact that the data is so heavily averaged, and second, that there are other major factors that contribute to the rate of waste diversion in communities. The results do not discount other studies in their attempts to prove that pricing, policies and programs have an effect on waste diversion.

Looking at Figure 3, the population density versus waste diversion rate, it might be beneficial to look at the data without such high outliers to prevent such skewing of the data. This is probably the reason for the resulting level of correlation that exists between population density and waste diversion. However, looking at the data without the outliers is problematic in itself, since it essentially eliminates a large number of big cities, and smaller, dense municipalities.

It is quite possible that the relationship between region and waste diversion could be stronger if the categories for Northwestern Ontario and Northeastern Ontario were combined into Northern Ontario. It is also possible that these categories are meaningless since they do not contain equal numbers of municipalities. As nominal data, different calculations are necessary.

It is clear that the winning independent variable among the four studied here is education, specifically whether one holds a university-level degree. The Beta, a standardized coefficient, of education is .314. Compared to % of Rental Households at .106, it is clear that education has a moderately significant impact on waste diversion according to this model. Looking at Appendices 3, 4, 5, 6 and 7 at models that include regression models with only one of the independent variables might be deceiving, since it appears (in separate models) that having a university education explains an equal amount of variation (11.9%) as population density.

Because the correlation values are not outstandingly strong or invariably weak, it is hard to say whether the hypotheses presented earlier have been 'proven'. While Hypotheses 1, 2 and 3 could be said to be proven true in a limited sense, Hypothesis 4 is proven false, also in a limited sense, since the correlation is weak (see Figure 6 below).

**FIGURE 6 - Hypotheses**

| **Hypothesis** | **True/False** |
|---|---|
| 1 - If *population density* (in people per square kilometre) rises in value, then *waste diversion rate* (%) will rise in value. | True |
| 2 - If *region* is equal to 3, 4, or 5,[62] then *waste diversion rate* (%) will be higher than if the region equaled 1 or 2.[63] | True |
| 3 - If *percentage of population over 15 with university degree* rises in value, then *waste diversion rate* (%) will rise in value. | True |
| 4 - If *percentage of rental households* rises in value, then *waste diversion rate* (%) will decrease in value. | False |

[62] Eastern Ontario (3), Central Ontario (4), Western Ontario (5)
[63] Northwestern Ontario (1), Northeastern Ontario (2)

## 6.0 Conclusions

While studying garbage is not a glamorous topic, this does not mean it is unimportant and has no significant value. The number of studies dealing with waste and the diversion of it is surprising, as are the possibilities for factors that influence it. Where pricing, and policies and programs were discussed in the literature review, this paper focused solely on socio-economic characteristics. Specifically, it looked at indicators of Ontarians' status in society: where in the province ones lives, how urban that municipality is, what level of education one has, and how transient one is. The latter two factors are indirect measures of one's income. To look into this, statistics were gathered on municipalities, where in the province they were located by region, the population density, the % of the population that had a university degree, and the % of rental households in the municipality.

What are the implications of the results discussed earlier? Perhaps it suggests that municipalities that do not have a lot of university-educated people should not bother with a waste diversion program. However, in the context of other studies, this is certainly not the case. Other studies have shown that having a certain types of recycling or diversion programs encourages recycling. Other studies still show that waste diversion is encouraged by charging for each bag at the curb.

What needs to be kept in mind for this study is the lack of depth into the extreme variances within municipalities and the fact that other factors, such as pricing, policies and programs are not studied here. The most interesting and powerful study on the subject would be one that was able to sample at a census tract level. While socio-economic data is quite possible to come by at this level, it would take extensive ground-work to obtain data on waste collection and diversion for each and every census tract.

However, this is not to say that this study was unimportant and has no real value. It seems surprising at all that even significant weak relationships exist in data that covers Canada's second-largest province. The extremely averaged data does not take into account any local

variations that happen between neighbourhoods, which would certainly explain the lack of relationship coming from the rental household variable. Other studies have shown a link between home ownership and waste diversion that could not be shown in a study that used such averaged data as this.

To make this study stronger, one suggestion would be to strengthen *region* as an indicator. Looking at a breakdown of municipalities by region, they are very unequal. Perhaps a more scientific way of assigning region would be most appropriate here and would provide more definitive results. As well, if the definition of socio-economic characteristics was expanded to include other factors, it is possible that a stronger explanatory power could be found through a different model.

In terms of value, this study confirms, while perhaps not in the concrete terms that an exhaustive study might be able to provide, that socio-economics should have a place in the study of waste diversion. Characteristics of a population are clearly important and should be taken into consideration when changes are made to waste management programs. While localized studies are obviously the best, larger studies can show indications of broad and strong trends that these localized studies are not able to.

For those who view the enormous amount of waste being produced as a challenge that needs to be dealt with, waste diversion remains a solid method of eliminating it. However a quote from Albert Einstein needs to be kept in mind: "A problem cannot be solved with the type of thinking that created it."[64] It is clear that dealing with the problem needs to move beyond just diverting what is produced. Instead, a community culture change is needed, whereby a realization that a reduction in production of waste brings benefits equal or greater to, diversion.

[64] Manfred Fehr, "A Successful Pilot Project of Decentralized Household Waste Management in Brazil," *The Environmentalist* 26 (2006): 24.

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**APPENDICES**

## APPENDIX 1 – Data Set

| Municipality | Population Density (Population per square kilometre) | Region | % Rental Households | % of Population Over 15 with University Degree | Total Residential Diversion Rate |
|---|---|---|---|---|---|
| | | | | | % |
| ADDINGTON HIGHLANDS, TOWNSHIP OF | 1.9 | 3 | 18.10% | 6.62% | 17.14% |
| ADMASTON/BROMLEY, TOWNSHIP OF | 5.2 | 3 | 9.60% | 6.38% | 19.92% |
| ALFRED AND PLANTAGENET, TOWNSHIP OF | 22.1 | 3 | 17.06% | 7.36% | 31.57% |
| ALGONQUIN HIGHLANDS,TOWNSHIP OF | 2.0 | 3 | 6.36% | 9.21% | 50.22% |
| AMARANTH, TOWNSHIP OF | 14.5 | 4 | 7.66% | 9.36% | 48.04% |
| ARMOUR, TOWNSHIP OF | 7.6 | 2 | 11.82% | 10.96% | 29.65% |
| ARNPRIOR, TOWN OF | 549.4 | 3 | 37.50% | 9.94% | 39.24% |
| ASHFIELD-COLBORNE-WAWANOSH, TOWNSHIP OF | 9.2 | 5 | 15.05% | 8.16% | 32.10% |
| ATHENS, TOWNSHIP OF | 24.4 | 3 | 11.71% | 7.11% | 39.89% |
| ATIKOKAN, TOWNSHIP OF | 10.4 | 1 | 16.90% | 8.60% | 4.73% |
| AUGUSTA, TOWNSHIP OF | 23.9 | 3 | 8.63% | 10.39% | 38.26% |
| AYLMER, TOWN OF | 1,135.7 | 5 | 28.39% | 8.20% | 40.15% |
| BALDWIN, TOWNSHIP OF | 6.8 | 2 | 16.28% | 4.40% | 7.31% |
| BARRIE, CITY OF | 1,668.1 | 4 | 23.61% | 13.05% | 45.26% |
| BAYHAM, MUNICIPALITY OF | 27.5 | 5 | 19.13% | 3.93% | 26.98% |
| BECKWITH, TOWNSHIP OF | 26.6 | 3 | 4.57% | 14.68% | 24.55% |
| BLACK RIVER-MATHESON, TOWNSHIP OF | 2.3 | 2 | 15.35% | 5.77% | 7.55% |
| BLIND RIVER, TOWN OF | 7.3 | 2 | 28.26% | 11.34% | 13.51% |
| BLUEWATER RECYCLING ASSOCIATION | 21.8 | 5 | 19.66% | 9.66% | 43.93% |
| BONFIELD, TOWNSHIP OF | 9.8 | 2 | 9.09% | 6.82% | 5.42% |

| | | | | | |
|---|---|---|---|---|---|
| BONNECHERE VALLEY, TOWNSHIP OF | 6.2 | 3 | 13.29% | 9.18% | 49.79% |
| BRANT, COUNTY OF | 40.8 | 5 | 12.30% | 11.37% | 26.30% |
| BRANTFORD, CITY OF | 1,244.5 | 5 | 31.09% | 10.94% | 33.10% |
| BROCKVILLE, CITY OF | 1,058.8 | 3 | 41.23% | 12.23% | 42.72% |
| BRUCE AREA SOLID WASTE RECYCLING | 18.8 | 5 | 17.70% | 11.14% | 29.00% |
| BRUDENELL, LYNDOCH AND RAGLAN, TOWNSHIP OF | 2.1 | 3 | 7.38% | 3.59% | 27.58% |
| CALLANDER, MUNICIPALITY OF | 32.2 | 2 | 13.46% | 14.96% | 18.36% |
| CALVIN, MUNICIPALITY OF | 4.4 | 2 | 18.18% | 2.06% | 8.23% |
| CARLETON PLACE, TOWN OF | 1,070.0 | 3 | 27.33% | 11.19% | 29.91% |
| CARLING, TOWNSHIP OF | 4.6 | 2 | 9.28% | 17.41% | 35.97% |
| CARLOW MAYO, TOWNSHIP OF | 2.4 | 3 | 4.05% | 5.70% | 11.02% |
| CASEY, TOWNSHIP OF | 4.8 | 2 | 14.81% | 14.06% | 29.61% |
| CASSELMAN, VILLAGE OF | 640.2 | 3 | 27.42% | 19.30% | 37.65% |
| CENTRAL ELGIN, MUNICIPALITY OF | 45.4 | 5 | 11.20% | 13.95% | 16.10% |
| CENTRAL FRONTENAC, TOWNSHIP OF | 4.8 | 3 | 12.47% | 10.88% | 9.05% |
| CENTRAL MANITOULIN, TOWNSHIP OF | 4.5 | 2 | 15.79% | 11.47% | 21.53% |
| CHATHAM-KENT, MUNICIPALITY OF | 44.0 | 5 | 26.98% | 8.85% | 29.27% |
| CHATSWORTH, TOWNSHIP OF | 10.7 | 5 | 7.59% | 8.98% | 10.18% |
| CHISHOLM, TOWNSHIP OF | 6.4 | 2 | 9.00% | 8.14% | 17.44% |
| CLARENCE-ROCKLAND, CITY OF | 70.1 | 3 | 14.75% | 10.39% | 24.06% |
| COCHRANE TEMISKAMING WASTE MANAGEMENT BOARD | 10.1 | 2 | 27.91% | 8.91% | 6.00% |
| CONMEE, TOWNSHIP OF | 4.4 | 1 | 9.26% | 1.75% | 2.59% |
| CORNWALL, CITY OF | 747.1 | 3 | 41.37% | 8.16% | 25.65% |
| DEEP RIVER, TOWN OF | 82.9 | 3 | 19.89% | 29.70% | 27.77% |
| DESERONTO, TOWN OF | 724.0 | 3 | 22.54% | 4.01% | 33.09% |
| DRUMMOND-NORTH ELMSLEY, TOWNSHIP OF | 19.5 | 3 | 6.89% | 11.90% | 22.25% |
| DRYDEN, CITY OF | 125.7 | 1 | 23.44% | 9.95% | 34.14% |
| DURHAM, REGIONAL MUNICIPALITY OF | 222.4 | 4 | 17.87% | 14.81% | 41.76% |
| DUTTON-DUNWICH, MUNICIPALITY OF | 13.0 | 5 | 14.39% | 6.81% | 17.73% |
| DYSART ET AL, | 3.7 | 3 | 15.32% | 12.47% | 24.33% |

| | | | | | |
|---|---|---|---|---|---|
| TOWNSHIP OF | | | | | |
| EAST FERRIS, TOWNSHIP OF | 28.0 | 2 | 5.81% | 13.45% | 14.93% |
| EAST GARAFRAXA, TOWNSHIP OF | 14.4 | 5 | 5.19% | 11.40% | 28.69% |
| EAST LUTHER GRAND VALLEY, TOWNSHIP OF | 18.0 | 4 | 16.40% | 5.05% | 51.71% |
| EDWARDSBURGH CARDINAL, TOWNSHIP OF | 21.5 | 3 | 14.31% | 9.81% | 35.19% |
| ELIZABETHTOWN-KITLEY, TOWNSHIP OF | 18.4 | 3 | 8.04% | 10.71% | 24.91% |
| ELLIOT LAKE, CITY OF | 16.5 | 2 | 38.97% | 8.13% | 18.47% |
| EMO, TOWNSHIP OF | 6.4 | 1 | 28.30% | 10.84% | 6.62% |
| ENNISKILLEN, TOWNSHIP OF | 9.2 | 3 | 18.89% | 5.14% | 10.19% |
| ESPANOLA, TOWN OF | 64.5 | 2 | 25.73% | 10.13% | 26.46% |
| ESSEX-WINDSOR SOLID WASTE AUTHORITY | 212.5 | 5 | 24.54% | 16.29% | 31.55% |
| FORT FRANCES, TOWN OF | 301.8 | 1 | 29.03% | 11.00% | 21.91% |
| FRONT OF YONGE, TOWNSHIP OF | 21.9 | 3 | 9.39% | 6.44% | 20.61% |
| FRONTENAC ISLANDS, TOWNSHIP OF | 10.6 | 3 | 8.33% | 12.58% | 22.08% |
| GANANOQUE, TOWN OF | 753.8 | 3 | 32.68% | 8.24% | 43.15% |
| GEORGIAN BLUFFS, TOWNSHIP OF | 17.4 | 5 | 7.20% | 9.99% | 43.24% |
| GILLIES, TOWNSHIP OF | 5.9 | 2 | 9.76% | 10.00% | 18.84% |
| GREATER MADAWASKA, TOWNSHIP OF | 2.7 | 3 | 6.25% | 11.34% | 15.25% |
| GREATER NAPANEE, TOWNSHIP OF | 33.5 | 3 | 24.92% | 7.77% | 39.03% |
| GREATER SUDBURY, CITY OF | 49.3 | 2 | 33.03% | 13.18% | 42.32% |
| GREY HIGHLANDS, MUNICIPALITY OF | 10.8 | 5 | 12.89% | 11.65% | 21.73% |
| GUELPH, CITY OF | 1,325.5 | 5 | 30.64% | 24.29% | 39.24% |
| HALDIMAND, COUNTY OF | 36.1 | 5 | 15.63% | 7.53% | 25.95% |
| HALTON, REGIONAL MUNICIPALITY OF | 454.2 | 4 | 17.03% | 26.28% | 41.11% |
| HAMILTON, CITY OF | 451.6 | 4 | 31.72% | 15.52% | 38.18% |
| HANOVER, TOWN OF | 728.8 | 5 | 34.81% | 7.90% | 54.00% |
| HARLEY, TOWNSHIP OF | 6.0 | 2 | 9.76% | 2.38% | 23.28% |
| HASTINGS HIGHLANDS, MUNICIPALITY OF | 4.2 | 3 | 6.80% | 8.62% | 25.67% |
| HAWKESBURY JOINT RECYCLING | 50.7 | 3 | 32.00% | 9.43% | 11.67% |
| HIGHLANDS EAST, MUNICIPALITY OF | 4.4 | 3 | 15.69% | 5.51% | 41.43% |
| HORTON, TOWNSHIP OF | 17.7 | 3 | 9.43% | 6.95% | 23.48% |
| HOWICK, TOWNSHIP OF | 13.5 | 5 | 15.26% | 3.36% | 31.27% |
| HUDSON, TOWNSHIP OF | 3.4 | 1 | 0.00% | 4.26% | 15.70% |

| | | | | | |
|---|---|---|---|---|---|
| HURON SHORES, MUNICIPALITY OF | 3.7 | 2 | 8.63% | 9.56% | 11.50% |
| JOHNSON, TOWNSHIP OF | 5.9 | 2 | 18.87% | 9.43% | 25.11% |
| KAWARTHA LAKES, CITY OF | 24.4 | 3 | 16.90% | 8.83% | 37.65% |
| KEARNEY, TOWN OF | 1.5 | 2 | 5.63% | 7.75% | 27.75% |
| KENORA, CITY OF | 72.0 | 1 | 22.72% | 11.35% | 27.66% |
| KERNS, TOWNSHIP OF | 3.6 | 2 | 8.33% | 6.52% | 17.91% |
| KILLALOE, HAGARTY, AND RICHARDS, TOWNSHIP OF | 6.4 | 3 | 12.08% | 8.55% | 23.96% |
| KILLARNEY, MUNICIPALITY OF | 0.3 | 2 | 12.50% | 8.97% | 14.10% |
| KINGSTON, CITY OF | 260.2 | 3 | 37.76% | 24.12% | 44.69% |
| KIRKLAND LAKE, TOWN OF | 31.5 | 2 | 37.58% | 7.15% | 19.15% |
| LANARK HIGHLANDS, TOWNSHIP OF | 5.0 | 3 | 11.85% | 10.97% | 23.61% |
| LAURENTIAN HILLS, TOWN OF | 4.4 | 3 | 10.13% | 8.19% | 22.60% |
| LEEDS AND THE THOUSAND ISLANDS, TOWNSHIP OF | 15.5 | 3 | 6.99% | 12.75% | 12.74% |
| LONDON, CITY OF | 837.9 | 5 | 37.71% | 20.30% | 39.73% |
| LOYALIST, TOWNSHIP OF | 44.3 | 3 | 19.86% | 11.30% | 37.32% |
| MACDONALD, MEREDITH & ABERDEEN ADDITIONAL, TOWNSHIP OF | 9.6 | 2 | 15.70% | 6.06% | 8.16% |
| MACHAR, TOWNSHIP OF | 4.7 | 2 | 10.67% | 15.44% | 17.17% |
| MADAWASKA VALLEY, TOWNSHIP OF | 6.5 | 3 | 15.79% | 11.75% | 37.77% |
| MAGNETAWAN, MUNICIPALITY OF | 3.1 | 2 | 14.18% | 8.87% | 35.15% |
| MALAHIDE, TOWNSHIP OF | 22.3 | 5 | 16.67% | 4.71% | 15.23% |
| MARATHON, TOWN OF | 22.7 | 1 | 25.50% | 9.53% | 22.57% |
| MATTAWA, TOWN OF | 548.0 | 2 | 40.12% | 4.39% | 22.85% |
| MCDOUGALL, MUNICIPALITY OF | 10.3 | 2 | 7.92% | 15.45% | 18.02% |
| MCKELLAR, TOWNSHIP OF | 6.1 | 2 | 6.25% | 10.27% | 18.49% |
| MCMURRICH/MONTEITH, TOWNSHIP OF | 2.9 | 2 | 13.04% | 6.29% | 30.27% |
| MCNAB-BRAESIDE, TOWNSHIP OF | 28.4 | 3 | 6.89% | 11.62% | 22.26% |
| MEAFORD, MUNICIPALITY OF | 18.6 | 5 | 16.87% | 12.93% | 45.77% |
| MELANCTHON, TOWNSHIP OF | 9.3 | 5 | 8.46% | 5.92% | 32.86% |
| MERRICKVILLE-WOLFORD, VILLAGE OF | 13.4 | 3 | 16.59% | 17.84% | 49.49% |

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|---|---|---|---|---|---|
| MINDEN HILLS, TOWNSHIP OF | 6.6 | 3 | 11.95% | 10.41% | 33.36% |
| MISSISSIPPI MILLS, TOWN OF | 23.1 | 3 | 13.04% | 20.90% | 24.76% |
| MONO, TOWN OF | 25.5 | 4 | 4.91% | 18.40% | 53.68% |
| MONTAGUE, TOWNSHIP OF | 13.0 | 3 | 10.00% | 8.41% | 25.25% |
| MULMUR, TOWNSHIP OF | 11.6 | 4 | 5.88% | 18.42% | 42.67% |
| MUSKOKA, DISTRICT MUNICIPALITY OF | 14.8 | 4 | 17.31% | 13.68% | 43.97% |
| NAIRN & HYMAN, TOWNSHIP OF | 3.1 | 2 | 10.26% | 0.00% | 19.85% |
| NEEBING, MUNICIPALITY OF | 2.5 | 1 | 4.27% | 11.67% | 41.53% |
| NEWBURY, VILLAGE OF | 236.7 | 5 | 19.44% | 2.99% | 19.37% |
| NIAGARA, REGIONAL MUNICIPALITY OF | 230.5 | 4 | 24.37% | 13.12% | 41.85% |
| NORFOLK, COUNTY OF | 38.9 | 5 | 19.99% | 8.62% | 25.07% |
| NORTH BAY, CITY OF | 171.4 | 2 | 38.74% | 14.35% | 30.94% |
| NORTH DUNDAS, TOWNSHIP OF | 22.0 | 3 | 17.49% | 9.67% | 17.43% |
| NORTH FRONTENAC, TOWNSHIP OF | 1.7 | 3 | 9.77% | 7.25% | 20.38% |
| NORTH GLENGARRY, TOWNSHIP OF | 16.6 | 3 | 19.51% | 9.86% | 32.48% |
| NORTH GRENVILLE, MUNICIPALITY OF | 40.5 | 3 | 12.21% | 16.17% | 38.17% |
| NORTH HURON, TOWNSHIP OF | 28.0 | 5 | 24.94% | 4.88% | 10.69% |
| NORTH STORMONT, TOWNSHIP OF | 13.1 | 3 | 13.84% | 9.93% | 23.64% |
| NORTHEASTERN MANITOULIN & ISLANDS, TOWN OF | 5.5 | 2 | 19.91% | 13.69% | 28.54% |
| NORTHERN BRUCE PENINSULA, MUNICIPALITY OF | 4.9 | 5 | 11.27% | 12.26% | 15.13% |
| NORTHUMBERLAND, COUNTY OF | 42.5 | 3 | 18.59% | 11.12% | 35.69% |
| OCONNOR, TOWNSHIP OF | 6.6 | 1 | 3.77% | 6.03% | 6.70% |
| OLIVER PAIPOONGE, MUNICIPALITY OF | 16.4 | 1 | 8.74% | 12.18% | 13.00% |
| ORANGEVILLE, TOWN OF | 1,729.3 | 4 | 20.01% | 10.76% | 41.19% |
| ORILLIA, CITY OF | 1,057.8 | 4 | 34.36% | 11.84% | 53.05% |
| OTTAWA VALLEY WASTE RECOVERY CENTRE | 51.7 | 3 | 31.01% | 9.99% | 45.48% |
| OTTAWA, CITY OF | 292.3 | 3 | 34.02% | 32.37% | 32.19% |
| OWEN SOUND, CITY OF | 898.1 | 5 | 40.19% | 11.49% | 44.74% |
| OXFORD, RESTRUCTURED COUNTY OF | 50.4 | 5 | 24.54% | 8.93% | 43.31% |

| | | | | | |
|---|---|---|---|---|---|
| PAPINEAU-CAMERON, TOWNSHIP OF | 1.9 | 2 | 18.07% | 6.86% | 23.18% |
| PARRY SOUND, TOWN OF | 436.4 | 2 | 36.78% | 9.21% | 22.89% |
| PEEL, REGIONAL MUNICIPALITY OF | 933.2 | 4 | 21.89% | 22.82% | 39.55% |
| PERRY, TOWNSHIP OF | 10.8 | 2 | 15.38% | 6.80% | 40.14% |
| PERTH, TOWN OF | 570.2 | 3 | 41.55% | 13.78% | 31.09% |
| PETERBOROUGH, CITY OF | 1,282.6 | 3 | 36.48% | 15.40% | 45.09% |
| PETERBOROUGH, COUNTY OF (minus City of Peterborough) | 15.5 | 3 | 9.16% | 31.36% | 51.07% |
| PLYMPTON-WYOMING, TOWN OF | 23.5 | 5 | 10.68% | 11.21% | 22.83% |
| POWASSAN, MUNICIPALITY OF | 14.9 | 2 | 16.06% | 8.25% | 11.47% |
| PRESCOTT,TOWN OF | 844.4 | 3 | 40.48% | 9.93% | 43.35% |
| PRINCE, TOWNSHIP OF | 11.5 | 2 | 0.00% | 13.53% | 24.08% |
| QUINTE WASTE SOLUTIONS | 33.0 | 3 | 26.70% | 10.42% | 42.23% |
| RENFREW, TOWN OF | 614.4 | 3 | 35.83% | 8.50% | 19.09% |
| RIDEAU LAKES, TOWNSHIP OF | 14.6 | 3 | 10.43% | 12.86% | 34.13% |
| RUSSELL, TOWNSHIP OF | 69.8 | 3 | 14.59% | 17.41% | 21.35% |
| SABLES-SPANISH RIVERS, TOWNSHIP OF | 4.0 | 2 | 21.24% | 5.37% | 5.30% |
| SARNIA, CITY OF | 433.8 | 5 | 29.69% | 12.56% | 35.81% |
| SAULT STE. MARIE, CITY OF | 338.0 | 2 | 30.66% | 13.75% | 35.37% |
| SEGUIN, TOWNSHIP OF | 7.3 | 2 | 8.93% | 10.61% | 28.92% |
| SHELBURNE, TOWN OF | 798.9 | 5 | 20.81% | 6.35% | 42.88% |
| SIMCOE, COUNTY OF | 87.2 | 5 | 18.83% | 11.91% | 33.11% |
| SIOUX LOOKOUT, TOWN OF | 13.7 | 1 | 28.39% | 13.04% | 48.65% |
| SIOUX NARROWS NESTOR FALLS, TOWNSHIP OF | 0.6 | 1 | 10.91% | 10.26% | 2.35% |
| SMITHS FALLS, TOWN OF | 1,070.7 | 3 | 40.68% | 8.26% | 39.97% |
| SOUTH DUNDAS, TOWNSHIP OF | 20.3 | 3 | 19.11% | 9.58% | 13.04% |
| SOUTH FRONTENAC, TOWNSHIP OF | 19.4 | 3 | 8.49% | 15.46% | 38.79% |
| SOUTH GLENGARRY, TOWNSHIP OF | 21.3 | 3 | 10.62% | 13.16% | 19.09% |
| SOUTH STORMONT, TOWNSHIP OF | 28.0 | 3 | 10.68% | 9.65% | 24.30% |
| SOUTHGATE, TOWNSHIP OF | 11.1 | 5 | 11.89% | 6.21% | 49.84% |
| SOUTHWEST MIDDLESEX, MUNICIPALITY OF | 13.8 | 5 | 17.80% | 6.60% | 23.84% |

| | | | | | |
|---|---|---|---|---|---|
| SOUTHWOLD, TOWNSHIP OF | 15.7 | 5 | 10.90% | 10.77% | 21.10% |
| SPANISH, TOWN OF | 6.9 | 2 | 29.23% | 3.36% | 32.32% |
| ST. CLAIR, TOWNSHIP OF | 23.7 | 5 | 14.22% | 7.87% | 19.63% |
| ST. THOMAS, CITY OF | 1,017.7 | 5 | 31.83% | 9.05% | 37.99% |
| STONE MILLS, TOWNSHIP OF | 11.0 | 3 | 8.73% | 11.72% | 23.03% |
| STRATFORD, CITY OF | 1,205.1 | 5 | 31.91% | 13.35% | 48.61% |
| STRONG, TOWNSHIP OF | 8.4 | 2 | 9.17% | 10.71% | 17.45% |
| SUNDRIDGE, VILLAGE OF | 422.0 | 2 | 26.74% | 12.35% | 35.19% |
| TARBUTT & TARBUTT ADDITIONAL, TOWNSHIP OF | 7.3 | 2 | 10.34% | 6.45% | 14.06% |
| TAY VALLEY, TOWNSHIP OF | 10.7 | 3 | 6.47% | 15.12% | 47.65% |
| THAMES CENTRE, MUNICIPALITY OF | 30.2 | 5 | 10.02% | 11.75% | 53.08% |
| THE ARCHIPELAGO, TOWNSHIP OF | 1.0 | 2 | 0.00% | 1.96% | 51.37% |
| THE BLUE MOUNTAINS, TOWN OF | 23.8 | 5 | 15.67% | 23.37% | 38.32% |
| THE NATION MUNICIPALITY | 16.2 | 3 | 15.68% | 9.78% | 27.18% |
| THUNDER BAY, CITY OF | 332.3 | 1 | 29.23% | 15.14% | 19.43% |
| TIMMINS, CITY OF | 14.5 | 2 | 31.43% | 8.78% | 20.96% |
| TORONTO, CITY OF | 3,972.4 | 4 | 45.62% | 29.52% | 42.29% |
| TRI-NEIGHBOURS | 10.9 | 2 | 15.53% | 10.20% | 25.35% |
| WATERLOO, REGIONAL MUNICIPALITY OF | 349.3 | 5 | 29.35% | 18.18% | 42.90% |
| WELLINGTON, COUNTY OF | 75.4 | 5 | 24.33% | 19.65% | 40.68% |
| WEST ELGIN, MUNICIPALITY OF | 16.6 | 5 | 16.63% | 5.11% | 23.94% |
| WEST GREY, MUNICIPALITY OF | 13.9 | 5 | 15.77% | 8.53% | 45.03% |
| WEST NIPISSING, MUNICIPALITY OF | 6.7 | 2 | 29.75% | 7.39% | 21.95% |
| WHITESTONE, MUNICIPALITY OF | 1.1 | 2 | 10.64% | 7.89% | 16.31% |
| WHITEWATER REGION, TOWNSHIP OF | 12.3 | 3 | 11.82% | 9.70% | 18.91% |
| YORK, REGIONAL MUNICIPALITY OF | 506.7 | 4 | 11.74% | 26.41% | 39.68% |

**APPENDIX 2 – Waste Authorities**

| Municipality | Population Density (people per square km) | Region | % Rental Households | % of Population Over 15 with University Degree | Total Residential Diversion Rate |
|---|---|---|---|---|---|
| | | | | | % |
| **BLUEWATER RECYCLING ASSOCIATION** | **21.8** | **5** | **19.66%** | **9.66%** | 43.9% |
| Bluewater | 17.1 | 5 | 16.64% | 9.64% | - |
| Brooke-Alvinston | 8.5 | 5 | 20.10% | 5.76% | - |
| Central Huron | 17.1 | 5 | 17.06% | 10.98% | - |
| Dawn-Euphemia | 4.9 | 5 | 20.50% | 3.99% | - |
| Goderich | 956.1 | 5 | 29.34% | 10.93% | - |
| Huron East | 13.9 | 5 | 20.85% | 6.02% | - |
| Lambton Shores | 33.7 | 5 | 17.37% | 10.23% | - |
| Middlesex Centre | 26.5 | 5 | 11.57% | 18.65% | - |
| Morris-Turnberry | 9.0 | 5 | 13.04% | 6.40% | - |
| North Perth | 24.8 | 5 | 25.14% | 6.71% | - |
| Oil Springs | 87.7 | 5 | 14.55% | 7.14% | - |
| Perth South | 10.5 | 5 | 18.44% | 8.65% | - |
| South Huron | 23.5 | 5 | 27.76% | 7.08% | - |
| Southwest Middlesex | 13.8 | 5 | 17.80% | 6.60% | - |
| St. Marys | 530.2 | 5 | 19.20% | 10.45% | - |
| Strathroy-Caradoc | 72.9 | 5 | 19.55% | 9.48% | - |
| West Perth | 15.3 | 5 | 17.04% | 8.21% | - |
| **BRUCE AREA SOLID WASTE RECYCLING** | **18.8** | **5** | **17.70%** | **11.14%** | 29.0% |
| Arran-Elderslie | 14.7 | 5 | 17.40% | 7.86% | - |
| Brockton | 17.1 | 5 | 19.14% | 8.54% | - |
| Huron-Kinloss | 14.8 | 5 | 14.81% | 11.59% | - |
| Kincardine | 20.8 | 5 | 18.15% | 12.65% | - |
| Saugeen Shores | 68.7 | 5 | 17.89% | 16.68% | - |
| South Bruce Peninsula | 15.8 | 5 | 17.60% | 9.75% | - |
| South Bruce | 12.2 | 5 | 17.63% | 6.06% | - |
| **QUINTE WASTE SOLUTIONS** | **33.0** | **3** | **26.70%** | **10.42%** | 42.2% |
| Belleville | 197.8 | 3 | 37.19% | 12.77% | - |
| Centre Hastings | 19.7 | 3 | 16.86% | 8.44% | - |
| Madoc Township | 7.7 | 3 | 5.77% | 6.96% | - |
| Marmora and Lake | 7.3 | 3 | 17.50% | 5.32% | - |

| | | | | | |
|---|---|---|---|---|---|
| Prince Edward | 24.3 | 3 | 18.87% | 13.86% | - |
| Quinte West | 86.5 | 3 | 25.93% | 7.45% | - |
| Stirling-Rawdon | 17.5 | 3 | 12.74% | 7.86% | - |
| Tweed | 6.3 | 3 | 15.32% | 8.06% | - |
| Tyendinaga (Township) | 13.0 | 3 | 10.58% | 6.14% | - |
| TRI-NEIGHBOURS | **10.9** | **2** | **15.53%** | **10.20%** | 25.4% |
| Thessalon, Town of | 299.9 | 2 | 23.81% | 5.91% | - |
| Bruce Mines, Town of | 95.3 | 2 | 6.12% | 12.37% | - |
| Plummer Additional, Township of | 2.8 | 2 | 7.69% | 16.67% | - |
| **HAWKESBURY JOINT RECYCLING** | **50.7** | **3** | 32.00% | **9.43%** | 11.7% |
| Hawkesbury, Town of | 1,149.3 | 3 | 46.05% | 6.85% | - |
| East Hawkesbury, Township of | 14.3 | 3 | 13.64% | 9.39% | - |
| Champlain | 41.9 | 3 | 19.77% | 12.61% | - |
| **OTTAWA VALLEY WASTE RECOVERY CENTRE** | **51.7** | **3** | **31.01%** | **9.99%** | 45.5% |
| Petawawa, Town of | 89.0 | 3 | 36.02% | 10.80% | - |
| Pembroke, City of | 970.7 | 3 | 38.77% | 10.27% | - |
| Laurentian Valley, Township of | 16.8 | 3 | 9.43% | 8.36% | - |
| **COCHRANE TEMISKAMING WASTE MANAGEMENT BOARD** | **10.1** | **2** | **27.91%** | **8.91%** | **6.0%** |
| Cochrane | 10.2 | 2 | 28.73% | 7.46% | - |
| Chamberlain | 2.9 | 2 | 7.41% | 3.70% | - |
| Charlton-Dack | 6.6 | 2 | 11.11% | 2.86% | - |
| Englehart | 491.7 | 2 | 31.30% | 8.57% | - |
| Evanturel | 5.3 | 2 | 13.89% | 11.11% | - |
| Hearst | 57.0 | 2 | 39.92% | 9.08% | - |
| Iroquois Falls | 599.4 | 2 | 20.30% | 8.35% | - |
| Kapuskasing | 101.3 | 2 | 33.11% | 8.27% | - |
| Mattice-Val Côté | 1.9 | 2 | 11.11% | 7.09% | - |
| Moonbeam | 5.5 | 2 | 13.89% | 10.14% | - |
| Opasatika | 0.8 | 2 | 9.52% | 0.00% | - |
| Temiskaming Shores | 60.6 | 2 | 25.95% | 11.42% | - |
| Temagami | 0.5 | 2 | 17.28% | 4.85% | - |

## APPENDIX 3 – Multiple Regression: Population Density Model

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .344[a] | .119 | .114 | 11.78640% |

a. Predictors: (Constant), Population Density

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 3625.442 | 1 | 3625.442 | 26.097 | .000[b] |
| | Residual | 26950.333 | 194 | 138.919 | | |
| | Total | 30575.775 | 195 | | | |

a. Dependent Variable: Total Residential Diversion Rate

b. Predictors: (Constant), Population Density

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 26.782 | .919 | | 29.142 | .000 |
| | Population Density | .010 | .002 | .344 | 5.109 | .000 |

a. Dependent Variable: Total Residential Diversion Rate

## APPENDIX 4 - Multiple Regression: Population Density without Toronto

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .378[a] | .143 | .139 | 11.61613% |

a. Predictors: (Constant), Population Density

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 4346.842 | 1 | 4346.842 | 32.214 | .000[b] |
| | Residual | 26042.338 | 193 | 134.934 | | |
| | Total | 30389.179 | 194 | | | |

a. Dependent Variable: Total Residential Diversion Rate

b. Predictors: (Constant), Population Density

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 26.235 | .930 | | 28.209 | .000 |
| | Population Density | .014 | .002 | .378 | 5.676 | .000 |

a. Dependent Variable: Total Residential Diversion Rate

## APPENDIX 5 – Multiple Regression: % Rental Households

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .251[a] | .063 | .058 | 12.15256% |

a. Predictors: (Constant), % Rental Households

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1924.921 | 1 | 1924.921 | 13.034 | .000[b] |
| | Residual | 28650.854 | 194 | 147.685 | | |
| | Total | 30575.775 | 195 | | | |

a. Dependent Variable: Total Residential Diversion Rate

b. Predictors: (Constant), % Rental Households

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 23.089 | 1.772 | | 13.033 | .000 |
| | % Rental Households | .307 | .085 | .251 | 3.610 | .000 |

a. Dependent Variable: Total Residential Diversion Rate

# APPENDIX 6 – Multiple Regression: % of Population over 15 w/University Degree

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .345[a] | .119 | .115 | 11.78308% |

a. Predictors: (Constant), % of Pop'n Over 15 w/University Degree

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 3640.629 | 1 | 3640.629 | 26.222 | .000[b] |
| | Residual | 26935.146 | 194 | 138.841 | | |
| | Total | 30575.775 | 195 | | | |

a. Dependent Variable: Total Residential Diversion Rate

b. Predictors: (Constant), % of Pop'n Over 15 w/University Degree

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 19.846 | 1.917 | | 10.354 | .000 |
| | % of Pop'n Over 15 w/University Degree | .810 | .158 | .345 | 5.121 | .000 |

a. Dependent Variable: Total Residential Diversion Rate

## APPENDIX 7 – Multiple Regression: Region

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .388[a] | .150 | .146 | 11.57221% |

a. Predictors: (Constant), Region

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 4596.068 | 1 | 4596.068 | 34.321 | .000[b] |
| | Residual | 25979.707 | 194 | 133.916 | | |
| | Total | 30575.775 | 195 | | | |

a. Dependent Variable: Total Residential Diversion Rate

b. Predictors: (Constant), Region

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 16.374 | 2.255 | | 7.261 | .000 |
| | Region | 3.924 | .670 | .388 | 5.858 | .000 |

a. Dependent Variable: Total Residential Diversion Rate