Comparing Apples and Oranges

Municipal Recycling Tonnages and Rates on Long Island in the 1990s
B. The Data Analysis

Part II of an Assessment of Recycling on Long Island

David J. Tonjes
R. Lawrence Swanson

Waste Reduction and Management Institute
Marine Sciences Research Center
University at Stony Brook

August, 1996

Table of Contents

List of Figures

List of Tables

Executive Summary

This is the second part of a six-part series on recycling on Long Island. This part, Comparing Apples and Oranges, is primarily a data report on the recycling programs in Nassau and Suffolk Counties. This particular volume of Comparing Apples and Oranges, Part B, presents our analysis of the municipal recycling data from the past ten years or so presented in Part A.

Long Island, as considered in this report, is comprised of Nassau and Suffolk Counties. It contains a population of approximately 2.6 million. It is primarily suburban in character (although it has some urban areas in western Nassau County, and the eastern portions of Suffolk County contain agricultural and/or undeveloped land, and tourist resorts). Most of the suburbanization of Long Island occurred after World War II.

The first part of the series, Doing the Right Thing, discussed the growth and extent of municipal recycling programs. Long Island municipal recycling programs began in earnest after the Islip Garbage Barge incident in 1986. By 1994 (the last year completely discussed in the report), all 15 municipalities in Nassau and Suffolk Counties had mandatory source separation programs. Although each program is unique, all of the mandatory programs recycle newspaper, and glass, metal and plastic containers. All but one of the mandatory programs also target corrugated cardboard; all but one of the municipalities also recycle yard wastes. All of the municipalities target additional materials, as well, although the particulars vary. Differences in the means of amassing recyclables, processing them, and the participants of the recyclables programs also distinguish each municipality.

Part A of the second volume, Comparing Apples and Oranges, is essentially a compilation of waste management statistics from the 15 municipal programs with a focus on recycling statistics. The data of Part A is summarized in this report in the course of analyzing them; however, one conclusion that was readily drawn from the raw data of Part A was the incredible growth in recycling tonnages and percentages of waste streams managed over the past ten years. Qualitative growth of Long Island's municipal recycling programs has been noted in Doing the Right Thing: one mandatory and several voluntary programs existed in 1986, and in 1994, all Long Island municipalities were supporting wide-ranging mandatory recycling programs. This qualitative growth was naturally reflected in tonnage data. Because of the various programs' differences, and in differences in what materials and waste streams are included in measurements (which can change even in one particular municipality over time), the best measure used to

compare recycling rates (across time or among the municipalities) is most probably not one of the traditional measures such as tons or percent of the waste stream recycled. However, in general, the statistics collected in Part A can be summarized as follows: from small tonnages recycled in the early 1980s, every muncipality has seen increases in recycling, whether measured as percentages of the waste stream, gross tonnages, tonnages of specific materials, or as per capita "paper and container" separation rates. Deviations from this general conclusion can be found for individual municipalities for particular time frames; nonetheless, the qualitative conclusion drawn in Doing the Right Thing, that recycling has become an integral and important waste management strategy for every municipality on Long Island through the 1990s, is supported by the data presented in Part A of Comparing Apples and Oranges.

In Part B, the analyses allow further conclusions to be drawn. They are summarized as follows:

Long Island-wide Recycling Rates

Based on data supplied by the municipalities, the Long Island-wide recycling rate for 1994 was 31%. When the entire Long Island waste stream (including wastes not counted by the municipalities) is considered, the rate is 25%. On a per capita basis, in 1994 Long Islanders recycled an average of 625 pounds (nearly 2 pounds person^{-1} day^{-1}).

The "Best" Recyclers

For 1994, based on claimed tonnages and rates (or our estimations of those rates, where data were not made available), the Town of Shelter Island had the best recycling rate (45% of its

claimed waste stream). In terms of per capita tonnages claimed, the Town of Hempstead recycled the most (955 pounds person^{-1} year^{-1}). If "household recyclables" (the paper and containers collected at curbside or separated at drop-off centers) only are considered, then the Town of East Hampton separated the most (365 pounds person^{-1} year^{-1}). Huntington had the best curbside collection program, collecting 241 pounds person^{-1} year^{-1}.

What is Recycled

According to municipal statistics, household recyclables accounted for less than 30% of all recycling in 1994. Yard waste accounted for nearly 40% of the claimed tonnages, and "other materials" (predominantly private sector recycling and post-collection recyclables separation) was another third of the tonnages. Of the household recyclables, paper accounted for well over two-thirds of the tonnages, and newspaper alone was more than half of the materials collected.

Thus, there is a disparity between public perceptions of "recyclables" (the household recyclables) and what accounts for most of Long Island's recycling credits.

Accounting for Differences in Recycling Programs

We did not find support in the data for either of two contentions: 1) WTE incineration waste management components detract from recycling program effectiveness; or 2) Pay-per-Bag systems increase recycling (the analysis of this contention was inconclusive, rather than negative). We did seem to find a positive relationship between household income and curbside collection program efficiency. It is not clear why this relationship exists.

Introduction

The Waste Reduction and Management Institute (WRMI) was established in 1985 by the New York State Legislature (as the Waste Management Institute). The mission of WRMI is to reduce the impact of waste generation on society through a program of research, assessment, education, and policy analysis. Locally, there is a need to compile accurate and credible information about Long Island's solid waste stream and infrastructure. This need was initially addressed by the publication of Where Does It All Go? in 1992 (Tonjes and Swanson).

Solid waste management on Long Island has evolved considerably since the data were collected for that report. This project began as an update to Where Does It All Go? In the course of data collection and analysis, it became obvious that certain aspects of Long Island's solid waste structure were deserving of study in and of themselves. The focus of the proposed report became recycling and its associated processes. As our assessment grew, it was suggested

to us that the report had grown to unwieldy size, and would be of little utility if issued as a single document. We therefore have attempted to break the inital report down into manageable pieces.

This paper, Comparing Apples and Oranges, is the second of a series of six related reports. All six of the reports discuss some aspect of recycling in Nassau and Suffolk Counties. Each report is intended to stand alone; however, the reader interested in all aspects of the recycling process on Long Island would reap the most benefit by reading the reports in order.

Comparing Apples and Oranges is a data report on the the extent of municipal recycling on Long Island, and how this has changed over the past ten years or so. It also makes some comparisons between aspects of the municipal recycling programs that we found to be consonant with each other. The report has been broken into two pieces: Part A comprises the data sets, and this Part B is our analysis of the data. The collected data are integral to the analyses; however, inclusion of the data with the analyses made the combined report too cumbersome.

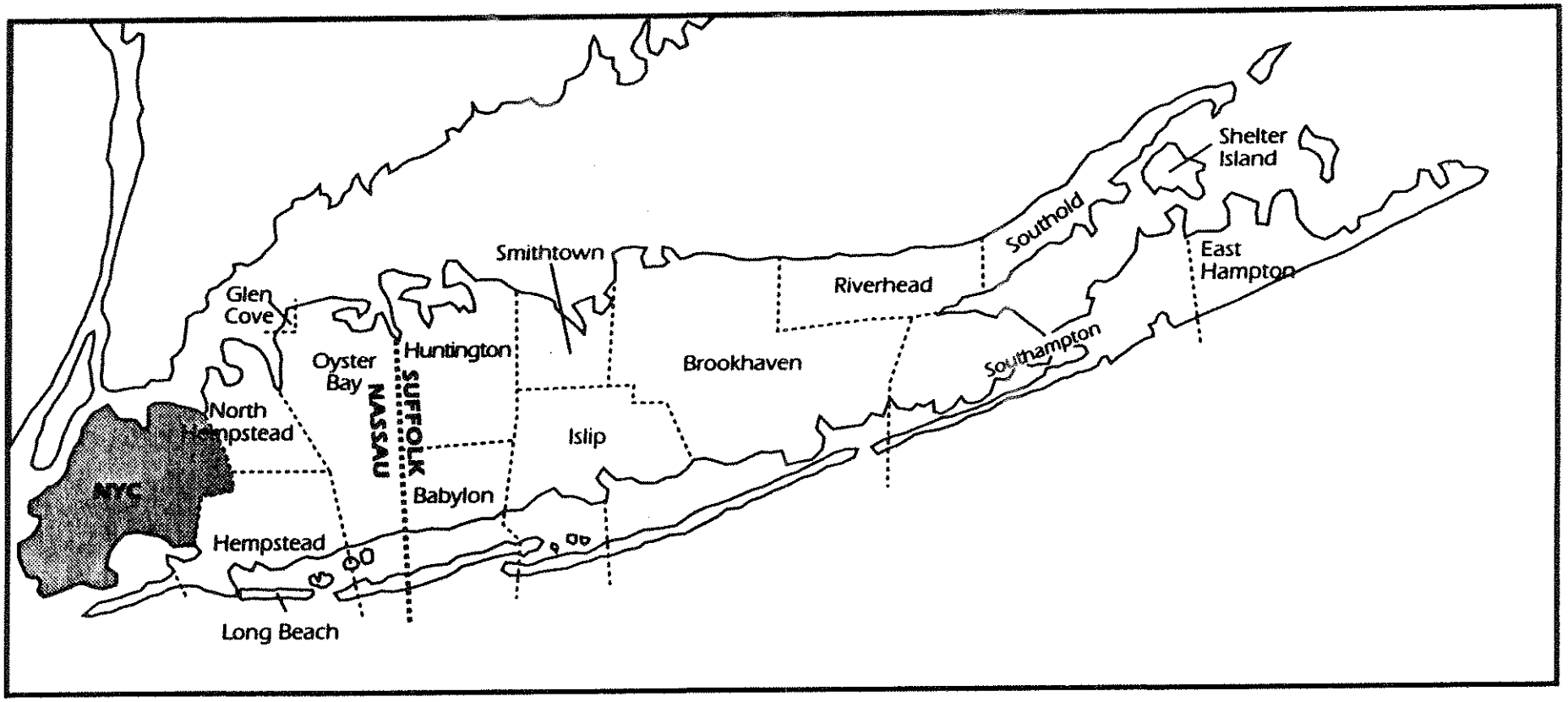
Doing the Right Thing (Tonjes and Swanson, 1996a), the first report in the series, is a report on the growth and evolution of Long Island's municipal recycling programs. It is a qualitative, descriptive account; many of the analyses contained in this report might be better understood in the full context of the intent of each municipality's program. However, we hope to have provided enough information with the analyses to make them understandable in the context of the individual programs' differences.

Comparing Apples and Oranges: Part A: The Data Report (Tonjes and Swanson, 1996b) followed the format of Doing the Right Thing. Each municipality was given a separate section, and details of changes in recycling tonnages (in total, and by material) and percentages were presented, as available. We believe the detail of Part A is necessary to support the levels of analysis we present in Part B; we also recognize that interest in the details may be restricted to a very select audience.

Each Long Island municipality was asked to provide information to us during 1994 and 1995. Personal interviews were held with most of the municipal waste managers; others responded by telephone or letter. In addition, reports on Long Island waste management by governmental and environmental organizations were reviewed. Each municipality was given multiple opportunities to review and comment on drafts of our descriptions of its system, and to provide more complete or amended data sets. Some were more accomodating than others; although there is a lack of complete data in some of the accounts, we believe that this is the most thorough and accurate account of overall Long Island recycling practices that has yet been made available.

This report departs from the municipality-by-municipality format of the previous two reports. Some organization by municipality is unavoidable; however, we hope that the presentation will begin to create a more Long Island-wide picture of recycling activities, and that the comparisons made here can be viewed in that context.

Figure 1. Long Island Municipalities



Part III of the series, Plumbing the Unknown, will be our attempt to address private sector recycling practices. Information is less available for this portion of the recycling industry on Long Island. Nonetheless, this report will contain qualitative and quantitative descriptions, such as were available or could be inferred. The reports to follow will thus build on the total description of recycling on Long Island, to meet our goal of the most complete account of recycling on Long Island hitherto attempted.

Long Island contains 15 solid waste management planning units -- ten Towns in Suffolk County (Babylon, Brookhaven, East Hampton, Huntington, Islip, Riverhead, Shelter Island, Smithtown, Southampton and Southold), and the three Towns (Hempstead, North Hempstead, and Oyster Bay) and two cities (Glen Cove and Long Beach) in Nassau County (Figure 1). Although Brooklyn (Kings County)and Queens County are geographically part of Long Island, history, political divisions, and common usage exclude them from public policy discussions of Long Island issues. They are not discussed in this report.

It must be realized that Long Island's municipal waste management infrastructure is organized differently from other areas of New York State. Elsewhere, waste management is the function of county government, or, in some instances, organizations comprised of groups of counties. On Long Island, the responsibility is assumed by Town or City government (the next lower level of government), and even, in some aspects, by Village government. This has led to a multiplicity of approaches in a relatively restricted geographical space.

Recycling (defined for the moment as the separation from the waste stream, or potential waste stream, of materials to allow for reuse or refabrication) has almost certainly always occurred on Long Island. Composting and the recovery for refabrication of certain valuable materials have occurred throughout recorded history. Government-sponsored programs have not been as continuous. They seem to be restricted to times of war, with a focus on materials that have use in supporting the war effort. Notable examples of such efforts in twentieth century America occurred during World War I and II (Melosi, 1981). These programs were discontinued with the end of the wars, and the perceived lack of need for such civic effort.

Modern recycling on Long Island appears to have begun in scattered municipalities through the co-opting of paper drives (which had often been organized by churches or scouting organizations). The Town of Huntington, for example, had some form of newspaper recycling beginning early in the 1970s. The initial goad to greater efforts appears to have been the notoriety of the famed Long Island Garbage Barge (1986), and the attention that Long Island waste management practices were therefore subjected to. To this was added the pressure of the Long Island Landfill Law, which mandated the closure of landfills on Long Island to unprocessed solid wastes by 1991, and the identification of a "solid waste hierarchy" by the State Legislature and its codification into state regulations. Pressures from residents to have municipal governments be environmentally responsible, coupled with the legal and regulatory strictures, made recycling part and parcel of every day waste management practices across Long Island (Tonjes and Swanson, 1996a).

This qualitative growth in recycling programs was reflected in the increasing tonnages and percentages of the waste stream accounted for by recycling programs (Tonjes and Swanson, 1996b). The remainder of this report will summarize the changes detailed, municipality by municipality, in Part A. The intent is to begin to create a Long Island-wide picture of the changes in recycling programs, and their effectiveness, through the 1990s.

Long Island generates 9,000 - 10,000 tons per day of MSW, or, parsed differently, 3.0 - 3.5 x 10^6 tons per year (Tonjes and Swanson, 1992). We have found no good information to substantially change that estimation at this time. The uncertainties associated with waste generation rates spring from definitional differences in what constitutes MSW, imports and exports of MSW, and poorly documented flows of MSW in and through the private sector.

Similar difficulties plague accountings of overall recycling on Long Island, especially for private sector activites. Sources of uncertainty include: facilities that receive wastes counted in cubic yards, and transport products as cubic yards, tons, or both; facilities that receive C&D and MSW, and do not differentiate the source of the product recyclables; uncertainties concerning the veracity of tonnages reported to the New York Department of Environmental Conservation (NYSDEC) or local municipalities; out-of-system activities (deliveries to scrap metal dealers, small-scale composting, supermarket and other direct-to-market recycling); imports of materials from off-Long Island to Long Island facilities; exports of materials to facilities off-Long Island; and definitional differences over what constitutes "recycling."

Municipal recycling statistics are better documented, but contain many uncertainties as well. Some of the more straight-forward problems include: inclusions of materials in recycling statistics which otherwise would not be considered solid waste (e.g., C&D, automobiles); counting collected tonnages versus tonnages sent to market; estimation errors associated with yard wastes; conversions of cubic yard and other non-weight measurements into tonnages; and incomplete and/or inconsistent inclusions of private sector activites under municipal statistics. The diversion of curbside recyclables from municipal systems into the private sector, or outright "paper piracy," during the time period that the SSC vs. Smithtown (Platt, 1994) decision was under appeal, introduced a new source of statistical inaccuracy. Because of the value of paper recyclables, many contract carters delivered paper set out under residential programs to private recyclers rather than to municipal facilities. "Entrepreneurs" also patrolled streets on recycling days, trying to collect newspapers before the municipal or contract carters arrived. Many programs experienced up to a 50% decline in recyclables received during the first nine months of 1995, without any apparent decrease in resident enthusiasm or participation in the recycling programs (Smith, 1995; Swenson, 1995). The best means of addressing this problem in an environment requiring the reporting and comparison of municipal recycling rates is not clear.

More fundamental questions concerning the very definition of recycling can interfere with assessments of recycling programs (see National Recycling Coalition, 1989; Reaven, 1991; deKadt, 1992; Meade et al., 1992). For example, consider a yard waste composting program. Should the "recycled" tonnage be the incoming tonnage (the tonnage presumably avoiding disposal) or the outgoing tonnage of finished compost -- the tonnage netted from the process?

How should residues disposed from the process be counted -- does it depend whether they are produced at the back end of the process, or at the beginning? For instance, suppose a facility received 2,000 tons of leaves; at the end of the year, 800 tons of compost has been produced, 10 tons of material were disposed, and 100 tons were returned to the composting process for another year (either as a compost "seed," as a bulking agent, or because the material had not completely composted). What recycling credit should be given?

The same question arises in more complexity when considering the recycling process as an industrial process generating its own wastes -- at what point should the "net" tonnage be calculated, and what rationale should be used to determine the amount of recycling? For example, should a recycling program receive credit for the tonnage collected, the tonnage delivered to an intermediary after some processing, the tonnage delivered to an end-user, the tonnage actually incorporated by the end-user into a re-usable product, or the tonnage actually reused? When and how would some of the further "downstream" determinations be made?

The question of the end use of many materials must be considered. Suppose the compost is not used immediately and is stored -- should recycling credit be given? What if the compost is used as landfill cover material? Should material used as cleanfill at, say, a building lot (which, presumably, displaces other materials from this use), be counted as recycled materials? Should "alternative landfill cover" be counted as recycled materials (very often, ground up C&D material can be used in place of clean sand at active landfills as daily cover material)? Should treated incinerator ash, displacing clean sands in a landfill methane venting layer, count as recycled

material? If so, analogously with compost, should the tonnage entering the incineration process be counted as the recycled tonnage, or should the tonnage of ash used as the sand replacement be counted?

The complexity of these questions creates variability in the treatment of recycling statistics among different observers -- even members of the same organization. Thus, without the omniscence to distinguish between the criteria used by the different compilers, the statistics generated in Part A of this report, on which the analyses contained here are based, did not attempt to distinguish "true" figures. For several municipalities, we had to generate data based on estimations. The criteria for those judgements are spelled out in Part A, as are the sources of all data presented there. Data presented in this report should be assumed to be documented in Part A (unless otherwise specified here).

Data precision is a concern when statistics are generated from across a range of different precisions. We have tried to acknowledge this without also losing all meaning from the data. The inclusion of rounded numbers and estimations make it unlikely that any summary statistic is precise beyong two significant digits, no matter how the data are presented.

The overall accuracy of the data, as in any solid waste situation, is even less well known, as discussed above. Sometimes variance in reported tonnages can be simply ascribed to rounding

by a particular reporter; sometimes the differences can be understood in terms of different methodologies being used to generate the data; and sometimes the differences are inexplicable.

Yet, given these difficulties, we believe that this presentation is the most complete yet offered. We have analyzed the available data to examine four of the most common questions about Long Island's municipal recycling programs: 1) what is the recycling rate? 2) who recycles best? 3) what materials are recycled? and 4) what factors affect recycling rates?

1. The Recycling Rate

We begin our analysis by combining the municipal data collected in Part A to produce some overall Long Island data sets. The first table, Table 1, was created by taking the municipally-generated data and combining them to create some cumulative data sets of reported recycling rates. The Table begins with 1986; in that year, no municipality reported any recycling (in the forums we were able to access), although elsewhere (Tonjes and Swanson, 1992) we have suggested that the overall recycling rate was approximately 1%. The data were almost all provided by municipal officials; when no municipal data were available, data from other sources were used. For 1994, when no data were available for particular municipalities, the last available year's data were carried forward to create a complete data set. Those entries are marked in the Table.

Table 1. Municipally-provided Recycling Rates, 1986, 1990 - 1994 (in percentages of the waste stream)

	1986	1990	1991	1992	1993	1994
Nassau						
Glen Cove	0%	12%		16%		16%*
Hempsted	0%	14%	24%	36%	39%	41%
Long Beach	0%	11%	12%	11%	13%	13%
North Hempstead	0%	13%	16%	45%	47%	34%
Oyster Bay	0%	35%	28%	30%	35%	29%
Suffolk						
Babylon	0%	23%	26%	23%	41%	30%
Brookhaven	0%	12%	15%	28%	28%	22%
East Hampton	0%	15%	34%		24%	24%
Huntington	0%	15%	30%	18%	14%	26%
Islip	0%	19%	38%	31%	31%	30%*
Riverhead	0%	4%	6%	16%	8%	8%*
Shelter Island	0%	4%	14%	29%	45%	45%*
Smithtown	0%	6%	10%	13%	13%	13%
Southampton	0%	12%	26%	33%	38%	18%
Southold	0%	4%	23%	25%	24%	24%*
LI total	0%	17%	23%	30%	33%	31%

* 1993 data, rounded

(Tonjes and Swanson, 1996b)

There are some difficulties with the compilation in Table 1. For one, the recycling rate increases over time not only because of increased recycling tonnages, but because of waste stream redefinitions and reconsiderations by various municipalities. Although we believe that the total Long Island waste stream is approximately 3.25×10^6 tons $year^{-1}$, the total denominator for the percentage calculation for 1994 for Long Island as a whole in Table 1 is only 2.6×10^6 tons. This is primarily due to waste diversion by the private waste management sector from municipal waste-handling systems; nonetheless, the data in Table 1 suggest that municipally-documented recycling is more effective at managing Long Island's wastes than it truly is.

Table 2 is another compilation of data from Part A, for 1991 - 1994. It centers on the reported recycling tonnages for each municipality, so as to avoid the difficulty of changing waste stream sizes. Except for 1994, we have not attempted to fill any data gaps. The missing data for 1994 (column 1994* in the Table) were estimated as follows:

Glen Cove: the 1992 3,000 ton recycling figure is a New York State Department of Environmental Conservation (NYSDEC) supplied number. It is approximately 15% greater than the City reported for 1990. We have been conservative in assuming a less than 10% recycling increase for the City over the two years from 1992 to 1994.

Islip: the recycling tonnages reported by Islip vary largely according to the tonnages claimed for the compost site. We assume that composting tonnages remained largely constant, and merely rounded 1993 tonnages up slightly (creating a 3% increase).

Riverhead: we believe that our 1993 statistics for Riverhead are a drastic underreporting of actual recycling in the Town. However, we are also loathe to create much more recycling credits for the Town absent reliable data. The 3,000 tons we show would be covered by 2,000 tons of curbside recycling and 1,000 tons of composting and bulk metals collection. This seems to be acceptably conservative speculation based on the available data.

Shelter Island: we have assumed that recycling tonnages have increased due to full implementation of the Town's Pay per Bag program, and rounded up to the next 100 ton level.

Southold: informal conversations with Town officials early in 1994 indicated a large improvement in the Town's recycling rates at that time. Therefore, we have speculatively shown a 30%+ increase in the Town's total over 1993.

Table 2. Documented Long Island Recycling Data (in tons)

	1991	1992	1993	1994	1994*
Nassau County	292948	448070	525090	504793	508043
Glen Cove		3000			3250
Hempstead	187854	275134	309547	346418	346418
Long Beach	2835	2842	3623	3655	3655
North Hempstead	34000	88594	118046	76442	76442
Oyster Bay	68259	78500	93874	78278	78278
Suffolk County	328397	327670	384702	206189	308189
Babylon	76459	66827	112433	45658	45658
Brookhaven	72211	110167	104062	75500	75500
East Hampton	13430	5922	6226	6178	6178
Huntington	53306	35338	30680	56001	56001
Islip	83482	70363	86518		90000
Riverhead		7000	2268		3000
Shelter Island	500	800	900		1000
Smithtown	13132	13815	14317	13281	13281
Southampton	9560	13000	21500	9571	9571
Southold	6317	4438	5798		8000
Long Island Total	621345	775740	909792	710982	816232
Est. Recycling Percent	19%	24%	28%	22%	25%

* = documented tonnages with projections from previous years

(Tonjes and Swanson, 1996b)

Tables 1 and 2 show the creation of a remarkable waste management system of the course of very few years. There was very little recycling on Long Island in 1986 (approximately 25,000 tons [Tonjes and Swanson, 1992]). Only eight years later this tonnage had grown thirty-fold or more.

Table 1 shows a rise in the calculated recycling rate by 5 percentage points each year from 1990 - 1993; Table 2 shows a slightly more modest increase of 4% of the total waste stream for 1991 - 1993. Both sets of data show a drop in 1994 rates. The decrease is almost entirely due to the demise of the CRRF program at Babylon, and the related loss of recycling credits for North Hempstead (both at Babylon, and those lost through the residential post-collection recycling credits earned through Star Recycling). The significant recycling tonnage increase in Hempstead balances the losses in tonnage experienced in both Brookhaven and Southampton. The losses in those Towns are entirely due to redefinitions of "recycled" (Brookhaven distinguished between landfilled wood wastes and recovered wood wastes in its Highway Department tonnages, and Southampton decided not to include any composting credits), and do not indicate any serious program changes. The tonnage increase at Huntington (due to the resumption of its composting program) almost equals the tonnage decrease in Oyster Bay (due to the near end of its cleanfill program at the Bethpage landfill site) (Tonjes and Swanson, 1996a).

Table 2 demonstrates, even given the uncertainty in some of the data, that the recycling programs in each Long Island municipality together create the diversion of well over three-

quarters of a million tons per year from the waste stream (as of 1994). This is over a billion and a half pounds of materials.

Given the conflicting computations, what is the overall recycling rate for Long Island? Our preference is to use the overall waste stream for Long Island as the denominator in the calculation. We believe that available data indicate that Long Island's waste generation has not varied much over the past five years or so, and it is therefore disingenuous in calculating an overall Long Island recycling rate to use the fluctuating tonnages managed (or counted) by the municipalities. Thus, the data suggest that Long Island recycled 25% of its waste stream as documented by local governments. However, we also understand why the 31% figure of Table 1 has support as "the" recycling rate. In both instances, most private sector recycling is not accounted for (in 1994, only Glen Cove, Hempstead, Islip, Oyster Bay, and the four East End Towns with drop-off recyclables collection programs -- East Hampton, Shelter Island, Southampton, and Southold -- were overtly accounting for any commercially-generated recyclables in their municipal statistics). Therefore, comparisons to the entire waste stream generated on Long Island (as in Table 2) do not adequately account for any private sector activities. Thus, it must be understood that both Table 1 and Table 2 are incomplete representations of a total Long Island recycling rate.

Another means of examining the recycling data is presented in Table 3. Table 3 shows per capita recycling rates, in pounds per year (population data used from Long Island, 1994). From the Table, it can be seen that Long Island recycles nearly two pounds person^{-1} day^{-1}. In

terms of USEPA estimates of nationwide waste generation (4.4 pounds person^{-1} day^{-1} [United States Environmental Protection Agency, 1994]), this recyclables output would be sufficient for Long Island to claim to have one of the highest recycling percentages in the country. However, Long Island actually generates nearly 7 pounds person^{-1} day^{-1} of MSW (Tonjes and Swanson, 1992), and so the resulting percentage is not as dramatic.

Table 3. Documented Long Island Per Capita Recycling Rates (pounds person^{-1} year^{-1})

	1991	1992	1993	1994	1994*
Nassau County	455	696	816	784	789
Glen Cove		249			269
Hempstead	518	759	853	955	955
Long Beach	169	169	215	217	217
North Hempstead	321	837	1115	722	722
Oyster Bay	467	537	643	536	536
Suffolk County	496	495	581	312	466
Babylon	755	660	1110	451	451
Brookhaven	352	537	508	368	368
East Hampton	1658	731	769	763	763
Huntington	558	370	321	586	586
Islip	557	469	577		600
Riverhead		606	196		260
Shelter Island	442	708	796		885
Smithtown	232	245	253	235	235
Southampton	421	572	947	421	421
Southold	637	448	585		807
Long Island Total	476	594	697	545	625
Est. Recycling Percent	19%	24%	28%	22%	25%

* = documented tonnages with projections from previous years

As with many other waste management statistics, the answer to the question "What is Long Island's recycling rate?" (when based on municipally-generated data), is answerable in several ways depending on what is counted, and how it is counted. The recycling rate for 1994,

based on municipal data alone, was 31%; adjusted for the total Long Island waste stream, the rate appeared to be 25%. In either case, 625 pounds of material per person were documented as recycled by the Long Island municipalities in 1994. Later sections of this overall report (particularly Part 4, Extending the Definition) will revisit these rates in light of additional information.

2. Recycling Rates Comparisons

The recycling percentages from Table 1 or the per capita data from Table 3 could be viewed as measures of the relative effectiveness of each municipality's approach to recycling. However, differences in what is counted in each municipality mean that the data in these Tables may only measure the different approaches used to count recyclables in the municipalities. The differences in recyclables programs and counting methodologies make the data incongruent.

In Part A of this report (Tonjes and Swanson, 1996b), we presented data on the curbside collection or drop-off program efficiencies for each municipality. These aspects of each recycling program are qualitatively (with some relatively minor exceptions) much more similar to each other than overall recycling programs, since they essentially target the same materials. Tables 4 - 8, "Household Recyclables" Recycling Rates, present the amounts of such paper and container recyclables collected by each municipality for 1990 - 1994.

Table 4. 1990 "Household Recyclables" Recycling Rates (in tons and pounds person^{-1} year^{-1})

Curbside Recycling	Tons			lbs/ person		
	Paper	Containers	Total	Paper	Containers	Total
Nassau County						
Glen Cove	1652	444	2096	137	37	174
Hempstead	39630	11038	50668	109	30	140
Long Beach	1849	422	2271	110	25	135
North Hempstead	14200	4829	19029	134	46	180
Oyster Bay	17232	6578	23810	118	45	163
Suffolk County						
Babylon	8337	3295	11632	82	33	115
Brookhaven			37960			185
Huntington	16253	4228	20481	170	44	214
Islip						
Smithtown	11845	1807	13652	210	32	242
Drop-off Recycling						
East Hampton	373	174	547	46	21	68
Riverhead			1381			120
Shelter Island	191	~120	~300	169	~100	~250
Southampton			4450			196
Southold			1919			194

Table 5. 1991 "Household Recyclables" Recycling Rates (in tons and pounds person^{-1} year^{-1})

Curbside Recycling	Tons			lbs/person		
	Paper	Containers	Total	Paper	Containers	Total
Nassau County						
Glen Cove						
Hempstead	39736	14329	54065	110	40	149
Long Beach	1908	486	2394	113	29	142
North Hempstead	11800	7200	19000	112	68	180
Oyster Bay	18797	6580	25377	129	45	174
Suffolk County						
Babylon	7982	3332	11314	79	33	112
Brookhaven	19970	8644	28614	97	42	140
Huntington	16610	5497	22107	174	58	231
Islip			27460			183
Smithtown	7903	4798	12701	140	85	225
Drop-off Recycling						
East Hampton	818	509	1327	101	63	164
Riverhead						
Shelter Island						
Southampton	2615	1295	3910	115	57	172
Southold	1016	705	1721	102	71	174

Table 6. 1992 "Household Recyclables" Recycling Rates (in tons and pounds person^{-1} year^{-1})

Curbside Recycling	Tons			lbs/person		
	Paper	Containers	Total	Paper	Containers	Total
Nassau County						
Glen Cove						
Hempstead	39056	15553	54609	108	43	151
Long Beach	1950	545	2495	116	32	148
North Hempstead	11903	6425	18328	112	61	173
Oyster Bay	15020	7227	22247	103	49	152
Suffolk County						
Babylon	8032	3742	11774	79	37	116
Brookhaven	26745	11050	37795	130	54	184
Huntington	16025	5538	21563	168	58	226
Islip			26221			175
Smithtown	10176	3374	13550	180	60	240
Drop-off Recycling						
East Hampton	1282	916	2198	158	113	271
Riverhead						
Shelter Island						
Southampton						
Southold	1245	840	2085	126	85	210

Table 7. 1993 "Household Recyclables" Recycling Rates (in tons and pounds person^{-1} year^{-1})

Curbside Recycling	Tons			lbs/person		
	Paper	Containers	Total	Paper	Containers	Total
Nassau County						
Glen Cove						
Hempstead	40074	17075	57149	110	47	158
Long Beach	2497	796	3293	148	47	196
North Hempstead	12157	6677	18834	115	63	178
Oyster Bay	17404	7559	24963	119	52	171
Suffolk County						
Babylon	8092	4046	12138	80	40	120
Brookhaven	29995	11825	41820	146	58	204
Huntington	17533	5489	23022	184	57	241
Islip			23971			160
Riverhead		216			19	
Smithtown	11020	3297	14317	195	58	253
Drop-off Recycling						
East Hampton	1634	914	2548	202	113	315
Shelter Island	206	167	373	182	148	330
Southampton	6213	1906	8119	274	84	358
Southold	1797	944	2741	181	95	276

Table 8. 1994 "Household Recyclables" Recycling Rates (in tons and pounds person^{-1} year^{-1})

Curbside Recycling	Tons			lbs/person		
	Paper	Containers	Total	Paper	Containers	Total
Nassau County						
Glen Cove	~2000	~500	~2500	~160	~40	~200
Hempstead	41067	17257	58324	113	48	161
Long Beach	2560	860	3420	152	51	203
North Hempstead	13274	6735	20009	125	64	189
Oyster Bay	18133	8080	26213	124	55	179
Suffolk County						
Babylon	8592	4233	12825	85	42	127
Brookhaven	26254	10871	37125	128	53	181
Huntington	17660	5349	23009	185	56	241
Islip			~24000			~160
Riverhead			~2000			~175
Smithtown	9846	3197	13043	174	57	231
Drop-off Recycling						
East Hampton	1986	973	2959	245	120	365
Shelter Island	~200	~175	~375	~175	~150	~325
Southampton	6000	2148	8148	264	95	359
Southold	~2000	~1000	~3000	~200	~100	~300

(Tonjes and Swanson, 1996b)

Tables 4 - 8 were created: 1) for municipalities with curbside recycling programs, by separating out curbside paper and container tonnages; and 2) for those with drop-off programs, by only considering the paper and containers gathered in these programs. This necessarily excludes portions of recovery programs outside of these limited definitions. However, despite educational efforts, we believe that most people focus on source separation of these materials, especially from household wastes, as "true" recycling. It is also one means of attempting to measure the disparate programs on a somewhat level playing field. It must be understood that all Long Island municipalities do have additional recycling efforts, and so these comparisons necessarily do not measure the true scope of any one program.

Drop-off programs are not directly comparable to curbside programs. The data indicate that drop-off programs are more difficult to initiate (see Table 4, for example), but once established, seem to have greater effectiveness and quicker growth rates. This could be due to the natural incorporation of some degree of business sector recyclables. The per person difference also stems from our lack of accounting for the East End summertime population increases. The summer influxes can lead to an annualized 10% or more "population increase" (Tonjes and Swanson, 1992). Accounting for summer visitors would decrease the per person rates for the drop-off programs by that same 10% (roughly 30 pounds person^{-1} year^{-1} in Table 8, for example). The greater per person efficiencies probably also stem from the greater degree of supervision possible when people are throwing MSW out at a facility, rather than placing it out at the curb.

Another notable programmatic difference is the inclusion of business sector recyclables (to various degrees) in the curbside programs in Glen Cove, Hempstead, and Long Beach (Tonjes and Swanson, 1996a). This increases the rates in these programs as compared to other curbside programs, and has not been accounted for in the presentation.

Among the more interesting data from Tables 4 - 8 are the following:

1) certain Long Island municipalities collect nearly one pound of household recyclables each day from every citizen, and all municipalities (with the exception of Babylon) appear to collect at least half-a-pound of household recyclables per person per day;

2) the drop-off programs have a remarkable degree of similarity in performance, especially as they become more well-established (see 1993 - 1994 data);

3) the large variance in the data from curbside collection programs is surprising, given the similarity in collection approaches -- all Long Islanders served by these programs have some sort of recycling container, and put paper (of varying kinds) and containers (generally, the same types) out for collection. Nonetheless, two Towns with a common boundary, Babylon and Huntington, do not recycle at nearly the same rates. Huntington collected nearly twice the amount of recyclables per person as Babylon did in 1994. There are some significant programmatic differences, however: Huntington collected more materials (corrugated cardboard, boxboard, and junk mail, along with more types of plastic containers) (Tonjes and Swanson, 1996a). Smithtown also significantly outcollects two adjacent Towns on a per capita basis, Islip (by approximately 50%) and Brookhaven (by nearly 30%), despite collecting fewer materials than either of those Towns, and despite adding and deleting certain materials from its program earlier this decade (Tonjes and Swanson, 1996a). Differences in rates are not nearly as noticeable in Nassau County.

Using the curbside and drop-off rate data as a means of comparing recycling programs, given some of the difficulties mentioned above, places East Hampton (in 1994) as the "best" recyclables collection program among all of the Long Island municipalities. Huntington had the "best" program among those municipalities conducting curbside collection programs. We repeat

that this statistic is a limited measure of total recycling program effectiveness, as all municipalities provide recycling services beyond paper and container collection.

Other statistical considerations provide different identifications of the "best recycler" among the Long Island municipalities. The per capita data from Table 3, for example, which more fully accounts for the other aspects of recycling services provided to residents (beyond paper and container collection), suggests that Hempstead had the most effective recycling program in 1994; and the waste stream percentage data in Table 1 would award Shelter Island the honors for 1994 (but not for 1993, the year that the particular Shelter Island data was based on).

Table 9. Recyclables Claimed, by Category (1993 - 1994) (in tons)

	1993				1994			
	House-hold Recycl-ables	Yard Wastes	Other	Totals	House-hold Recycl-ables	Yard Wastes	Other	Totals
Glen Cove					2500	500	250	3250
Hempstead	57149	149950	102448	309547	58324	158370	129724	346418
Long Beach	3293	0	330	3623	3420	0	235	3655
North Hempstead	18834	24431	74781	118046	20009	22853	33580	76442
Oyster Bay	24963	14712	54199	93874	26213	8459	43606	78278
Babylon	12138	17781	82514	112433	12825	25371	7462	45658
Brookhaven	35493	66000	2569	104062	32112	41250	2138	75500
East Hampton	2548	2978	700	6226	2959	2534	685	6178
Huntington	23022	993	6665	30680	23009	26511	6481	56001
Islip	23971	30063	32484	86518	24000	30000	36000	90000
Riverhead	373	1861	34	2268	2000	750	250	3000
Shelter Island	350	500	50	900	375	500	125	1000
Smithtown	14317	0	872	15189	11845	0	1436	13281
Southampton	8119	12000	1381	21500	8148	0	1423	9571
Southold	2741	2064	993	5798	3000	2250	2750	8000

(Tonjes and Swanson, 1996b)

3. Materials Targeted

It is our contention that most Long Islanders consider the paper and container materials that they either set out curbside or sort at a drop-off facility to be "recyclables," and, despite educational efforts, do not usually consider the other materials managed by municipalities to be "true" recyclables. Nonetheless, a quick comparison of the data presented in Tables 3 and Tables 4 - 8 shows that much more than the household recyclables are recovered in most municipalities.

This difference can be quantified. Table 9 lists (in tons) 1993 and 1994 recycling for the municipalities, divided into Household Recyclables, Yard Wastes, and "Other." Table 10 restates this data: each category is listed as a percentage of total recycling credits claimed for that municipality in the particular year. The data are summed for each county, and for Long Island as a whole.

Table 10. Recyclables Composition, 1993 - 1994 (percent)

	1993				1994			
	House-hold Recycl-ables	Yard Wastes	Other	Totals	House-hold Recyc-lables	Yard Wastes	Other	Totals
Nassau County	20%	36%	44%		21%	36%	39%	
Glen Cove					~75%	~15%	~10%	
Hempstead	18%	48%	33%		17%	46%	37%	
Long Beach	91%	0%	9%		94%	0%	6%	
North Hempstead	16%	21%	63%		26%	30%	44%	
Oyster Bay	27%	16%	58%		33%	11%	56%	
Suffolk County	32%	35%	33%		39%	42%	19%	
Babylon	11%	16%	73%		28%	56%	16%	
Brookhaven	34%	63%	2%		43%	55%	3%	
East Hampton	41%	48%	11%		48%	41%	11%	
Huntington	75%	3%	22%		41%	47%	12%	
Islip	28%	35%	38%		~25%	~35%	~40%	
Riverhead	16%	82%	1%		67%	25%	8%	
Shelter Island	39%	56%	6%		~40%	~50%	~10%	
Smithtown	94%	0%	6%		89%	0%	11%	
Southampton	38%	56%	6%		85%	0%	15%	
Southold	47%	36%	17%		~40%	~30%	~30%	
Nassau County Total (in tons)	104239	189093	231758	525090	110466	190182	207395	508043
Suffolk County Total (in tons)	123072	134240	128262	385574	120273	129166	58750	308189
LI Total (in tons)	227311	323333	360020	910664	230739	319348	266145	816232
LI total	25%	36%	40%		28%	39%	33%	

Certain aspects of Table 9 (which are carried over into Table 10) should be explained. The most important is the "Other" category. The largest "Other" tonnages in Table 9 stem either from inclusions of commercial recyclables collection (Hempstead, Oyster Bay, and Islip, both years) or from post-collection recyclables recovery (North Hempstead, both years; Babylon, 1993). A good portion of Hempstead's "other" tonnages comes from extensive efforts of the Town to document all recovery efforts, including such items as clamshells from a seafood processor, and flotsam and jetsam turned into bulkheading. For most other municipalities, this category is mostly comprised of bulk metals recoveries.

Yard wastes can also be defined in several ways. For most municipalities, yard wastes are compostable leaves, grass clippings, and, sometimes, brush trimmings. For others (notably, Brookhaven and East Hampton), the tonnages also include large wood wastes made into wood chips.

In any case, for Long Island as a whole, household recyclables account for less than a third of the claimed recycling tonnages. They account for a larger portion of the recyclables total in Suffolk County, but much less of Nassau County's tonnages. In both counties, yard wastes comprise a greater percentage of the claimed recycling credit than the household recyclables do (although the difference in Suffolk County is probably within the margin of error -- but is also affected by some municipalities not claiming any yard wastes credits at all). For Long Island as a whole, the "Other" category of recyclables is also a more significant contributor to the overall recycling rate than household recyclables are.

Thus, despite a public focus on paper and containers generated within the home, recycling (as defined by local governments through their claims of credits) is better thought of as a process that is more concerned with other sources of recoverable materials.

Paper does comprise the clear majority of materials collected as household recyclables. Table 11 displays the county-by-county, and Long Island-wide, breakdown of paper and container tonnages, and the ratio of paper collected to containers collected (as data were available). Because most municipalities do not process these materials themselves, further material breakdowns were not deemed feasible due to data sparseness. However, qualitatively, newspaper comprised at least three-quarters of the paper collected. Metal and glass containers, in general, may be thought to comprise approximately equal tonnages collected (with glass a slightly greater tonnage, perhaps), and plastics comprising a much smaller tonnage[1]. Since paper is collected at greater than twice the rate of containers, and newspaper appears to account for at least 75% of the paper tonnages, it seems fair to conclude that newspaper accounts for over half the household recyclables collected on Long Island (as of 1994).

[1] Part A does contain some data from some municipalities (such as Brookhaven, East Hampton, Southampton, and Southold) which can be used to verify this claim. Some of the data presentations (such as Babylon, Hempstead, North Hempstead, and Oyster Bay), because they include materials from sources other than the residential programs, are not as appropriate.

Table 11. Household Recyclables Tonnages, 1990 - 1994
(Number of municipalities per county included in parentheses)

	Paper	Containers	Total	Ratio Paper to Containers
1990				
Nassau County (5/5)	74563	23311	97874	3.2
Suffolk County (4/10)	36808	9504	46312	3.9
Total	111371	32815	144186	3.4
1991				
Nassau County (4/5)	72241	28595	100836	2.5
Suffolk County (7/10)	56914	24780	81694	2.3
Total	129155	53375	182530	2.4
1992				
Nassau County (4/5)	67929	29750	97679	2.3
Suffolk County (6/10)	63505	25460	88965	2.5
Total	131434	55210	186644	2.4
1993				
Nassau County (4/5)	72132	32107	104239	2.2
Suffolk County (8/10)	76490	28588	105078	2.7
Total	148622	60695	209317	2.4
1994				
Nassau County (4/5)	75034	32932	107966	2.3
Suffolk County (6/10)	70338	26771	97109	2.6
Total	145372	59703	205075	2.4

4. Sources of Recycling Rate Differences

The preceding discussion (especially Table 10) should make it clear that most of the differences in recycling rates reported by the municipalities on Long Island stem from yard waste recovery differences, and by a municipality's ability to claim credits other than household recyclables and yard wastes. Nonetheless, the measure we suggested removed some other counting differences between the municipalities (presented in Tables 4 - 8, "Household Recyclables") also shows distinct differences in recycling rates.

Reputed sociological differences between the North and South Shores of Long Island could be responsible for some of the differences. The superior collection rate in North Hempstead as compared to other municipalities in Nassau County in the early 1990s (despite not having a business collection segment as did Glen Cove, Hempstead, and Long Beach) would fit with this theory, as would Huntington and Smithtown's better per capita collection rates over

other Suffolk County Towns. Evidence collected in New York City strongly supports such sociological bases for recycling rate differences (Thomas, 1994).

We were able to make a simplified test for the Long Island data presented here. A measure of each Town's household income was developed by using household incomes organized by zip codes (Newsday, 1995) and parsing each zip code into its respective municipality (Hagstrom Map Co., Inc., 1986; Hagstrom Map Co., Inc., 1993). We used the mean and median zip code-based household income as relative standards for household income across the municipalities (Table 12).

Table 12. Annual Household Incomes (from data organized by Zip Code) for Long Island Municipalities

Nassau County	Median	Mean
North Hempstead	$87,803	$71,026
Oyster Bay	$74,360	$71,264
Long Beach	$65,609	$65,538
Glen Cove	$61,466	$61,466
Hempstead	$61,358	$60,616
Suffolk County		
Huntington	$71,264	$72,234
Smithtown	$66,083	$65,172
Islip	$54,920	$54,913
Southampton	$53,710	$55,909
Shelter Island	$53,653	$53,608
East Hampton	$52,399	$52,353
Brookhaven	$52,353	$52,586
Babylon	$50,762	$51,763
Southold	$43,718	$47,472
Riverhead	$36,362	$37,283

With the obvious exception of North Hempstead, there are not large differences between the median and mean data. Theoretically, the median should be a better measure, as zip code

divisions are not necessarily made on population bases, and using the mean weights each code equally. Therefore, we have used the median figures for the analysis that follows (but we will mention variations that result from using mean data).

We conducted a regression analysis on the per capita "household recyclables" recycling rates against household income. The regressions were made for five different groupings. Four were fairly obvious: the Nassau County municipalities, the Suffolk County Towns with curbside and drop-off recycling (separately), and the pooled curbside recycling programs for both Counties (all using the 1994 data sets). None of the regression lines, when tested by F-test ($p < 0.05$) had a slope significantly different than 0; however, the r^2 (a measure of the amount of variability between the regression line and the data) for the East End Towns was 0.6, suggesting that household income has some relation to drop-off recycling rates, and for the Suffolk curbside Towns, the $r^2 = 0.5$ (again, suggesting a positive, linear relationship between increasing household income and recycling rates). The lack of statistical significance may be from the small number of data points. There was no positive linear trend at all to the Nassau County data. The graph of all 11 municipalities with curbside programs had $r^2 = 0.15$, indicating that the changes in household income did not account for very much of the recycling rate variability, despite the "conventional wisdom" that income levels have a strong relationship to recycling rates (and the r^2 found using mean incomes was only slightly better -- 0.25) (Hoel, 1954; Darlington, 1990). Figures 2 - 5 show these regressions.

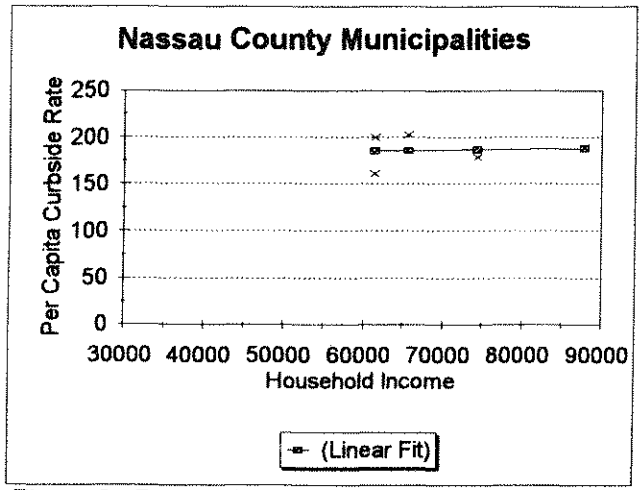


Figure 2. Regression of Curbside Recycling against Household Income, Nassau County (1994)

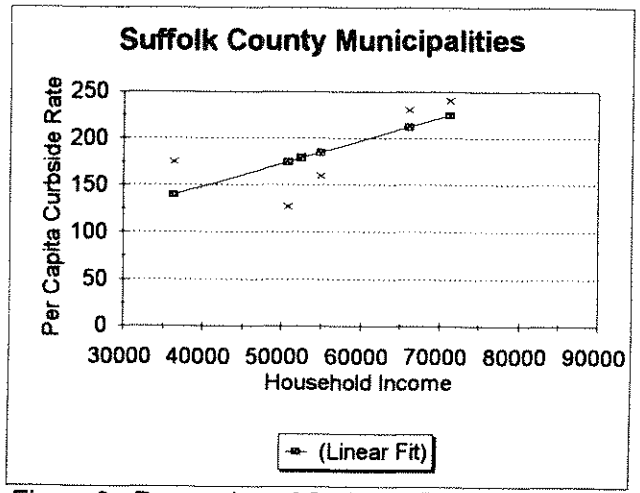


Figure 3. Regression of Curbside Recycling against Household Income, Suffolk County (1994)

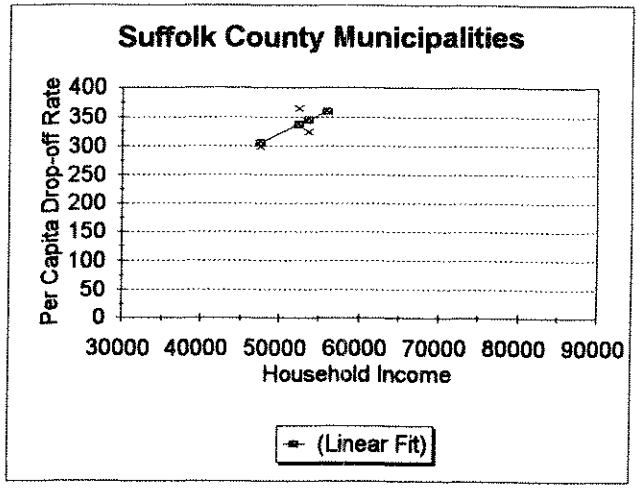


Figure 4. Regression of Drop-off Recycling against Household Income, Suffolk County (1994)

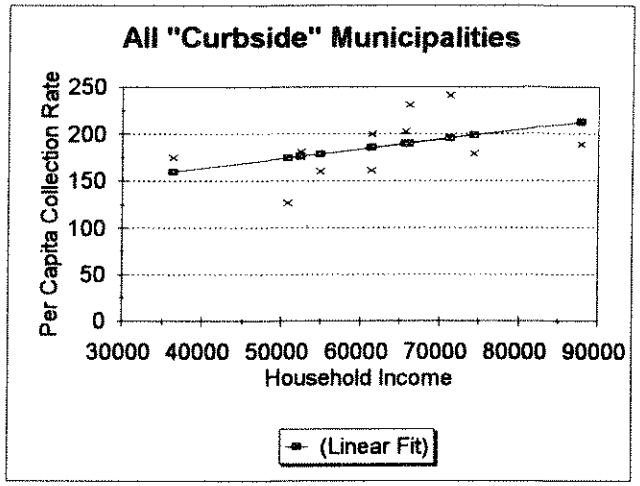


Figure 5. Regression of Curbside Recycling against Household Income, All LI Municipalities (1994)

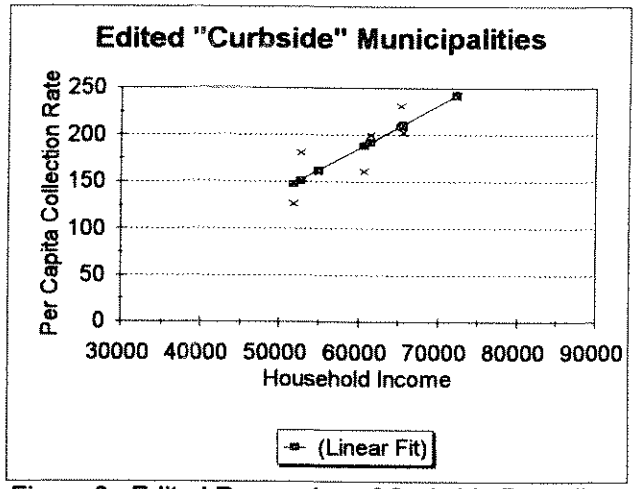


Figure 6. Edited Regression of Curbside Recycling against Household Income, All LI Municipalities (1994)

However, a close look at Figure 5 suggests that in "middle" income municipalities there is a stronger increasing trend for them than for the data as a whole. Figure 6 is a regression of the curbside recycling programs set-out rate against household income, with the lowest (Riverhead) and the two highest (Oyster Bay and North Hempstead) median income municipalities excluded from consideration to isolate the "middle income" communities. Statistical significance for a non-zero regression slope line was found ($F = 17.83$, d.f. = (6,1), $p<0.01$). This indicates that these data have a "non-random" relationship between increasing household income and increasing set-out rates -- suggesting that there is indeed a dependence between income and recycling rates. The $r^2 = 0.75$ for the regression line, which indicates that changes in household incomes accounts for 75% of the difference between the recycling rates of the included municipalities. A Student's t-test ($t = 4.12$, d.f. = 6, $p < 0.01$) found this to be statistically significant (Darlington, 1990; Hoel, 1954).

Although the exclusion of the lowest and two highest income municipalities has no good statistical justification, this manipulation and the original data lead to some interesting inferences. One is that recycling does not appear to be an activity of the "rich." The wealthiest Long Island municipalities did not recycle better than less wealthy communities in the same manner that recycling rates increased for those less well-off communities as incomes rose. Conversely, the Long Island community with the lowest income included in this analysis (Riverhead) appeared to recycle at a much higher per capita rate than could have been projected by income data alone (Figure 4). This seems contrary to simplistic notions that decreases in available income might lead to fewer available recyclables in each household, or that problems associated with lower income

cause poorer people to be less concerned about recyclables separation. The Riverhead data, however, was based on estimations, and therefore should be viewed with some caution.

However, for middle income groupings on Long Island, there appears to be a strong relationship between income levels and recycling rates. This may be due to increased purchases associated with increased income, resulting in more available recyclables. It could also be due to some correlating factor of income -- such as the amount of education -- which creates more interest in recycling with increasing income.

Municipalities wishing to build Waste-to-Energy (WTE) incinerators as part of their waste management systems, or wishing to use existing WTE incinerators, often face charges from recycling advocates that recycling will not be fully supported, due to the necessity of providing feedstock to the incinerator (Dvirka and Bartilucci, 1993; Wehran Envirotech, 1993; Gibson, 1995). It is not clear from the data we have collected whether or not this charge can be verified.

One municipality with a WTE component in its waste management structure (Babylon), has admitted to sending newspapers to the incinerator, when waste flows were low at the plant, and the value of recyclable newspapers was not as the Town wished. This was explained as a decision based solely on economics. The value of the electricity received from burning the newspapers was said to be greater than the value of the newspapers in the recycling market (Tonjes and Swanson, 1996a). It is not clear whether the Town also included possible penalties for not meeting its tonnage commitment to the incinerator operator in this financial calculation.

The need to avoid the "pay" portion of such put-or-pay arrangements (they are called put-or-pay because the operator will be paid for a minimum tonnage whether or not the wastes are actually delivered) is what many recycling advocates fear may make these municipalities less than optimal recyclers.

Table 13 attempts to compare household recycling rates across Long Island, with regard to participation in WTE incineration. At first glance, there is something of a difference between those municipalities incinerating wastes, and those that export wastes off Long Island. The difference, quantitatively, appears to amount to a 10% edge in collection efficiency for the programs with no incineration. There may be some extenuating factors to consider, however.

For one, the drop-off collection programs bias the data towards favoring the no WTE-component side. These programs have been cited as collecting more recyclables per capita than curbside programs. The difference is apparently due to the manner of materials collection, and not to other factors such as the means of disposal used. However, it must be said that no drop-off program currently sends its unrecycled wastes to a Long Island WTE incinerator.

Secondly, the inclusion of Babylon in the WTE category may not be entirely appropriate. Recycling partisans fear that WTE municipalities have a decided lack of interest in increasing recycling rates because, given a fixed waste stream, increasing recycling tonnages diminishes tonnages available to be burnt. The tone of these discussions has always been that while the municipalities will not overtly divert recyclables, they will not provide the necessary support to

make recycling as efficient as it could be. Babylon, however, is quite open about diverting paper recyclables to its incinerator at times. While such a municipal attitude may affect recycling participation rates, the effect we wished to test is less extreme. Does the mere presence of a WTE component lead to diminished municipal recycling enthuiasm, and therefore, less recycling participation? (It could be said that the rates for Babylon support a contention that overt diversions do affect recycling participation.)

Table 13. 1994 Household Recyclables Separation Rates

	in tons			lbs. per capita		
	Paper	Containers	Total	Paper	Containers	Total
East Hampton	1986	973	2959	245	120	365
Southampton	6000	2148	8148	264	95	359
Shelter Island	~200	~175	~375	~175	~150	~325
Southold	~2000	~1000	~3000	~200	~100	~300
Huntington	**17660**	**5349**	**23009**	**185**	**56**	**241**
Smithtown	**9846**	**3197**	**13043**	**174**	**57**	**231**
Long Beach	**2560**	**860**	**3420**	**152**	**51**	**203**
Glen Cove	~2000	~500	~2500	~160	~40	~200
North Hempstead	13274	6735	20009	125	64	189
Brookhaven	**26254**	**10871**	**37125**	**128**	**53**	**181**
Oyster Bay	18133	8080	26213	124	55	179
Riverhead			~2000			~175
Hempstead	**41067**	**17257**	**58324**	**113**	**48**	**161**
Islip			**~24000**			**~160**
Babylon	**8592**	**4233**	**12825**	**85**	**42**	**127**
Programs with no WTE-component			65204			205
Programs with a WTE component			**171746**			**174**
Programs with a WTE component (minus Babylon)			**158921**			**179**
Curbside programs with no WTE component			50722			184

bold lettering indicates use of WTE incineration for waste management

As it turns out, removing Babylon from the set of WTE-users does not dramatically affect the comparison. There is still an approximately 10% difference between the two classes. However, when the drop-off collection systems are removed from the data set, the gap between those municipalities using incinerators and those not using incinerators decreases to what is probably less than the margin of error in the data. Therefore, the data we have collected does not appear to support the contention that incinerator use leads to less recyclables collection fervor.

It should also be pointed out that the municipalities claiming to collect the largest set of recyclables materials, Hempstead and Brookhaven, both use incineration. In addition, Islip, which has been the pacesetter in the expansion of much of Long Island's recycling activities over the past ten years, has been using incineration as its primary waste management technique during those years.

Another contention that might be tested by this data is the concept that Pay-per-Bag systems result in enhanced recycling (when combined with no fee for recyclables). The Towns of Shelter Island and Southold both had implemented such systems. It is easy to see from Table 13 that both have nearly the highest recyclables collection rate on Long Island. However, it may be more apt to compare these two Towns to the other two drop-off recycling collection Towns. This has been done in Table 14.

Table 14. 1994 Municipal Drop-off Rates for Household Recyclables

	in tons			lbs. per capita		
	Paper	Containers	Total	Paper	Containers	Total
East Hampton	1986	973	2959	245	120	365
Southampton	6000	2148	8148	264	95	359
Shelter Island	**~200**	**~175**	**~375**	**~200**	**~150**	**~325**
Southold	**~2000**	**~1000**	**~3000**	**~200**	**~100**	**~300**

bold lettering indicates "pay-per-bag" system

This table shows that, in comparison with similar collection programs, no increase in recyclables results from a Pay-per-Bag program. However, such a conclusion does not appear to be supportable for other reasons. If household income levels affect recyclables separation, then the fact that East Hampton and Southampton have higher income levels should be considered. Secondly, the 1994 data for Shelter Island and Southold are based on estimations, and therefore should be viewed as somewhat uncertain. Finally, both Towns appeared (from qualitative assessments by Town officials [Tonjes and Swanson, 1996b]) to have increased their recyclables collection rates following the implementation of the Pay-per-Bag systems; at this time, it is difficult to separate the effects of the imposition of the new system from what appears to be a general recyclables separation rate increase experienced by all of the drop-off collection municipalities. Therefore, the data we have collected is not sufficient to determine the effect of the Pay-per-Bag systems on recyclables separation rates.

Conclusions

It is possible to draw some general conclusions about municipal recycling programs on Long Island from the data analyses presented here. First of all, a tremendous quantity of materials are managed through recycling. In 1994, the sum of municipally-claimed recycling credits was over 800,000 tons. This represents 25% of the total Long Island waste stream. It is equivalent to over 1.5 billion pounds.

As in all other waste management calculations, these numbers can change depending on what is included in the analyses. Another defensible recycling rate calculation for Long Island is 31% (which results from a denominator based on the municipally managed and counted total waste stream size). In terms of per capita credits, the average Long Islander could be said to have recycled 625 pounds in 1994. These calculations will be revisited in this project in light of additional data and analyses.

The municipalities with the highest recycling rates were either those that counted the most recyclables (often by including private sector activities, or by participating in post-collection separation programs, and that also had aggressive yard waste recovery programs), and/or the municipalities that limited their waste stream definitions. By these reckonings, Shelter Island had the greatest recycling percentage of the waste stream in 1994, at 45%, and Hempstead had the greatest per capita recycling rate, at 955 pounds person^{-1} year^{-1}.

We suggest that measures of curbside set-out rates, or drop-off collection rates, of the common materials of paper and containers, might be a more meaningful comparison of recycling program efficiencies. This is because of our perception of public attitudes towards these materials -- that the public perceives of these materials as "true" recyclables. Examination of the programs in terms of these materials also eliminates some gross differences in program scopes. Using these measures, the drop-off programs (at East Hampton, Shelter Island, Southampton, and Southold) were much better at recovering materials than were the curbside programs (after the early 1990s), with East Hampton reporting the best rate in 1994 (365 pounds person^{-1} year^{-1}). The analysis is somewhat clouded because the measures are per capita rates, and no effort was made to account for summertime vacation influxes on the East End. Of the curbside programs, Huntington's collected the most materials in 1994 (241 pounds person^{-1} year^{-1}).

In a closer examination of the data, however, the paper and container materials, considered "household recyclables," were shown to have a relatively small contribution (28%) to the overall tonnages claimed as recycled in 1994. Yard wastes comprised the greatest percentage,

at 38%. The remainder of the tonnages (33%) fell into the "Other" category. These tonnages included measurements of private sector recycling, post-collection recoveries, and collections of materials such as bulk metals and other more idiosyncratic materials (in some of the municipalities). Newspaper proved to be approximately half of the household recyclables collected.

Some factors were examined for their effect on recycling rates. No support was found for the contention that municipalities with an incineration component to their waste management strategies are less enthusiastic recyclers than those without such a component. It was impossible to say whether "Pay-per-Bag" programs increase recycling rates. A relationship between increasing incomes and increasing curbside set-out rates across most of the municipalities was discovered; the meaning of the relationship could not be determined at this time.

Finally, there is a disparity between public perception of recycling (a focus on household recyclables) and the fact that most Long Island recycling credits come from other sources. This could become important in terms of public perceptions of municipal policies aimed at augmenting recycling statistics or improving recovery rates.

Acknowledgements

Thanks are due to all the individuals at the various municipalities who most graciously provided the information contained in this report. They were unstinting of time and effort. The thoughtful research suggestions of Audrey McNulty-Gallo of Huntington were appreciated particularly.

We would also like to thank our reviewers of the initial version of this report, notably Vincent Breslin (The University at Stony Brook) and Carolyn Zenk (The Group for the South Fork), for their perceptive comments. Special thanks are also due to Jim Heil for continuing support and guidance.

References

Darlington, Richard B. 1990. Regression and Linear Models. McGraw-Hill, New York, NY.

deKadt, Maarten. 1992. Evaluating recycling programs: do you have the data? Resource Recycling. 11.6:28-36.

Dvirka and Bartilucci. 1993. Town of Huntington Draft Solid Waste Management Plan and Generic Environmental Impact Statement. Dvirka and Bartilucci, Syosset, NY.

Gibson, Dorothy. 1995. Recycling on the island. Newsday. May 22, Letter to the Editor, p. A25.

Hagstrom Map Co., Inc. 1986. Nassau County Atlas. Hagstrom Map Co., Inc., Maspeth, NY.

Hagstrom Map Co., Inc. 1993. Suffolk County Atlas. Hagstrom Map Co., Inc., Maspeth, NY.

Hoel, Paul G. 1954. Introduction to Mathematical Statistics. 3rd. ed. Wiley & Sons, New York, NY.

Long Island. 1994. Economic trends: LI population grows slightly. Long Island. November, pp. 8-9.

Meade, Kathleen, with Susan Combs, Michael Misner, and Maria Robertson. 1992. Recycling rates: how states count. Waste Age. 23.4:71-80.

Melosi, Martin V. 1981. Garbage in the City. Texas A&M University Press, College Station, TX.

National Recycling Coalition. 1989. The National Recycling Coalition Measurement Standards and Reporting Guyidelines (Draft). The National Recycling Coalition, Washington, DC.

Newsday. 1995. Breaking down the lottery. Newsday. December 4, chart, p. A22.

Platt, Thomas. 1994. Oral decision in SSC Corp v. Town of Smithtown et al., United States District Court for the Eastern District of New York. Adept Court Reporting, Hauppauge, NY.

Thomas, Jo. 1994. After growing in success, recycling faces obstacles. The New York Times. November 27, Main News Section, pp. 1, 44.

Tonjes, D.J. and R.L. Swanson. 1996a. Doing the Right Thing: Municipal Recycling Programs on Long Island in the 1990s: Part I of an Assessment of Recycling on Long Island. Marine Sciences Research Center, The University at Stony Brook, Stony Brook, NY.

Tonjes, D.J. and R.L. Swanson. 1996b. Comparing Apples and Oranges: Municipal Recycling Tonnages and Rates on Long Island in the 1990s: A. The Data Report: Part II of an Assessment of Recycling on Long Island. Marine Sciences Research Center, The University at Stony Brook, Stony Brook, NY.

Tonjes, D.J. and R.L. Swanson. 1992. Where Does It All Go? The Size and Method of Disposal of Long Island's Solid Waste 1986 and 1991. Special Report #103, Marine Sciences Research Center, The University at Stony Brook, Stony Brook, NY.

United States Environmental Protection Agency. 1994. Characterization of Municipal Solid Wastes in the United States: 1994 Update. EPA530-R-94-042. Solid Waste and Emergency Response, United States Environmental Protection Agency, Washington, DC.

Wehran Envirotech. 1993. Town of Brookhaven Cell 5 Landfill Expansion Final Environmental Impact Statement. Wehran Envirotech, Middletown, NY.

Personal Communications

Bunchuck, Jim. 1994. Supervisor, Department of Public Works. Town of Southold, NY.

Reaven, S.J. 1991. The concept of recycling. Department of Technology and Society, The University at Stony Brook. Unpublished manuscript.

Sherman, Huson. 1994. Supervisor, Town of Shelter Island, NY.

Smith, Jennifer. 1995. Recycling Educator, Department of Waste Management, Town of Brookhaven, NY.

Swenson, Eric. 1995. Superintendant of Environmental Control, Town of Oyster Bay, NY.