Silk Purse or Sow's Ear

Evaluating Recycling on Long Island
in the 1990s

Part VI of an Assessment of Recycling on Long Island

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David J. Tonjes
R. Lawrence Swanson

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

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J.K. Cochran
Dean and Director

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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 initial report into manageable pieces.

This paper, Silk Purse or Sow's Ear, is the sixth and final part of the series of 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.

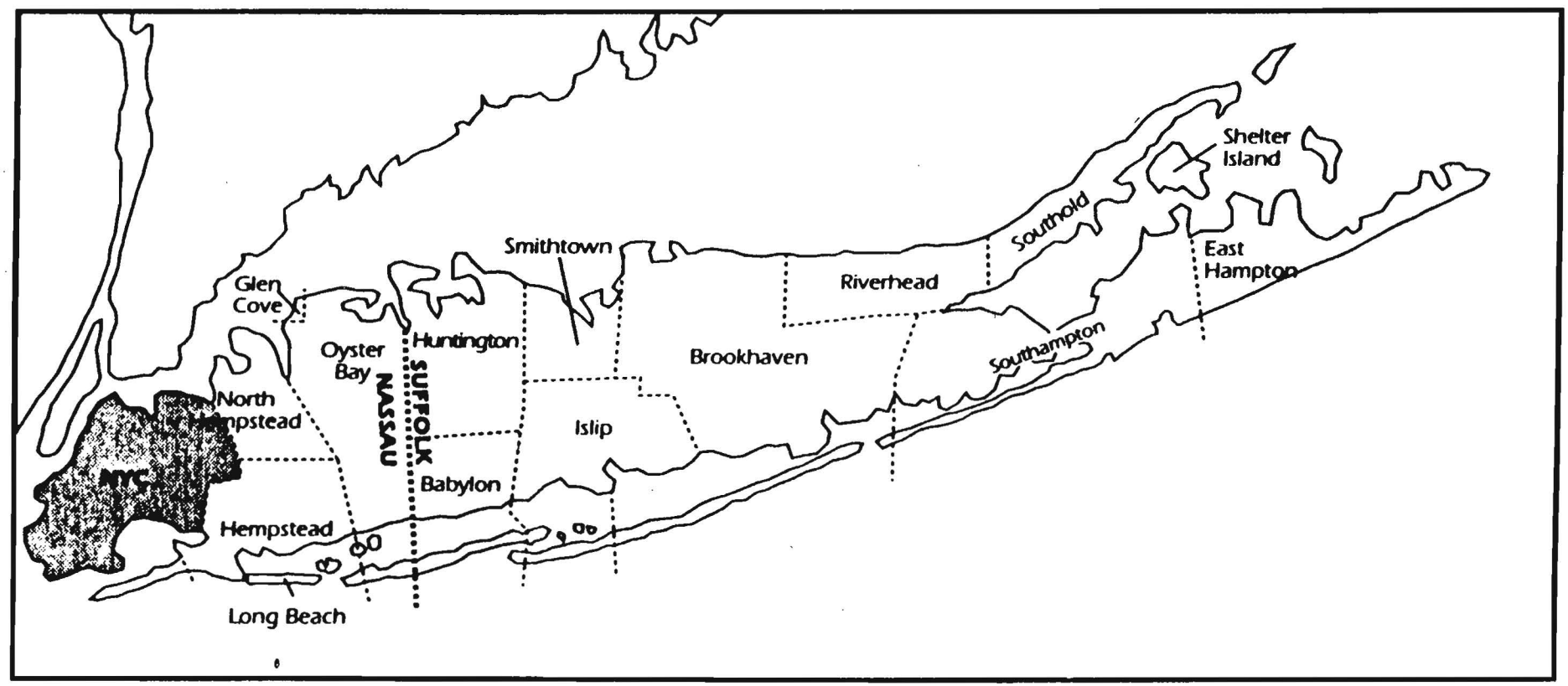
Silk Purse or Sow's Ear is intended to summarize the series of reports, and to address some of important issues raised in the course of the series. We have decided to discuss two of the issues at greater length. One has been mentioned throughout the series. It is the problem of credibly discussing something that can not be counted accurately or consistently. We list some ways to reform the entire "counting process" for recyclables and solid wastes. We do not believe that these changes will be adopted without discussion or perhaps even controversy. Nonetheless, we offer the changes in light of our dismal experiences with the present means of collecting information on wastes and waste processes.

The second issue is one we have studiously avoided addressing (even mentioning) in the previous papers. That is the question of whether or not the current effort made by Long Island to recycle can be justified. This topic has been discussed loudly in the mainstream press over the past year or so. We will attempt to briefly summarize the positions of the involved partisans, and

then present our assessment of the issues. We aim to please no one side in particular, and yet hope to be persuasive through logic and factual presentations.

We believe that this report will complete what is the most complete assessment of recycling by unbiased observers for a region such as Long Island. We trust that this series will be of some use to those concerned with solid waste issues in general (and recycling in particular) on Long Island and, perhaps, elsewhere.

Figure 1. Long Island Municipalities



Review of Parts I - V

Long Island lies to the east of New York City, and, in terms of this report, is comprised of the two counties of Nassau County and Suffolk County. The portions of New York City that are physically located on Long Island (Queens County and Brooklyn [Kings County]) have not been included in this report.

Waste management on Long Island is primarily managed by the 13 Towns and two Cities found in the two Counties (Figure 1). This has led to a multiplicity of approaches that might not be expected in such a relatively compact space.

Although Long Island was one of the first areas settled by Europeans on the East Coast, its population remained relatively small and almost exclusively devoted to agriculture and

seafaring until the 20th Century. The population of Long Island has increased over an order of magnitude this century. Particularly after World War II, Long Island became increasingly suburbanized. At this time, most of Long Island (to approximately the eastern Brookhaven border) is considered to be New York City suburbia. This is true despite the evolution of an increasingly independent identity for Long Island from New York City, particularly economically. The East End Towns (East Hampton, Riverhead, Shelter Island, Southampton, and Southold), while not thought of as New York suburbs, are considered to be summertime resort destinations for New Yorkers, predominantly.

Part I: Doing the Right Thing

Doing the Right Thing (Tonjes and Swanson, 1996a) was a report on the growth and evolution of Long Island's municipal recycling programs. It was a qualitative, descriptive account, examining the differences and similarities among the Long Island municipalities' approaches to recycling. It concentrated on recycling activities accomplished by the municipalities themselves.

Municipal recycling programs on Long Island prior to the 1980s consisted of several small-scale, limited collection programs, which were not intended to provide major diversions of wastes from disposal sites. The Town of Islip was the Long Island pioneer in requiring its residents to separate certain materials from the waste stream; as of 1994, all Long Island municipalities have adopted similar ordinances mandating residential and commercial source separation recycling. This may, in part, be due to the New York State law, GML-120-aa, which

requires source separation of all materials for which it is economically better to recycle than to dispose; certainly, the desire of residents for municipally-sponsored recycling also played a large role.

All Long Island municipalites recycle certain materials: newspaper, steel and aluminum cans, and glass bottles. All of the municipalities, with the exception of Babylon, collect corrugated cardboard (although the material is recycled in Babylon if dropped off by the homeowner at a collection site). All of the municipalities, with the exception of Long Beach, recover some portion of yard waste. All of the municipalities, with the exception of Glen Cove and Babylon, require the separation of some form of plastic containers (Babylon does accept drop-off plastics). In addition, many municipalities recycle various other materials. These, as reported to us, are listed in Tables 1-3.

Table 1. Municipal Paper Recyclables other than Corrugated Carboard and Newspaper

	Mixed paper Junk Mail	Magazines	Hi-grade	Telephone Books	Kraft	Box-board
Hempstead	x*	x*	x	x*		
Long Beach	x*		x			
North Hempstead	x*	x*				
Oyster Bay	x*		x	x		
Brookhaven	x*	x*	x	x*	x*	
East Hampton	x*					
Huntington	x*					x*
Riverhead	x*	x*				x*
Southampton	x*					
Southold	x*					

* = mandatory source separation

Table 2. Municipal Metal Recyclables, other than Containers

	Bulk metals White Goods	Cars	Car Batteries	Household Batteries	Aerosol cans	Aluminum foil
Hempstead	x		x			
Long Beach	x					
North Hempstead	x		x	x		
Oyster Bay	x		x			
Babylon	x		x			
Brookhaven	x		x	x	x*	x*
East Hampton	x	x				
Huntington	x		x	x		
Islip	x					
Riverhead	x					
Shelter Island	x					
Southampton	x		x			
Southold	x		x			

* = mandatory source separation

Table 3. Other Municipal Recyclables

Hempstead	waste oil, tires, sewage sludge, wood, mattresses, surf clam shells, cleanfill
Long Beach	waste oil
North Hempstead	waste oil
Oyster Bay	Christmas trees, C&D, cleanfill, tires
Babylon	waste oil, tires
Brookhaven	waste oil, PS, clothing, oil filters, wood
East Hampton	waste oil, food, tires, clothing, wood
Huntington	waste oil, PS, tires
Islip	waste oil, incinerator ash, C&D
Shelter Island	waste oil, tires, clothing, "ledge treasures"
Southampton	tires, clothing
Southold	waste oil, tires, wood, cleanfill

There are factors which differentiate the programs from one another. One difference is the means by which the paper and container recyclables are prepared for market. Some municipalities have built their own processing facilities (Municipal [or Materials] Recycling [or Recovery] Facilities -- MRFs). Brookhaven, Islip, and Smithtown have full-service versions of these plants; East Hampton, and, to a lesser extent, Oyster Bay, have some processing capabilities. Babylon has a facility that was developed with extensive municipal participation (although it is owned and operated by a private firm). Sanitary District 1 in Hempstead also has its own MRF. Riverhead's contract with its private sector waste manager, East End Recycling, calls for the construction of recyclables processing. Other municipalities rely on private facilities.

Collection (for recyclables and other solid waste) is accomplished in one of two means: either through municipally-arranged curbside service, or through the combination of privately-

contracted for service or homeowner self-haul, where the municipality plays no role in collection. Considering the residential waste stream, and excluding those villages that provide waste management services, the four Towns of East Hampton, Shelter Island, Southampton, and Southold have chosen not to provide collection services; the remaining municipalities do provide collection services (with Hempstead and Oyster Bay having bought special trucks for recyclables collection). All municipalities providing curbside collection services have issued residents special containers to facillitate the separation of recyclables. Service is provided once a week (although some municipalities collect paper and containers alternating weeks). When considering commercially-generated solid waste, only the Town of Babylon provides comprehensive collection services; Glen Cove, Hempstead, Huntington and Long Beach provide some form of limited (either in volume or areal extent) commercial collection.

Waste reduction has become much more prominent over the past several years as a waste management strategy actually used on Long Island. Organized waste reduction efforts in use are "Pay-per-Bag," "Don't Bag It," and Stop Throwing Out Pollutants (STOP) programs. Pay-per-Bag means that disposers are required to buy municipally-provided bags, which are priced according to the volume of wastes these bags hold. This makes the costs of disposable explicit, and dependent on waste generation rates. This kind of program is in use in Shelter Island, Southampton, and Southold. Don't Bag It programs are for yard waste control. The intent is to have the waste generator let grass clippings lie on the lawn, or to compost or mulch them, and to compost (or otherwise self-manage) leaves, branches, and other gardening wastes. Mandatory programs for grass clippings are in place in Brookhaven, Huntington and Islip, where these wastes

are no longer considered to be acceptable in the collection programs; these Towns have non-mandatory programs for the other yard wastes. Oyster Bay and Smithtown promote totally voluntary versions of the program. STOP programs are intended to divert hazardous household chemicals (insecticides, pesticides, solvents, oil-based paints and the like) from landfills and incinerators. All municipalities have some form of STOP program, with the exception of Long Beach. Brookhaven, Huntington, Riverhead, Shelter Island, Southampton, and Southold have built permanent facilities to accept these materials. The other eight municipalities have collection days at temporary locations during the year.

Composting of yard wastes in the 14 municipalities that collect them occurs in two primary forms: either through a municipal site, or through contracts with with the private sector. The division of the municipalites is primarily geographical, with Islip and Brookhaven, and the East End Towns operating outdoor yard waste composting sites (Huntington and Oyster Bay had composting sites earlier this decade, as well).

Several municipalities are investigating composting materials beyond yard wastes, and one municipality, East Hampton, has actually begun to do so. East Hampton is currently composting source separated food wastes in an enclosed composting facility. Riverhead has signed a contract with East End Recycling which calls for the construction of an MSW composting facility; East End, through a subcontract with Star Recycling, had been identified as a potential MSW composter for Brookhaven (this procurement stalled, and was officially cancelled in early 1997).

Another innovation in recycling on Long Island is the use of "dirty" MRFs. These are facilities which extract recyclables from the general waste stream. The Babylon Commercial and Residential Recycling Facility (CRRF) operated for approximately one year (1993), receiving commercial MSW generated in Babylon and North Hempstead. However, this facility failed. Over the same time period, and for approximately half a year more, North Hempstead used Star Recycling's facilty in Brooklyn for the same purpose (first for the Town's residential waste stream, and, following the closure of the CRRF, for the Town's commercial waste stream). Costs and the changed legal environment following the U.S. Supreme Court Carbone decision ended that relationship. The Town of Brookhaven has been involved in a long procurement process for a dirty MRF, partly to generate compostable materials (see just above); Long Beach had been hopeful that its new incinerator operator would deliver a front-end processor for the plant to remove additional recyclables from the waste stream (late in 1996, the NYSDEC acted to close the Long Beach incinerator for air quality and other environmental law violations, to be implemented in the Spring of 1997; it is not expected to re-open); and the new owners of the Babylon CRRF may once again accept materials other than source separated recyclables.

The U.S. Supreme Court Carbone decision (banning "flow control" laws that required the use of certain disposal facilities in a particular area) continues to affect Long Island waste management. The Town of Babylon's commercial recycling program, for example, is an off-spring of this decision. Babylon, in order to ensure waste flows to its WTE incinerator with its flow control statute declared invalid, created a collection district for its commercially-generated

wastes. This bid district disenfranchised the private carters who were not part of the consortium that won the bid. It also led to litigation, which delayed the onset of the district by over a year.

Out of this process, however, came a comprehensive municipal effort to collect commercially-generated recyclables. Because a clause of GML-120-aa forbids governmental interference with pre-established private recycling enterprises, there has been some competition for the recyclables in the Town (and some allegations of recyclables collection being used to circumvent the districting concept). The full impact of Town collection of recyclables has not been assessed yet; nonetheless, other municipalities, especially those with facilities where waste flows may also be at risk from the Carbone decision, are carefully observing the experiment.

The lack of an ability to establish flow control has certainly played a role in slowing Oyster Bay's waste planning process, including how and/or whether the Town's recycling program will be developed. Flow control questions also appeared to be a factor in the cancellation by Brookhaven of its Dirty MRF-MSW Composting procurement. Flow control is also an element in the lack of construction activity at the permitted East End Recycling MSW composting plant in Calverton.

Part II: Comparing Apples and Oranges

Physically, Comparing Apples and Oranges was divided into two volumes. 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.

Part B: The Data Analysis (Tonjes and Swanson, 1996c) used the information from Part A to reach several conclusions regarding municipal recycling efforts. 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 Long Island waste stream (given an estimate of 3.25 million tons $year^{-1}$ for the total waste stream). The sum of claimed recyclables was equivalent to over 1.5 billion pounds in 1994.

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 based on the data collected here was 31% (which results from a denominator based on the municipally managed and counted total waste stream size). The data also translated to an average Long Island per capita recycling rate of 625 pounds in 1994 (see Table 4, below).

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 $person^{-1}$ $year^{-1}$ (Table 4).

Table 4. Municipally-claimed Recycling Percents, 1986 & 1994, and 1994 Per Capita Recycling Rates (in pounds person^{-1} year^{-1})

	1986 Recycling Percent	1994 Recycling Percent	1994 Per Capita Recycling Rate
Nassau County			**789**
Glen Cove*	0%	16%	269
Hempstead	0%	41%	955
Long Beach	0%	13%	217
North Hempstead	0%	34%	722
Oyster Bay	0%	29%	536
Suffolk County			**466**
Babylon	0%	30%	451
Brookhaven	0%	22%	368
East Hampton	0%	24%	763
Huntington	0%	26%	586
Islip*	0%	30%	600
Riverhead*	0%	8%	260
Shelter Island*	0%	45%	885
Smithtown	0%	13%	235
Southampton	0%	18%	421
Southold*	0%	24%	807
Long Island	**1%**	**31%**	**625**

* 1994 information is estimate based on data from earlier years

We suggested 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 paper and containers as "true" recyclables. Examination of the programs in terms of these materials also eliminates some gross differences in program scopes (see Doing the Right Thing). 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. No effort was made to account for summertime vacation influxes on the East End[1]. Of the curbside programs, Huntington's collected the most materials in 1994 (241 pounds person^{-1} year^{-1}) (see Table 5 for 1994 calculations).

Table 5. 1994 "Household Recyclables" Recycling Rates (pounds person^{-1} year^{-1})

	Paper	Containers	Total
Curbside Recycling Programs			
Nassau County			
Glen Cove	~160	~40	~200
Hempstead	113	48	161
Long Beach	152	51	203
North Hempstead	125	64	189
Oyster Bay	124	55	179
Suffolk County			
Babylon	85	42	127
Brookhaven	128	53	181
Huntington	185	56	241
Islip			~160
Riverhead			~175
Smithtown	174	57	231
Drop-off Recycling Programs			
Suffolk County			
East Hampton	245	120	365
Shelter Island	~175	~150	~325
Southampton	264	95	359
Southold	~200	~100	~300

[1] Although summertime residents can increase some East End Towns' populations by 50%, on an annualized basis that increase is only 10-15%. It is far from clear whether visitors recycle as well as permanent residents. In addition, other areas on Long Island also experience summertime tourism. This may be overnight visitors (Fire Island) or day trippers (such as at Port Jefferson or Jones Beach). In the absence of a simple means of accounting for all these effects, they were all discounted.

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 (Table 6). 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.

Table 6. Recyclables Composition, 1994 (by percent)

	Household Recyclables	Yard Wastes	Other
Nassau County	**21%**	**36%**	**39%**
Glen Cove	~75%	~15%	~10%
Hempstead	17%	46%	37%
Long Beach	94%	0%	6%
North Hempstead	26%	30%	44%
Oyster Bay	33%	11%	56%
Suffolk County	**39%**	**42%**	**19%**
Babylon	28%	56%	16%
Brookhaven	43%	55%	3%
East Hampton	48%	41%	11%
Huntington	41%	47%	12%
Islip	~25%	~35%	~40%
Riverhead	67%	25%	8%
Shelter Island	~40%	~50%	~10%
Smithtown	89%	0%	11%
Southampton	85%	0%	15%
Southold	~40%	~30%	~30%
LI total	**28%**	**39%**	**33%**

These data show 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.

Part III: Plumbing the Unknown

Plumbing the Unknown (Tonjes and Swanson, 1996d) attempted to address private sector recycling practices not accounted for in the municipal compilations. This was not completely possible, because waste management companies on Long Island tend to be small and privately-held (limiting public information), and because of the substantial organized crime role in the Long Island carting industry (which also reduces information availability because of illegal practices and intimidation). State and local government oversight was also deemed to be inadequate.

The overall framework of private sector recycling was sketched through descriptions of nation-wide trends, and through anecdotes and observations of local practices. Three major means of recovering materials for re-use emerged:

(1) source separation. This may be through a carting firm, where a separate collection is provided. However, much of this activity appears to be through direct marketing by the generator to a recycler (as with supermarket corrugated cardboard). Long Island carters appear to offer little in the way of source separation because of the relatively small size of

most companies (which limits flexibility in establishing economic routing) and because of real or perceived space limitations at the generation points.

(2) "pure" waste stream recovery. This is when a single component waste stream is either totally or partially recovered. Examples include lawn-care companies' composting, or in-house salvaging of scraps or imperfect products. The latter example is rarely included in assessments of the degree of materials recycled from a waste stream.

(3) post-collection separation. Materials can be salvaged from the waste stream after being collected as commingled MSW. This process can become intertwined with C&D recovery and processing operations. This appears to be the most obvious means of recovery from the commercial waste stream on Long Island (in terms of visibility and reported tonnages). The large number of transfer stations (30 permitted facilities in 1995, with more unpermitted facilities) expedites this process. Transfer stations exist because of limited or economically uncompetitive local disposal sites; the removal of recyclables is largely motivated by reduced hauling costs, although positive resale values encourage recovery efficiencies.

Although it is difficult to determine exactly how much is recovered from the commercial waste stream outside of some limited municipal efforts, we developed an estimate based on some available municipal data (from the Towns of Babylon, Hempstead, and Oyster Bay). This estimate was that carting companies and transfer stations recovered approximately 200,000 tons

of materials from the waste stream in 1994, which was not included in any municipal accounting of Long Island recycling. This tonnage represents 6% of the total baseline amount of MSW generated on Long Island. It is not possible to determine how inflated that estimate is because of recoveries from C&D (not considered part of the MSW waste stream).

Additionally, we estimated that a minimum of 75,000 tons of source separated paper goods were recovered, and marketed directly, by the waste generators (typically, supermarkets). We also suggested that it is feasible that another 75,000 tons of yard wastes were composted by landscaping firms and related businesses, without being included in any reckoning by local or State authorities.

The impact of these activities would then have been to recover an additional 350,000 tons from the waste stream beyond the amounts counted by the local municipalities (in 1994). This additional recycling would have accounted for some 11% of the baseline annual generation of MSW on Long Island.

Part IV: Extending the Definition

Extending the Definition (Tonjes and Swanson, 1997a) began by discussing waste reduction. The paper closed by combining the previous waste stream recovery estimates into one overall rate.

Waste reduction is considered to be the highest form of waste management in the hierarchical ranking of general waste management techniques. Nonetheless, it has often been given short shrift in general discussions of waste management, and can be difficult to describe and define.

We defined waste reduction as two processes. One is the elimination or minimization of wastes through process changes and modifications. The other is the elimination or minimization of wastes by changing or modifying the description of the materials as "wastes" -- that is to say, excluding the materials from waste stream definitions. The first kind is generally performed by manufacturers, or product users; the second is often a function of disposal system management.

The first, especially when conducted by manufacturers in the normal course of business, appears to be much more effective in reducing waste production than the second process. Choices made by individuals to reduce wastes are also effective, especially when sponsored by the organization within which the action occurs (such as when a company espouses paper use minimization strategies by promoting double-sided copying or e-mail use). It is more difficult to eliminate wastes by, say, refusing to collect these materials -- as in Don't Bag It programs, where the amount of wastes is not decreased, but the management of the wastes changes.

Waste reduction has been relied upon to provide significant portions of the total waste diversion amounts targeted by regulatory agencies. New York State assigned nearly one-quarter of the diversion from the overall waste stream to waste reduction (8 - 10% of the overall 50%

reduction goal). Nonetheless, recent State advisories admit that direct computation of waste reduction appears to be impossible.

We created an estimate of waste reduction credits generated on Long Island through the Don't Bag It programs for yard wastes, through per capita determinations of grass clippings disposal. We estimated that approximately 70,000 tons were not managed through waste management programs because of this (in 1994). It did not seem possible to calculate other credits due to waste reduction efforts.

We also created an estimate of the tonnage recovered due to the nickel deposit program for containers (from Town of Hempstead data). The estimate summed to 75,000 tons for all of Long Island.

Thus, the way appeared to be clear to create an account of all quantifiable waste recovery programs on Long Island, in comprehensive and yet conservative manner. The sum of municipally-accounted for and private sector recycling on Long Island was found to be approximately 1.25×10^6 tons in 1994. This totaled to some 900 pounds person^{-1} in 1994, and accounted for between 35% and 40% of the entire waste stream. The Town of Shelter Island appeared to recycle the greatest amount per person, at 1050 pounds person^{-1} year^{-1} (albeit that Town's per capita rates may be affected by not including seasonal population fluctuations and second-home ownership); however, data uncertainties due to rounding make this rate almost indistinguishable from the rates of Hempstead (at 1027 pounds person^{-1} year^{-1}) and Southold (at

975 pounds person^{-1} year^{-1}). The Town of Hempstead received credit for recycling the greatest tonnages of any of the municipalities in this accounting (Tables 7 and 8).

Table 7. Augmented 1994 Long Island Recycling, using Published and Modelled Data (in tons)

	Estimated or Known (1994)	Modelled Priv. Sect.	OCC and Compost	Bottle Returns	Estimated Total 1994
Nassau County	**508000**	**19000**	**75000**	**40000**	**650000**
Glen Cove	3250	1500		600	5250
Hempstead	346418			26167	372585
Long Beach	3655	2100		800	6600
North Hempstead	76442	15500		5250	97000
Oyster Bay	78278			7250	86000
Suffolk County	**300000**	**180000**	**75000**	**33000**	**600000**
Babylon	45658	29000		5000	80000
Brookhaven	75500	59000		10250	145000
East Hampton	6178	1000		400	7500
Huntington	56001	28000		4750	90000
Islip	90000	43000		7500	140000
Riverhead	3000	3400		600	7000
Shelter Island	1000	140		50	1200
Smithtown	13281	16000		2750	32000
Southampton	9571	2800		1100	13500
Southold	8000	1200		500	9750
Long Island Total	**825000**	**200000**	**150000**	**75000**	**1250000**
Estimated Percent of the Total Waste Stream	25%	6%	5%	2%	38%
Estimated Percent of Adjusted Waste Stream	24%	6%	4%	2%	36%

Adjusted Waste Stream = 3.5 million tons year^{-1}. See the discussion below.

Table 8. Maximal Long Island Per Capita Recycling Rates (1994) (pounds person^{-1} year^{-1})

Nassau County		**1000**
	Glen Cove	425
	Hempstead	1027
	Long Beach	400
	North Hempstead	925
	Oyster Bay	600
Suffolk County		**900**
	Babylon	800
	Brookhaven	700
	East Hampton	925
	Huntington	950
	Islip	925
	Riverhead	600
	Shelter Island	1050
	Smithtown	575
	Southampton	600
	Southold	975
	Long Island Total	**950**

Of some concern is the spread between different municipalities that do not appear to have such distinctly different recycling programs. For example, there appear to be many parallels between the Town of Hempstead and the City of Glen Cove recycling and overall waste management programs. Nonetheless, by the time all the recycling sources are tallied, residents of Hempstead had approximately twice the per capita recycling rate as residents of Glen Cove. We did not see any serious methodological problems in our analysis; it may be that differences between what is and is not counted in these municipalities creates the difference in rates. The situation appears to be the same for other Long Island municipality groupings.

In addition, as we discovered seemingly new sources of recycling and tonnages of recycled materials, we needed to address the fact that our earlier waste generation estimates had most certainly not included all of these materials in them. Therefore, with the expanded definition of

recycling credits, it seemed wise to use the upper bound of our earlier-developed waste stream size (1992) for Long Island (3.5 million tons $year^{-1}$). The calculated percentages did not vary much with this change in overall waste stream size (see Table 7).

The following Towns all appeared to be able to claim to recycle more than 900 pounds $person^{-1}$ $year^{-1}$ in 1994, according to our data: Hempstead and North Hempstead in Nassau County; and East Hampton, Huntington, Islip, Shelter Island and Southold in Suffolk County. The Long Island-wide recycling rate was approximately 950 pounds $person^{-1}$ $year^{-1}$.

Waste reduction credits summed to 2% of the total Long Island waste stream. This made overall waste diversion, Long Island-wide, between 37% and 40% of the total waste stream. Waste diversion tonnages totalled to approximately 1.3×10^6. Islip appeared to divert the most wastes on a per capita basis, at 1125 pounds $person^{-1}$ $year^{-1}$. The uncertainties associated with rounding errors make it seem that the rates for Shelter Island (1100 pounds $person^{-1}$ $year^{-1}$) and Southold (1050 pounds $person^{-1}$ $year^{-1}$) were approximately equal to Islip's rate. Hempstead (1027 pounds $person^{-1}$ $year^{-1}$) and Huntington (1000 pounds $person^{-1}$ $year^{-1}$) also appeared to divert wastes at rates equal to or greater than the mean Long Island per capita rate for 1994 (approximately 1000 pounds $person^{-1}$ $year^{-1}$), and East Hampton and North Hempstead were within error estimates of the Island-wide rate (the Long Island-wide rate was greater than the weighted mean of the municipalities because of some credits that were not allocated to individual municipalities) (Table 9).

Table 9. 1994 Long Island Waste Diversion Rates (pounds person^{-1} year^{-1})

	Waste Diversion Rate	Degree of Rounding
Nassau County	**1000**	**50**
Glen Cove	450	50
Hempstead	1027	1
Long Beach	400	25
North Hempstead	925	25
Oyster Bay	675	25
Suffolk County	**1000**	**50**
Babylon	800	25
Brookhaven	775	25
East Hampton	950	50
Huntington	1000	25
Islip	1125	25
Riverhead	700	50
Shelter Island	1100	100
Smithtown	650	25
Southampton	675	25
Southold	1050	50
Long Island Total	**1000**	**100**

It was possible to construct, therefore, a range of recovery rates for Long Island as a whole (and, indeed, similar ranges for almost all of the individual municipalities). The variability in the data presented in Table 10 stems from the fact that all calculations of recycling for Long Island had hitherto not included some aspects of wastes recovery. The range of values is in keeping with an overall theme of this report: recycling rate calculations depend greatly on what is included in the calculations (and what is excluded).

Table 10. Calculated Recovery Rates for Long Island (1994 Data), using Three Waste Stream Sizes[2]

Estimate Number	Estimate Basis	Percent (2.6 x 10^6 tons)	Percent (3.25 x 10^6 tons)	Percent (3.5 x 10^6 tons)	Per Capita (lbs. person^{-1} year^{-1})
1	Curbside-Dropoff (Paper & Containers)	9%	7%	7%	175
2	All Municipally-reported	31%	25%	24%	625
3	(2) plus Unaccounted-for Commercial Sector		31%	30%	775
4	(3) plus "Other" -- OCC and Yard Wastes		36%	34%	900
5	(4) plus Bottle Bill Returns		38%	36%	950
6	(5) plus "Don't Bag It" Estimates		40%	37%	1000

Finally, this data allowed for the construction of an estimate for various elements of the waste management hierarchy on Long Island for 1994. These data are presented in Table 11.

Table 11. Estimated Long Island Waste Balance (tons per year)

	WTE Incineration	Waste Diversion	Off-Island Transport	Total
1994	1500000	1250000	750000	3500000
(approximate)	45%	35%	20%	

Waste reduction could be documented to recover less than 5% of the waste stream, and therefore was included with recycling as an overall "waste diversion" category. Waste diversion

[2] 2.6 x 10^6 tons is the waste stream size developed from municipally-reported data in 1994 (Tonjes and Swanson, 1996c); 3.25 x 10^6 tons is the total waste stream size we developed for Long Island in the early 1990s (Tonjes and Swanson, 1992), and argued was still valid for 1994 (Tonjes and Swanson, 1994c); 3.5 x 10^6 tons is the upper limit of the total Long Island waste stream according to our calculations (Tonjes and Swanson, 1992); the use of this as the total waste stream may be most appropriate when all-inclusive measures of recycling are considered.

accounted for approximately 35% of the waste stream (plus or minus 5%). Incineration with energy recovery accounted for 45% of the waste stream. Landfilling was considered to be effectively 0%, as the Long Island Landfill law approached full implementation. Transport of wastes outside of the region for disposal, which is not part of the formal waste management hierarchy, accounted for the remaining 20% of Long Island's waste stream.

Part V: Going for the Goal

Going for the Goal (Tonjes and Swanson, 1997b) discussed the possibility of Long Island as a whole, and its constituent municipalities, meeting the New York State 1997 goal of 50% waste reduction and recycling. The goal was set in 1987 as part of the New York State Solid Waste Management Plan (SWMP). Because of its use as a regulatory tool by the State in reviewing local waste management planning, and as a permit condition in many projects, this goal can be considered to be a "mandate" -- something that has been required of those at whom it is aimed.

In order to describe how Long Island waste management might evolve from 1994 (the last full year of our data collection) to 1997 (the year that the 50% waste reduction and recycling goal was to be met), Solid Waste Management Plans (SWMPs) for the municipalities were examined. These planning tools were also required by New York State as an element in the permitting process for major facilities. The NYSDEC claimed that 12 of the 13 eligible municipalities (in 1995) had either "accepted" or "submitted and under review" SWMPs. However, closer

examination of the situation showed that this was a somewhat optimistic reading of the situation (Table 12).

Table 12. LI SWMPs Summary (as of December, 1995)

Municipality	Date Submitted	Accepted?	All Facilities Built or Operating?	Comments
Glen Cove	Not eligible			Change of law in 1995 made cities eligible; privatized operations/closed facilities in 1995.
Hempstead	1993	Yes	Yes	Recycling rate growth lower than projected.
Long Beach	Not eligible			see Glen Cove (above);incinerator closed, 1996.
North Hempstead	1993	Yes	No	Joint with Babylon; necessary facilities closed/contracts dissolved, 1994.
Oyster Bay	not yet			
Babylon	1993	Yes	No	Joint with North Hempstead; necessary facility closed, 1994; major program change, 1995.
Brookhaven	1993	Yes	No	Necessary facilities not built.
East Hampton	1991	Yes	Yes	Recovery projections not being met.
Huntington	1993	Yes	Yes	
Islip	1995	No		Responding to State comments.
Riverhead	1991	No		Rejected State comments; privatized operations, 1993 - 1994.
Shelter Island	not yet			Planning underway.
Smithtown	1995	No		Responding to State comments.
Southampton	1991	Yes	No	Necessary facilities not built; major program change, 1995.
Southold	1995	No		Responding to major State criticisms.

Table 12 shows that four of the seven municipalities with accepted SWMPs do not have the necessary (or promised) infrastructure in place and operating. Two of the other three

municipalities are not meeting the SWMP recovery goals (East Hampton's failure being due to use of an unfortunately-chosen baseline year). Huntington escapes without comment because its SWMP was written with extremely vague and modest goals. It was also written for an in-place program, with already-built facilities, and merely called for recycling rate "maximization," while leaving that goal almost entirely unquantified.

However, the SWMPs, flawed as they may be, were used to help create estimates of 1997 waste management for Long Island. The estimates developed in the paper were based on: 1994 data collected from the municipalities themselves; and on augmentations of those statistics, based on data collected (or applied) in other papers in the series. The estimates and estimation process illustrate a failure in the State mandate: the 1997 50% waste recovery goal was set without defining what could be counted, what should be counted, and what should not be counted.

Long Island as a whole was predicted to be unable to reach the State 50% recovery goal for 1997. However, Long Island appeared to be able to reach a nearly 40% recovery rate by the end of 1997 (Table 13).

Table 13. 1997 Projected Long Island Waste Diversion, by Municipality (in tons)

	Recycling	Don't Bag It	Total
Nassau County	**625000**	**10000**	**650000**
Hempstead	400000		400000
Long Beach	6500		6500
North Hempstead	65000		65000
Oyster Bay	90000	11000	100000
Suffolk County	**600000**	**120000**	**700000**
Babylon	60000	7500	70000
Brookhaven	145000	41000	190000
East Hampton	11000		11000
Huntington	90000	19000	105000
Islip	135000	30000	165000
Riverhead	8000	2300	10000
Shelter Island	1100	225	1300
Smithtown	40000	11000	50000
Southampton	21000	4500	25000
Southold	8000	2000	10000
Long Island Total	**1225000**	**125000**	**1350000**
Estimated Percent of the Total Waste Stream	35%	4%	39%

Two measures were used to assess the individual municipalities. One was use of a per capita waste recovery measure (Table 14), where 1350 pounds person^{-1} year^{-1} translates (on a Long Island-wide basis) to 50% of the waste stream. The second was the more familiar (and traditional) percentage recovery measure (Table 15). The projections showed it is possible that four Long Island municipalities will be able to claim to meet the State mandate (Southampton, Shelter Island and Islip by percent, and East Hampton by per capita claims). It is also possible that Brookhaven, Hempstead and Huntington, as they are projected to achieve greater than 90% of the State mandated recovery levels, may be able to manipulate the data enough to achieve the goal, or may simply claim to be close enough for the difference not to matter. These seven municipalities account for 65% of Long Island's population.

Table 14. 1997 Projected Long Island Per Capita Waste Diversion Rates (pounds person^{-1} year^{-1})

	Waste Diversion Rate	Degree of Rounding
Nassau County	**1000**	**50**
Glen Cove	450	50
Hempstead	1100	50
Long Beach	400	25
North Hempstead	625	25
Oyster Bay	675	25
Suffolk County	**1100**	**100**
Babylon	700	25
Brookhaven	925	25
East Hampton	1400	200
Huntington	1100	100
Islip	1100	25
Riverhead	900	100
Shelter Island	1100	100
Smithtown	900	50
Southampton	1100	50
Southold	1000	100
Long Island Total	**1000**	**100**

Table 15. Projected 1997 Waste Stream Recovery Rates for Long Island Municipalities

Nassau County	**37%**
Glen Cove	23%
Hempstead	46%
Long Beach	21%
North Hempstead	28%
Oyster Bay	36%
Suffolk County	**40%**
Babylon	26%
Brookhaven	49%
East Hampton	43%
Huntington	41%
Islip	52%
Riverhead	40%
Shelter Island	54%
Smithtown	36%
Southampton	61%
Southold	39%
Long Island Total	**39%**

For some of the Long Island municipalities, it may be difficult to reach the State goal, at least as estimated using our methods. Nonetheless, Long Island appears to be able to say it has done much better in straining for this goal than could have been imagined in 1986, and, indeed, than many would have imagined in 1994. The achievements documented, although some may appear to be paper recoveries or accounting tricks, are on the whole authentic (if somewhat underdocumented in some cases). Recycling and waste reduction represent mammoth effort, and management of some 35 - 40% of the waste stream for Long Island. As an unfair, but irresistable comparison, Long Island has spent nearly $1 billion in capital to build its WTE incinerators (recycling is much less capital intensive, and the facilities operated by municipalites certainly cost much less than $100 million). The incinerators manage some 45% of the waste stream.

2. Report Conclusions

A. How Good Are The Numbers?

The title of this section, How Good are the Numbers?, is obviously more than a little disingenuous. Our intent was to create the best possible numerical description of recycling on Long Island. Therefore, the numbers are as good as it was possible for us to determine.

Nonetheless, certain fundamental problems are incorporated into these numbers. The five discussed below show where much of the uncertainty in the data originates.

Gross vs. Net Measures Certain municipalities measure recyclables only in terms of what is collected; others measure gross tonnages, but also report a "net" tonnage that results from processing the collected materials. It is understandable that those municipalities that do not

process the recyclables at their own facilities would have difficulties in determining what the net (post-processing) tonnages for the materials are. Philosophically, as reject and unprocessible materials are generated all along the path from curbside back to the marketplace, it may be appropriate for each member of the chain of cusody to report only the "known" recycling facts: tonnages received, tonnages shipped. This is because, in a sense, determining what tonnage to use as the "recycled" tonnage does seem to be somewhat arbitrary. However, such standards lead to inconsistent reporting.

Processes that, due to their inherent nature, result in tonnage losses, are even more confusing. In leaf composting, as the simplest example, up to 50% of the incoming tonnage may be lost as evaporation, and exuded carbon compounds and water. Materials may be removed from the incoming wastes as a pre-screening step -- tree trunks, any plastic bags, rocks, etc. A certain amount of materials is generally screened from the composted materials -- shredded plastic bags and other MSW, pieces of trees, leaves that have not thoroughly composted. Assigning these numbers to categories such as "reject," "amount recycled," "process residues," and other general categories associated with recycling can be impossible (Tonjes and Swanson, 1996b).

"Net vs. gross" is also a problem in considering waste reduction, in a sense. Should the credits for waste reduction be required to be demonstrable ("net"), or can they be calculated from some theoretical measures? For example, should yard waste reductions due to Don't Bag It programs be calculated by determining the change in wastes delivered to various disposal facilities, and then computed with regard to other reductions? Should a theoretical participation-

rate-and-wastes-diverted caculation be used? Should a grand "leaves in the forest and in the yards" amount be determined, and the waste diversion rate equal what is not processed from that "universe?"

We believe that "net" data, from the first line of processing, are the preferrable tonnages to report for recyclables. This data, since it should occur mostly one step away from the initial collector of materials if not at the collector, should not be difficult to obtain. If a processor collects from more than one source, pro-rated data can be reported -- although good business practices suggest that the processor should be able to determine the source of contaminants in the process.

Each situation calls for similar kinds of decisions. A guiding principle should be that the collection of inappropriate material should not result in increases of recovered material tonnages. In addition, it may be that certain initiatives, such as most waste reduction measures, may not be quantifiable. If they can be demonstrably counted, then perhaps waste reduction measures should be included in waste diversion determinations.

Because much of the data we used was "gross" data, materials that later were disposed (and counted in disposal tonnages) may also have been included as recycled tonnages. In addition, because we used a theoretical determination for grass clippings diversion, certain tonnages may have been counted as diverted although they had never been included in any previous waste calculation.

Waste Stream Definitions This applies mostly to private sector operations, where it appears that it can be difficult to separate different waste streams (in calculations, that is). State regulations require separation of C&D and MSW (if the C&D is to avoid the stricter disposal and handling rules associated with MSW) (New York State Department of Environmental Conservation, 1993). Therefore, the materials (as they are processed) must be separated. However, the separated recovered materials do not need to be segregated from each other based on origin. Therefore, reports detailing recovery rates at private facilities do not clearly distinguish between those materials gleaned from C&D and those from MSW. To the operator, the difference may be unimportant. However, in determing recycling rates from the solid waste stream, which has definitionally excluded C&D, the difference is important.

If it is not possible for such operators to directly determine the origin of recyclables, it should be possible to create estimates -- either through comparisons of inflows and outflows, or through process auditing. Both of these calculations would seem to be necessary to properly run such businesses -- although the release of such data may not be. Regulations and/or permits should require the collection of such data.

Data holes These may exist because of data unavailability. Records may not be easily accessible, or staffing problems may make compliance with requests for data inconvienient or difficult. The data may never have been collected in the first place, or may not have been collected properly, or may have been recorded incorrectly.

The lack of an ultimate data collection authority for Long Island waste stream data makes the existence of data holes unavoidable. We, of course, believe that we have established credibility and a certain semi-official role as Long Island data compilers through our own efforts. However, we certainly have neither the means of requiring adherence with data management requirements, nor the powers to require participation in reporting efforts.

In 1994, the western Suffolk County municipalities were discussing cooperative efforts in waste management (Tonjes and Swanson, 1996d). At one point, a serious proposal to establish a Long Island waste management authority was presented (Cahill, 1994), although given the existing rats' nest of governmental bodies on Long Island, even without the demise of flow control authority implementation would not have been simple. One of the major functions of the authority would have been waste management data collection.

The New York State Legislative Committee on Solid Waste has been generating State-wide reports on waste management for several years (see Heintz et al., 1996). However, these reports rely extensively on municipally-generated and -reported data, and do not attempt to analyze the quality of the reported data. This makes the problems discussed in our Part II (Tonjes and Swanson, 1996b; Tonjes and Swanson, 1996c) greater for the Legislative Committee's reports.

It makes sense for the regulator to collect data on the process. In most instances, this suggests that the NYSDEC is the appropriate data manager. However, regulators may have

certain problems critically assessing data. In many instances, it is not the prime function of the regulator to ensure that accurate data is reported. The regulator may have more critical concerns about processes. For example, although the operator should not mislead with scale data, at a landfill it is probably more important that the site be operated so as to cause a minimum of environmental effects. A regulatory crackdown on data management may not be conducive to the relationships that may be useful in ensuring proper functioning at the landfill. A focus on paperwork and scale balances may not be the critical issue at most regulated facilities.

In one area, however, greater attention by regulators is called for. All municipalities on Long Island grant permits to carters to operate within the municipality. It is most appropriate for the municipalities to require waste management data as a permitting condition. This should result in no great impositions on carter practices, judging from the experiences of Babylon and Oyster Bay (Tonjes and Swanson, 1996d).

The two county governments (Nassau and Suffolk Counties) have no direct waste management roles. These two governments do have many relationships with their constituent municipalities, and have large staffs that are adept at collecting and processing data. The many official and unofficial ties between the governments should result in good compliance with information requests, without, however, presenting any threats of regulatory difficulties. In addition, the large and active County planning departments may result in some broad planning on waste management (somewhat freed from NIMBY pressures, as the County is not likely to actually enact any waste management plans).

Inconsistent Classifications of Materials as Recycled MSW This problem mostly affected our understanding of commercial recycling efforts. Some municipalities also used what we would describe as incorrect definitions of recyclables: counting automobiles, for example, or wishing to include STOP program materials in the quantifications. Automobiles, although certainly widely processed to recover metals, have not been included in MSW definitions. STOP programs typically do not result in reuse or reformulation of the collected materials, but rather in disposal through hazardous waste facilities.

In the private sector, however, many more tons may have been called recycled than should have been. Firms that listed wood as a recovered material at their transfer station, also reported using the Hubbard Power and Light facility (which was supposed to burn a clean wood waste stream to produce electricity) as the recycler (New York State Department of Environmental Conservation, Region I, 1995). Burning materials, even when they are separated from the general waste stream, and when electricity is produced, is not considered to be recycling. Additionally, many of the materials quantified in both municipalities' and individual firms' annual reports seemed likely to be recovered from C&D: concrete, bulk wood, cleanfill. Because of their origin as C&D, inclusion of these materials as MSW recyclables is inappropriate.

In Part B ("Redefinitions of Recyclables, Recycling, Reuse, Recovery ...") immediately following, we suggest a comprehensive solution to this problem.

Linear Data Trends We made certain assumptions when data was skimpy or flawed. The premise that is shakiest is that the trends we found applied equally across Long Island, and across time.

For example, we created a rate for per capita commercial recycling, based on limited data from Oyster Bay, Babylon, and, to a lesser extent, Hempstead. The rate of commercial activity, and therefore commercial waste generation, may be different for the other portions of Long Island. This would make such a recycling rate incorrect. Or, the kind of businesses could vary so as to change the recycling rate. The recycling rate itself may vary geographically, without an overt reason, as appears to be the case for residential recycling.

Another recycling tonnage projected from incomplete data was the Long Island supermarket corrugated cardboard tonnage, which was extrapolated from only one company's efforts. The deposit bottle recovery rate was likewise projected from one point (which itself was an estimate). The grass clippings composting amount, and the Don't Bag It waste reduction credit, were not only applied equally across Long Island, but were based on scant data.

These five factors show that the data we presented are most probably inexact, to one degree or another. We believe that the figures we created are the most likely data set that could have been or has been constructed for Long Island.

If the data are indeed in error, the most likely direction of the error is to overstate some of the recycling rates. This is despite efforts to err conservatively in estimating recovered amounts. The errors raising the rates would be due to inclusion of recyclable tonnages that were derived from non-MSW origins. Becuase we believe our work on the general size of the Long Island waste stream (Tonjes and Swanson, 1992) is still accurate, we resisted increasing the waste stream size from 3.25×10^6 tons year^{-1} (only suggesting that 3.5×10^6 tons year^{-1} might be more appropriate to use as the unrecorded tonnages of recyclables increased in the later projections) (Tonjes and Swanson, 1997a; Tonjes and Swanson, 1997b). If much of commercial recycling credits, for example, were derived from C&D and other non-MSW materials, than the effect was to not increase the denominator of the recycling rate calculation as much as it should have been increased. This artificially increases the recycling percentage.

An imprecise, but perhaps accurate, rendering of how we think waste management on Long Island should be represented is: less than 50% incinerated (~45%), about a fifth transported off Long Island (~20%, or a little less), and something more than a third (~35%, or a little more) recycled or otherwise recovered.

We believe that the suggestions we have offered above to improve data collection, etc., would result in much more precise (and accurate) descriptions of the waste stream. The suggestions made below concerning the definition of "recyclables" will also make the counting process simpler.

B. Redefinitions of Recyclables, Recycling, Reuse, Recovery ...

As we concluded in Apples and Oranges: B. The Data Analysis (Tonjes and Swanson, 1996c), there appears to be dissonance between the perception of recyclables as materials such as paper or aluminum cans set aside for eventual reuse as raw materials, and the fact that such paper and containers comprise less than 30% of Long Island municipalities' claimed recycling (in 1993 and 1994).

We believe that the perception that recyclables are elements of a (re)-manufacturing process contains the germ of a redefinition of recyclable. We are suggesting that a recyclable should only be claimed when a waste stream material replaces an item in an existing process, or results in a material that replaces another existing material.

Under this, the containers and papers that are processed to create feedstocks for other paper goods or containers (or aluminum, glass, plastic or steel products) would be counted as recyclables. Appliances, net of the unrecovered wastes, would be counted as recyclables. Waste reduction would not result in "recycling" credits; neither would composting, on the grounds that compost is essentially a new consumer market created to absorb the production of the material -- and, since the peat moss market was never as large as current compost usage is, compost is not replacing an existing material's use. Similarly, recovering bulk wood for wood chips would not be recycling. Burning waste stream-seaparated woods to produce electricity would not count as recycling. Substitution of concrete and other materials for "cleanfill" would not count as

recycling. Materials reuse would not count as recycling, as the material never became part of the waste stream. Similarly, process scrap recovery would not count as recycling.

This does not mean that we believe composting and other means of avoiding incineration or landfilling should not be encouraged and recognized. We think they should be described as "avoided disposal" credits, not as recycling. Materials such as compost and wood chips seem to fall naturally under the rubric of "secondary materials" (Breslin et al., 1993).

We recognize that this is a restrictive definition of recycling. We believe it is important to be strict about what is considered to be recycling, however. We like this definition because it removes artifical distinctions between programs that are urban or rural in nature (where yard wastes may not be important in recovery calculations) and those in the suburbs (where yard waste management needs are great). It centers the concept of recycling on the replacement of raw materials with those recovered from the waste stream. It denies credit (as recyclables) to materials mined from landclearing debris and C&D, which have always been (to some degree) distinct from general MSW. It avoids the public perception problem that two-thirds of governmentally-claimed recycling credits on Long Island are currently derived from non-household materials recovery.

Consider the effect of this definitional change on some of the more innovative materials claimed as recyclables by the Town of Hempstead (Tonjes and Swanson, 1996a). The shells from clam processors used as beach roadways would become recovered, secondary materials, or

avoided disposal tons, under the proposal. As discussed below, the Town would still receive recognition for this efforts, but not recycling credits. The Town effort to collect used mattresses for re-covering and eventual resale, since it results in the replacement of new mattresses in the market, counts as a recycling effort.

C. Redefining the Regulatory Goals

Stricter definitions for recycling credits probably ensure that Long Island municipalities will not be able to recycle 50% of the waste stream. The original intent of the Department of Environmental Conservation in 1987 had been to set a 25% recycling goal (Liblet, 1993). Political pressures resulted in a last minute doubling of that goal to the current 50%.

Restricting recycling credits to the "Household Recyclables" (glass, metals, plastics, paper, etc.) makes a goal of 25% recycling a challenge. This is especially true if data collection is improved and refined in the private sector to accurately count the recycling efforts and waste production of stores and businesses. While this might increase the tons of recyclables in each municipality's inventory, it will also result in a more accurate assessment of waste disposal tonnages. The Recycling Rate would then be computed as RR = R/(R+D), where R = the recycled tonnage, and D = the disposed tonnage.

Other efforts would be recognized as Avoided Disposal tons. The State could recognize those that maximize this amount, either on per capita or gross tonnage bases. Included in this assessment would be claimed waste reduction and reuse efforts, composting and wood recovery

tonnages, and special efforts -- such as, perhaps, incinerator ash reuse, glassphalt, or crumb rubber roadway usages.

Applying these rules listed above[3] would result in the following recycling rates for the Long Island municipalities in 1993 or 1994 (Table 16). Please note that these data are still plagued by disparities between various municipalities. For example, the disposal tonnages for Glen Cove, Hempstead, Long Beach, Smithtown, and the East End Towns with municipal drop-off services only (East Hampton, Shelter Island, Southampton, and Southold) include commercial wastes as well as residential wastes. Smithtown's recycling tonnages do not include any commercial sector data; it is not clear that the other municipalities in the above list also collected recylables from the commercial sector in a comparable way to that in which they disposed of commercial MSW. Therefore, these data still contain certain problems.

[3] Somewhat -- the data for recycling tonnages are collected tonnages, not net tonnages, due to a general lack of the latter, to avoid more data disparities.

Table 16. Redefined Recycling Rates for Long Island Municipalities (1993 or 1994) (percent)

		Recycling Rate
Nassau County		
	Glen Cove	13%
	Hempstead	12%
	Long Beach	13%
	North Hempstead	12%
	Oyster Bay	13%
Suffolk County		
	Babylon	12%
	Brookhaven	13%
	East Hampton	15%
	Huntington	16%
	Islip	18%
	Riverhead	7%
	Shelter Island	25%
	Smithtown	14%
	Southampton	17%
	Southold	14%

Table 16 Notes: Glen Cove, Riverhead, Shelter Island data estimated based on partial/earlier data.
Islip, Shelter Island, Southold data based on 1993 data.

It is quite probable that the Riverhead data is too incomplete to allow for a reasonable comparison to the other municipalities. Ignoring that datum, then, it is intriguing to note that, with one exception, all the recycling rates range between 12% and 18%; and most of the municipalities were credited with 12 - 14% recycling. This is despite acknowledged differences in the types of waste streams considered, and a certain degree of differences in the data collection for recycling tonnages. The common thread between those municipalities exceeding the normative 12 - 14% recycling rate seems to be success in limiting waste stream sizes. Shelter Island, in particular, decreased its waste stream size tremendously for the data year. The amount of wastes disposed for Islip, Southampton, Huntington, and East Hampton were all, at the least, smaller than has usually been reported for these municipalities. Of course, some of these

municipalities have also managed to maximize per capita household recyclables collection rates (notably, Huntington, Shelter Island, and Southampton -- see Table 5).

Therefore, the municipalities that had the highest recycling rates (under our redefinition) achieved those rates by minimizing disposal tonnages. This was accomplished by using disincentives, or by yard waste or other waste diversion programs, and, to a lesser degree, maximizing household recyclables collection efforts.

It is somewhat dispappointing to realize that this data suggests that for every pound of "real recyclables" diverted from the waste stream on Long Island, approximately six or seven pounds are disposed, in most areas. This suggests that there are large tonnages of potentially recyclable materials available in the waste stream after source separation efforts. However, given the maturity of most Long Island programs, and the generally flat growth rates for these programs, it seems unlikely that current approaches will succeed in mining that potential.

D. Why Should Long Island Recycle?

There appear to be four general factors that affect this question: legal, economic, environmental, and social. We shall address them in that particular order.

Legal Issues

Technically, Long Island households source separate recyclables because they are legally required to. New York State General Municipal Law 120-aa, passed in 1988 by the State

Legislature, requires solid waste planning units to have laws mandating source separation of all materials "for which economic markets exist." In addition, certain materials (newspaper, corrugated cardboard, tin, aluminum, glass and HDPE and PET plastic containers) are required to be source separated unless a demonstration is made that no economic market exists for the materials. Commercial establishments and institutions are required to recycle all materials on the household list, as well.

Therefore, all Long Island municipalities have passed local laws mandating source separation of recyclables. Complaints have been made by numerous recycling advocates that these laws are not enforced. New York City, under legal pressure from Natural Resources Defense Council in the early- to mid-1990s, made enforcement of its laws a centerpiece of its attempt to meet the State recycling goal (and the ambitious recycling figures outlined in its SWMP) (Thomas, 1994). The City has slacked off on the publicity and ticketing program garnered newspaper coverage in the past year or so. This may be due to ower expectations for recycling, especially in light with the City decision to close its Fresh Kills landfill (New York City Department of Sanitation, 1996). With no landfill to permit, the City is somewhat free from regulatory pressures to meet its SWMP goals.

James Heil, former Commissioner of Waste Management at the Town of Brookhaven and former Commissioner of Sanitation at Town of Hempstead, is one of many who think that practical impediments prevent effective use of recycling law enforcement. Barriers to effective ticketing include: 1) identification of the "miscreant" -- i.e., whose name goes on the citation. The

choices include the homeowner, who may not live there; the occupant, whose name may be difficult to obtain; or the actual person who set the garbage out (the person not responsible for the offense may accurately argue innocence in court, if that is whose name is on the ticket). 2) How is the ticket served -- taped on the offending can? delivered in person to the offender? 3) What is the basis for the ticket? Is it not setting out recycling bins -- non-participation -- or inclusion of recyclable materials in with disposed MSW, for example. One of the more difficult problems is the necessity that enforcement efforts will be selective rather than comprehensive (Heil, 1994).

All of Mr. Heil's points are somewhat persuasive, and somewhat not persuasive. Municipalities are able to enforce various other violations of local codes through homeowner and/or occupant ticketing. New York City, for one, had been able to establish a basis for non-compliant recycling ticketing that had been perceived as uniformly unfair but deserved (Thomas, 1994) (which is probably a good test of a fair basis for ticketing). Other laws are generally enforced selectively, such as traffic violations or the tax law, without too much public outcry.

The existence of State goals, coupled with the solid waste regulations, could lead to a regulatory impetus for recycling efforts. As discussed in Going for the Goal (Tonjes and Swanson, 1997b), New York State regulations allow major waste management facilities to be permitted only when an approved SWMP calls for meeting or exceeding the State recycling goals. For WTE incinerators and landfills, even more restrictive criteria (named "The Broome County Rules," after a court case between Broome County and the NYSDEC) apply, where yard wastes are excluded from the calculation. The calculation of 40% recovery from the remaining

"processable" waste stream is required before the permit will be given (New York State Department of Environmental Conservation, 1993). However, it is not clear that any major facilities, except for those aimed at removing recyclables from the waste stream, or processing them for markets, will be placed on Long Island any time soon. Additionally, it is not clear how the regulations would be enforced, if the targeted municipality merely created a SWMP that called for it to move towards meeting the State goals.

We will argue later that the imposition of legal requirements for recycling may weaken two of what we believe are better reasons for recycling, (see the Social Issues section). Because enforcement of recycling laws may lead to adverse voter reactions, and because of impediments cited by Mr. Heil, it does not seem likely that Long Island municipalities will enforce their recycling ordinances merely as good government actions. Recycling is viewed as a good activity; it does not appear to have widespread support as a necessary activity (as, for example, traffic law enforcement is viewed). The existence of advisory State goals is almost certainly insufficient to spark local action -- especially given a discernable lack of public outrage.

Economic Issues

Economics is the ultimate justification for public policy decisions in the mid-1990s. The market has been decreed as the unfailing judge of the worthy and the unworthy. Therefore, it is no surprise to find that supporters and opponents of current recycling efforts cite economic justifications for their positions.

In 1994, it would have been difficult to mount an economic attack on recycling. The Town of Brookhaven realized nearly $1 million in revenue from its MRF that year, after half a decade of revenues of less than a tenth that amount. The Town then budgeted recycling monies as a tax increase avoidance measure for 1995 (Smith, 1995). Turning a profit from recycling was not exclusively found in Brookhaven, but was a general Long Island trend for that year (Gannon, et al., 1995). Nationwide, the Environmental Defense Fund (EDF) used to publish an advertisement with the tag line, "Don't throw it all away." This was meant to be moral suasion for recycling. The EDF now pitches its support for recycling as it being the most cost-effective public waste management technique available (Wurster, 1994).

The source of this economic support was high used paper values -- so high that newspapers set out for recycling curbside were stolen by "paper pirates" (Smith, 1995; Swenson, 1995). Then China closed its markets to outside waste paper, and prices plummeted. The economic argument now belonged to those who did not support recycling. One of the strongest in a series of economic reassessments of recycling was an article in the Wall Street Journal. It found that the costs of recycling programs greatly exceed those of other waste management methods (Bailey, 1995). Others had suggested that recycling was not the most economic method of managing wastes prior to this particular article (see Rathje, 1989; Scarlett, 1991; Rathje and Murphy, 1992; Alexander, 1993; Garbage editors et al., 1993; Van Voorst with Monroe, 1993). After the Wall Street Journal article, the economic failures of recycling were discussed in scientific terms in a refereed journal (Black, 1995); of particular local importance were high-profile articles in Newsday (Yan et al., 1995) and The New York Times (Tierney, 1996).

The true cost of recycling is difficult to determine. It depends on the assignment of costs. In general, the Suffolk Town survey by Suffolk Life (Gannon et al., 1995) merely compared monies received for the sale of recyclables to the costs of preparing the recyclables after collection (whether through a MRF or a private processor). The Wall Street Journal article tried to account particularly for collection costs as well as making the preparations versus sale revenues comparison, but also briefly considered other program costs. Some seem to have carried the determination of the marginal costs of recycling to extremes. For example, Tierney (1996) included the sorting effort of householders (assessed at the prevailing wage rate for New York City union unskilled laborers) and the space allotment in apartments for the recyclables (assessed at the average cost per square foot for apartment space in Manhattan). Not surprisingly, he found that the costs for recycling greatly exceeded revenues, and were much higher than all other forms of waste management.

Thoughtful assessments whose conclusions support the costliness of recycling acknowledge that this economic determination strongly depends on local factors (Black, 1995) -- as do those that find recycling may be cost-effective (Ackerman, 1997). Most assessments do not find that recycling makes a true profit, although some serious work -- Commoner et al., 1990; Ron Albrecht Associates with Corrdy, Capenter, Dietz and Zack, 1990 -- have made that determination. Most evaluations favorable to recycling are content to find recycling is the most economic form of waste management (i.e., loses money at the slowest rate per ton) (Ackerman, 1997).

New York State at one time attempted to standardize the financial portion of the accounting, because of the State law requiring curbside collection of all "economically feasible" materials (GML 120-aa). Economically feasible was defined as finding the cheapest means of managing the material was to recycle it. NYSDEC released a draft guidance document; objections from the regulated community were so fierce that a final version of the guidance was never released (New York State Department of Environmental Conservation, 1992). Many of the objections concerned the difficulty of creating an accounting scheme that fairly approximated the componenet costs involved in various waste management processes, for different MSW materials.

It is clear that, for strictly defined accounting purposes, the costs of recycling for individual businesses can be quantified and compared to costs of other waste management methods (Reaven and Tonjes, 1992; Cornell Cooperative Extension [Suffolk County] and County of Suffolk, 1993). It is also clear that decisions regarding how to conceptualize the distribution of costs are extremely important.

In a sense, some of the more important baseline economic choices concerning recycling are philosophical. For example, if the essential nature of modern waste management is seen to flow from the historical purpose of protection of public health, then certain economic evaluations are appropriate. For example, "single-stop" garbage collection may be determined to be the baseline method of waste collection. Then recycling collection costs become "extra costs." This would be true even if recycling collections accounted for the majority of wastes -- because if the "baseline" collection were not continued, the wastes so managed could not be added to the

recyclables (where they would be contaminants), whereas the reverse would be true (and public health preserved). It is not clear that because a system has evolved for "historical" purposes, that the historical valuations should continue to be used. If nearly all MSW is potentially recyclable, should the primary collection service focus on the small amount of residues that are not recyclable? On the other hand, if it is necessary to collect all wastes to protect public health, then the means that can manage all the wastes should have collection priority. However, all forms of disposal are limited in some fashion, and often municipalities on Long Island today are finding that some materials apparently have no legal means of disposal -- such as whole tires, or the pesticide chlordane (even excluding other legal limitations, such as the State ban on landfilling or incinerating yard wastes, or local bans on grass clippings) (New York State Department of Environmental Conservation, 1993; Tonjes and Swanson, 1996a). Nonetheless, it is accepted by most waste managers that recycling collection costs are an extra cost, and "disposal" collection costs are a system necessity. Such determinations color other system valuations.

Practical considerations also affect economic evaluations of recycling. In the private sector, for example, the cost allocations may be made on a "start-up" basis. When the required equipment procurement and other costs are spread across a small economic base, costs can be too high to justify expansion into recycling.

Costs allocation can be understood by considering the example of a small supermarket. Hypothetically, a decision is to be made whether or not corrugated cardboard recycling should

begin. If the carting company serving this stop does not already offer such services to other customers, the carting company has the expenses associated with the following:

- creating a new route (one which, without other customers, is likely to be extremely costly);
- purchasing new containers or re-allocating old containers;
- establishing a new billing system;
- adjusting its route structure for MSW (assuming that the recycling program is successful, and leads to fewer or smaller volume MSW pickups at the store);
- learning to market, do quality control, and deliver the new product to the recycling system.

Other areas of expenses can be found, of course. These costs will, in a "rational" market, be passed along directly to the supermarket. The chances that recycling will begin are small, unless the return on cardboard is great.

These same costs could be minimal if the same store had an established recycling program, and decided to add a new material to its recyclables list. This is especially so if the new material could be set aside in a container already devoted to recyclables. Then there is minimal additional cost to both the store and the carter -- perhaps even no additional costs for either (Reaven et al., 1991; Reaven and Tonjes, 1992; Cornell Cooperative Extension [Suffolk County] and County of Suffolk, 1993).

The supermarket example was deliberately made simple. Including the disposal and processing systems further into the calculations makes the results even more indeterminate due to the number of reasonable inclusion-exclusion of costs decisions.

Consider cost determinations associated with the Town of Brookhaven Leaf Composting Site in Manorville. Should a cost or value be assigned to the 33 acres of the site? The site is an old landfill -- does it have diminished value as compared with the surrounding land, or not? Is the use of the land an improvement of an old landfill site, or a diminishment, due to the loss of passive open space? Should the value of the land be determined through a comparison of costs that a private entreprenur would pay for similar and similarly-situated land, or as no-cost use of the old landfill -- or even as positive value to the Town as leading to improvement (remediation) of the contaminated land? Would the land now devoted to composting have been used for other purposes -- and if so, should costs or lost revenues associated with these other uses be included in the valuation? Similar considerations can be associated with other site-related factors -- such as the equipment and personnel assigned to the site. Lines need to be drawn to determine other system boundaries -- such as accounting and other overhead services. Costs should also be considered if different departments contribute to recycling efforts (such as Highway Department leaf collection, or the Parks Department's summertime clean-up work) -- but again, how can those costs be determined? Well-considered answers that differ tremendously can be created for such situations. Developing a single answer to the "costs" of any method of waste management thus becomes difficult.

Such considerations may be seen as tediously academic, and divorced from the "real world." A standard accounting factor was created for recycling to address the cost questions in terms of the real world, but also including some of the inherent complexities. This factor is "avoided disposal costs" (National Recycling Council, 1989). Avoided disposal costs are the presumed charges for treating the recyclables as MSW. Although this figure is not strictly a cost, it is the basis of most recycling economics evaluations. Unfortunately, the complexities of what to include and what not to include, once beyond the simple case of paying a tipping fee to dispose of wastes, can make the determination of avoided costs difficult.

For example, many waste management systems have put-or-pay obligations, where a minimum amount of waste must be paid for whether it is delivered or not. If a recycling program brings the deliverer under the tonnage obligation, system costs may increase. Should that cost be assigned to the recycling system's costs? A variation of put-or-pay obligations are stepped disposal costs, where the amounts paid depend on the rate of delivery. Furthermore, if different disposal options are available, should the disposal cost to be avoided be the greatest cost, the least cost, or the cost associated with the "most responsible" disposal means available?

A determination of the true costs of recycling that accounts for individual situations would be impossible to use in any large-scale analysis; one that does not account for the idiosyncrasies may be seriously misleading and controversial -- the lesson that the NYSDEC learned in 1992 in its failed attempt to move its proposed avoided costs calculation rules beyond the "Draft" stage. It may be that accounting for costs over longer periods of time is the only means of determining

true costs. However, the longer the projected time period becomes, the more assumptions are necessary. This can again lead to misleading results, and academic and unrealistic exercises such as pervade the SWMP process. The carter or municipality deciding to offer recycling services, if not assuming growth or long-term economics, will never be able to begin because of start-up considerations. It is always a difficult decision to decide to assume short-term losses for the prospect of long-term gains.

The benefits from recycling are also not simple to determine. The benefits can be found simplistically by examining revenues from the sales of the collected materials. Most observers admit that is not a complete assessment of the value of recycling. The most prevalent addition to the benefit side is avoided costs. The next benefit often considered is some evaluation of environmental gains from recycling (for examples: Fishbein, 1994; Repetto, 1995; Ackerman, 1997).

Controversy involving these assessments also occurs. For one, as we discuss next, it is not clear whether or not recycling is an unalloyed environmental benefit. Assuming that it is a benefit to the environment, properly assessing the benefits is tremendously difficult. Dollar values have been assigned to energy savings, for example, in many assessments of recycling benefits. However, assessing the value of an uncut forest, or an unmined mountain is difficult. Attempts have been made to quantify the economic value to the world of natural systems (Constanza et al., 1997), but these attempts are necessarily speculative and tentative. The effort to revamp standard economics by creating credits for maintaining environments in good health are receiving more

attention (i.e., French, 1995; Daly, 1996; Halstead and Cobb, 1996). Nonetheless, they are not part of standard accounting procedures yet.

We do not think there is any means of creating an unbiased economic evaluation of recycling. Boundary questions are often resolved according to conventions that may or may not relate well to the real world (consider the concept of "depreciation allowances," for example). At this time, the determination of economic benefits or losses from recycling according to standard methodologies appears to be generally weighted against finding a benefit.

Environmental Issues

It is an environmentalist axiom that recycling is good for the environment. Data from scientific studies are less certain.

"Life-cycle analyses" have attempted to quantify the effects of certain materials on the environment. As could be expected from the name, life cycle analyses attempt to combine all the disparate effects associated with products -- including manufacture, sale, use, and disposal. The effects are tracked through air, water, and land impacts. Again, because determinations of costs and benefits can be dependent on the boundary determinations or site specific characteristics, the results of such studies often conflict (Fagin, 1993; Ackerman, 1997).

Consider the simple determination of the environmental impact of waste reduction steps -- which seems to be an obvious open-and-shut finding in favor of waste reduction. However, by

assigning impacts to the use of wash water, for example, one study concluded that disposable coffee cups were environmentally more sound than ceramic cups, unless the reusable cup lasted for nearly 100 cups of coffee and was only washed every other cup (Rattray, 1993). This assignment is not, on the face of it, unreasonable. However, it can also be argued that no (or little) hot water is created for the sole purpose of washing coffee cups. That might change the analysis results considerably. Another relatively well-known group of studies have found that the question of the use of disposable diapers versus cloth diapers depends on rainfall and general water availability -- during a drought, or in dry regions, use disposable diapers, and if water is widely available (with proper sewage treatment), use a cloth diaper (Arthur D. Little, 1990; Lehrberger, 1991; Warmer Bulletin, 1993).

Therefore, it is not surprising that studies struggle with more complicated waste management issues. The environmental impact of incineration has been assessed as either largely benign, or as one of the more dangerous activities occurring in the U.S. Two of the more contentious decisions that largely determine the results of the studies have to do with whether plastics contribute to dioxin production, and if dioxins have the extreme health effect popularly attributed to them -- and neither issue seems well-determined at this time (Jones, 1991; Breslin et al., 1993; Swanson et al., 1993). "Devil's advocate" reports can even suggest malign effects occur from composting (Heil and Tonjes, in press). The field of life cycle analyses has improved its reputation since the earliest days, when the ability to make choices based on boundary and other conditions resulted in reports that always clearly vindicated the sponsor of the report (Ackerman, 1997).

Nonetheless, there have been serious attempts to quantify the environmental effects of recycling. There are aspects of recycling that are certainly environmentally sound -- such as the energy use reductions obtained in many industries when using recycled materials as a feedstock in place of virgin materials. However, entire system analyses of recycling tend not to be as rosy. For one, there is a great deal of entropy to overcome in recycling -- materials are dispersed into each household, and must be regathered. Then there are the sorting and cleaning tasks, and finally transportation costs to the re-fabrication site. Working with virgin materials, which are often concentrated in one place and can allow for the fabrication point to be established close to the supply of materials, can limit these considerable environmental costs (Arthur D. Little, 1990; Franklin Associates, 1990; Brown et al., 1991; Jones, 1991; Lehrberger, 1991; Reaven, 1991; Alexander, 1993; Breslin et al., 1993; Swanson et al., 1993; Black, 1995). Aesthetic and ecological considerations are important in any such discussion, but can only be approximated -- and only with great uncertainty and subjectivity, despite some claims (Repetto, 1995; Halstead and Cobb, 1996; Constanza et al., 1997) to the contrary.

Among the more complete efforts to determine the costs and benefits of recycling and other waste management strategies are those conducted by the Tellus Institute in the mid-1990s. Frank Ackerman, in his literate and well-thought out book, Why Do We Recycle? summarizes the conclusions of those reports as showing a slight environmental impact preference for recycling as a waste management strategy. However, the advantage is small enough that it probably does not hold under certain site-specific conditions, and in the face of variability associated with the other measured factors in the studies (Ackerman, 1997).

In fact, for Long Island itself, the environmental impacts from recycling may well be negative. If it is assumed that the recycling collection efforts are "extra" -- i.e., if only one collection was offered to citizens, it would only be for undifferentiated MSW -- then curbside collection programs result in increased truck traffic in Long Island's neighborhoods. The difference in "disposal" costs also depends on the assessment of effects of incineration versus the impacts of the truck traffic necessary to move the recyclables off Long Island. Finally, if Tellus is correct and the determination is slightly tipped towards recycling, Long Island, locally, because it does not receive any benefits directly from decreased energy usage in manufacturing, or added effects from the non-use of natural resources (since Long Island has little to no manufacturing, and no resource utilization beyond sand mining for concrete and asphalt), probably is negatively impacted environmentally by recycling as compared to other available waste management methods (especially off-Island disposal).

Social Issues

If legal, economic, and environmental justifications for recycling are not convincing, it may be that social rationales are. There appear to be two good justifications for recycling from a social/moral perspective.

One is a call on the old-fashioned virtue of thrift. Recycling is often simply perceived as the "proper, thrifty" allocation of resources. Many are horrified by the throw-away culture where so many valuable items have extremely short lifespans, and receive little use before being discarded. Terms such as "junk mail" or the disdain that plastics receive (because of their

association with single-use or cheaply made, easily disposed items) are signals of a general societal ill-ease with our consumptive ways. By recycling, we assuage some of our guilt, and believe that we are contributing to a more frugal way of life (Faggiani et al., 1993).

This attitude is compelling, and no environmental group has lacked for support because of an antagonistic approach to plastics or single-use materials. The EDF slogan, "You're throwing it all away," still resonates srongly although that group has adopted a more market-oriented approach to environmental activism. Although every claim of imminent resource shortages (for example, Meadows et al., 1992, and Brown, 1995) seems to have come to naught, we all "know" that we cannot continue to put soda in aluminum cans, drink the soda, and discard the can -- not after the effort and environmental disruption involved in creating the aluminum can in the first place, and given the fact that bauxite is not a renewable resource. We know -- despite the scholarly studies cited above -- that such single-use items must have deleterious environmental impacts, and that returning the can for remanufacture prevents some small amount of environmental degradation, and saves the resource for future generations' use. We "know" these things are true, and some studies (Brown et al., 1991, for example, because of limits placed on factors considered) will support these feelings. We would like to believe they are true, in any case. We do know that by recycling we combat the "waste culture," and we are being thrifty. And a certain amount of pride and other good feelings is associated with that.

The second social force for recycling, especially for suburban Long Islanders, is that recycling is the most direct (and easiest) means for Long Islanders to validate themselves as

environmentalists. Public opinion surveys consistently find that most Americans identify themselves as environmentalists. Recycling, as a government sponsored activity occurring (for most Long Islanders) right outside their own front doors, is a relatively simple and painless way to participate in the "Great Environmental Awakening."

Other means available for suburban environmentalist participation are not so easy. It is difficult to limit consumption, to protect groundwater resources by eliminating pesticide, herbicide, and fertilizer use, and to carpool or try to use the (mostly) unusable mass transit alternatives available in suburbia (commuter rail to New York City excepted). But recycling, despite some momentary inconvieniences, is mostly painless.

The further reward is that recycling program participation allows the concerned Long Islander to become involved in environmental issues elsewhere. No-one wishes to be perceived hypocritical. This is especially true in environmental issues, and it is an issue that the first world is often criticized about when discussing world-wide environmental problems (Brundtland, 1997). Participation in recycling is a kind of innoculation for Long Islanders against hypocrisy. It allows us to think we are doing our part in the struggle to save the world, and therefore allows us to urge others to do their share, as well.

Our justifications may not be seen as positive descriptors. That may be especially true if participation in recycling allows Long Islanders to dismiss other forms of environmentalist actions as unnecessary. For example, if recycling is perceived of as being all that is necessary to do to

save the environment, more significant actions (carpooling or responsible use of pesticides and herbicides, for example) may not be considered. Although we fear this is possible, we do not think it is typical.

Certainly it is possible to be cynical about these two justifications. Thrift is a small virtue, a household virtue. It is not dramatic, and the effects of thriftiness are cumulative and slow. And without the ability to justify the label of environmentalist, many might feel compelled to abandon interest in the subject, as something outside of normal experience -- as something that is not part of everyday life. Certainly, if the environmentalist ethos is to become engrained in the American psyche, it must be through the usual participation of people from all walks of life -- not just the activists who may garner the headlines, and be involved in the "large" issues.

These justifications we offer are quiet, and similar to the actions required to make recycling work. They are small adjustments in otherwise unaffected lives, which may add to fairly substantial effects.

Other justifications do not have that same kind of transforming power. Legal enforcement can bring about changes -- for a time. Forcing compliance with regulations only succeeds when the regulators are around. Otherwise, voluntary compliance is required. The economic justification only works when it directly affects pocketbooks. Being told that recycling profits reduced Town taxes by $4 - $5 per household may not inspire great efforts. On the other hand, reducing a waste billing to a business owner by one-third may be inspiring -- if the effort required

is not too great. As of right now, recycling economics seem too whimsical to be used to justify great public effort. And finally, the "rational" environmental argument is not entirely satisfying (although the belief that recycling is good for the environment is the basis of one of our own justifications). For one, the actual data collected on the environmental impacts of recycling are inconclusive. For another, the benefits appear to be occurring at a distance, and that is always troublesome in environmental affairs. It is always easier to gather protests for the destruction of local woods, for example, rather than the disappearance of the rain forest -- possibly because people believe that such protests might actually affect the course of events close to home.

The justifications we are forwarding for recycling are moral ones. All morality is intended to make people feel better, and often is intended to remove certain guilt feelings. We believe that recycling certainly fits those two elements.

But are these justifications good enough? Are we asking Long Island to accept recycling as a good activity -- the silk purse -- when it is, in reality, only the sow's ear?

It is difficult, in the times of diminished expectations of governmental programs, to accept the expenditure of money to make people feel better, and because it is the right thing to do. However, that is what appears to be the case with recycling -- a sort of hold-over from the greater expectations of Great Society days. It is only as the requirement that government be run like a business has become the order of the day that cost-benefit studies of recycling became common.

We believe that our moral justifications of recycling are sufficient. It may be that others disagree. We hope that we have been able to lift some of the foggier notions away from the mystiques of both recycling and "anti-recycling," at a minimum, and to redirect the discussion on the benefits of recycling to other worthwhile topics.

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