New York City Department of Sanitation
Kevin P. Farrell
Commissioner

NEW YORK CITY RECYCLING —IN CONTEXT—

A Comprehensive Analysis of Recycling in Major U.S. Cities

Prepared by
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Abbreviations and Definitions

BWPRR	Bureau of Waste Prevention, Reuse and Recycling (formerly known as the Recycling Programs and Planning Division)
Capture Rate	Percentage of items recycled out of all the recyclables present in the waste stream. The amount of recyclables in the waste stream is based on waste composition sampling.
Community District/ Sanitation District	One of the 59 administrative districts of NYC whose Boards advise Borough Presidents and City agencies on planning and services. Sanitation Districts, designated by the NYC Department of Sanitation for operational/administrative purposes, contain the same boundaries as community districts.
DOS/Department/ Sanitation	NYC Department of Sanitation
Diversion Rate	The portion of total discarded materials collected by the NYC Department of Sanitation that is diverted from the waste stream through recycling. Diversion rate is measured by dividing the weight of collected recyclables by the weight of collected waste plus recyclables.
EPA	United States Environmental Protection Agency
Expanded Recycling/ Expansion	Addition of mixed paper, beverage cartons, bulk and household metal to the materials collected for recycling citywide. The Expansion was phased-in by borough from 1995 to 1997.
HDPE	High-density polyethelene, one of the resins collected by DOS for recycling
MGP	Metal, glass, and plastic items collected in municipal recycling programs
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
Local Law 19	Local Law 19 of 1989 (the NYC Recycling Law)
Low-Diversion District	Sanitation Districts with diversion rates below 12%.
PET	Polyethelene Terephalate, one of the resins collected by DOS for recycling
The "Program"	The NYC Recycling Program
QBUFs	Quantity-Based User Fees, where residents are charged for garbage collection according to the volume of waste they generate
Recycling	For the purposes of this report, this term refers to that fraction of total waste that is set out and collected for recycling. May also refer to the act of recycling.
Refuse	For the purposes of this report, this term refers to that fraction of total waste that is set out and collected for disposal. Also called trash or garbage.
Waste	For the purposes of this report, refuse and recycling set out for collection.
Waste Prevention	The practice of reducing waste by preventing its creation. This includes: buying products that have the least amount of packaging or are packaged to last longer; not buying more of a product than needed; reusing, donating, or repairing items that might otherwise be discarded as trash or for recycling.

Director's Note

In the year 2000, New York City attained a residential recycling rate of 20%, an all-time-high since recycling was made mandatory here in 1989. This accomplishment stems from the continual efforts by the City's Department of Sanitation since 1986 to coordinate infrastructure, collection, public education, and contracting such that this dense City of nearly eight million could efficiently and reliably divert 2,200 tons to recycling each day.[1]

A NYC Department of Sanitation worker loads blue plastic bags (containing beverage cartons, bottles, cans, metal, and foil) into a recycling truck.

Since 1993, the Department of Sanitation ("the Department") has run a full-service Recycling Program for all City residents as well as public and nonprofit institutions. Municipal trucks and crews collect recyclables at curbside once a week from all households in the City, providing the same level of service to single-family homes, high-rise apartment buildings, and everything in between.[2] In fact, unlike many other U.S. cities, recycling in residences of all sizes has been part of the City's curbside program from its inception.

A worker loads cardboard and mixed paper into a paper recycling truck.

NYC Residents sort recycling into two color-coded categories for separate collection:

- Mixed paper (such as newspaper, magazines, catalogs, junk mail, paperback/telephone books, and all types of cardboard) is placed in a *green*-labeled bin or *clear* plastic bag.
- Beverage cartons, bottles, cans, metal, and foil are placed, all together, in a *blue*-labeled bin or *blue* plastic bag.

To achieve compliance among the millions living here, the Department conducts extensive recycling outreach and education.[3] Department messages regularly appear in venues that include subway trains and platforms, bus shelters, phone kiosks, newspapers, TV, and the radio. These placements feature the friendly and informative "recycling bin and bag" characters that New Yorkers have come to know and love. The Department also conducts special events for particular audiences, organizing fun and educational

The Department of Sanitation uses recycling bin and bag characters to teach New Yorkers how to comply with NYC recycling regulations.

Phone kiosks are but one of the many venues for DOS advertising.

activities for building superintendents, schoolchildren, and residents of districts with lower-than-average recycling rates. And unlike other municipal recycling programs in the U.S., New York City's program is mandatory. Single-family homes and apartment buildings alike are required to recycle, and chronic noncompliance is met with tickets and fines.

In sum, full and frequent service to all residents, the comprehensive collection of marketable secondary materials in the waste stream, and a high public profile come together to make recycling work in New York City. Ongoing survey and focus-group research has confirmed that the Department's messages are hitting home. New Yorkers overwhelmingly report liking their recycling program, and show a strong knowledge of its rules and procedures.[4]

But as this report will show, evaluating NYC's 20% residential recycling rate against other benchmarks is a tricky business.

National averages generally combine commercial and residential recycling into one overall rate (as reflected in President Clinton's Year 2000 recycling goal of 25%,[5] or the most recent EPA figures showing an average 28% recycling rate nationwide[6]). But some cities in the U.S. report higher rates. A recent article in *Waste News* magazine summarized self-assessed rates for thirty large U.S. cities, and reported some localities as surpassing the 25% mark. (See Appendix I for a summary of this survey.)

These findings raise a number of questions. How should we assess NYC's 20% rate in comparison to other cities? What can we learn from studying their programs? How should we interpret our achievement of a 20% recycling rate given what the City has already done? To summarize, this includes:

1. Mounting citywide public education campaigns for more than seven years.
2. Mandating and enforcing recycling.
3. Providing weekly curbside collection to *all* residents.
4. Collecting the major recyclable materials found in the waste stream.

The Department of Sanitation's recently redesigned residential building poster provides tenants with a quick and easy reference for how to separate their recyclables and allows building staff to write in site-specific instructions.

The Department takes the position that to answer these questions accurately, we must make sure that we are comparing "apples to apples," rather than "apples to oranges" when we compare NYC's recycling statistics to those of other U.S. cities. This first requires studying how different jurisdictions calculate their recycling rate (what materials they count, what kind of generators they include, and the source of their data). Second, it means looking at the recycling-relevant characteristics of particular localities. New York City is unlike any other city in the nation because of the following two factors: the predominance of apartment buildings (many of them built decades ago) and the corresponding scarcity of yards. When both factors are properly taken into account, NYC actually comes out ahead of, or at least on par with, other U.S. municipalities in terms of recycling performance.

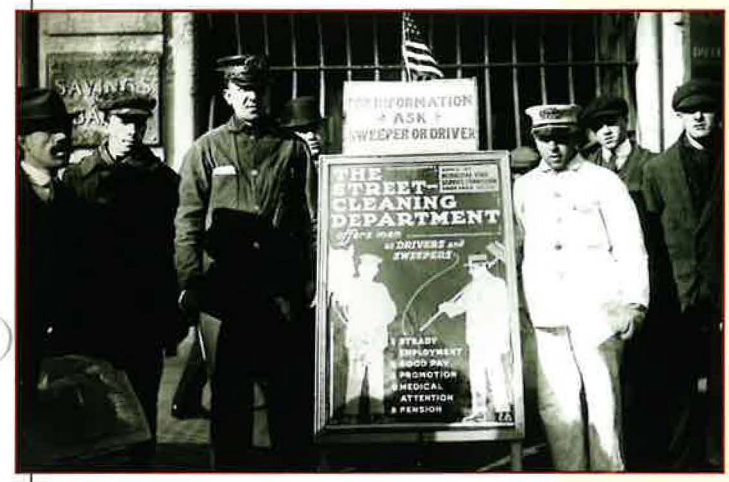
However, before even examining how NYC compares to other cities, it is necessary to understand what the Department of Sanitation has *already done* to achieve 20% recycling in this crowded urban environment. This will set the stage for an informed discussion of comparisons among existing recycling programs nationwide, and a consideration of future options for NYC.

I would like to thank Samantha MacBride and Susan Cohen from the Bureau of Waste Prevention, Reuse and Recycling for their contributions to this report.

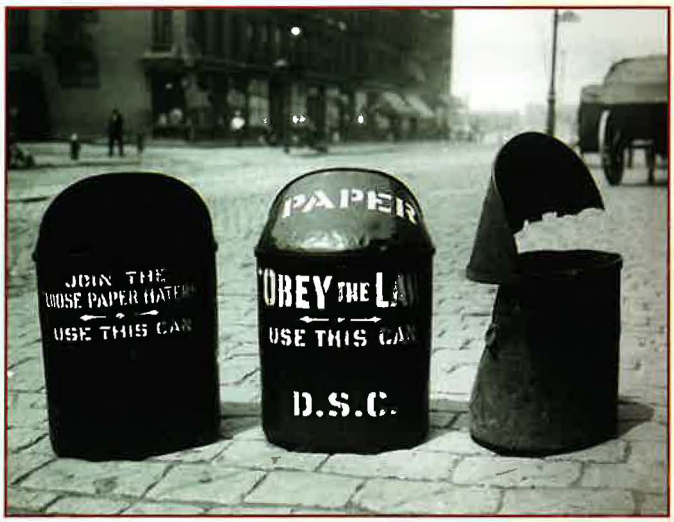
Robert Lange
Director
Bureau of Waste Prevention, Reuse and Recycling

History of the Program

The challenge of changing the way New Yorkers handle their garbage is not a new one. Only the iron will of Peter Stuyvesant in the mid-17th century could stop the residents of this burgeoning metropolis from throwing rubbish, filth, ashes, oyster shells, and dead animals into the streets.[7] Over a century later, the visionary Colonel George Waring, modernizer of waste management in this city, had to deploy a squad of forty officers to enforce new rules requiring households to separate the material they put out for curbside collection. His extensive (though short-lived) program for turn-of-the-century New York set up a system in which paper, wood, metal, rags, and animal products were collected and recovered for beneficial use.

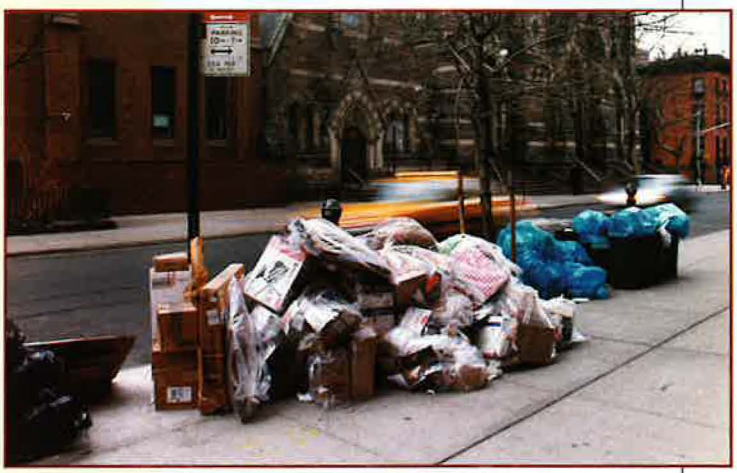


At the turn of the century, Colonel Waring revolutionized sanitation in New York City, in part by raising pay, benefits, and morale among Sanitation workers.



In Colonel Waring's day, paper was source-separated.

Yet despite those reforms and some recycling during World War II, New Yorkers throughout most of the second half of the 20th century had the luxury of simply throwing out all household waste, with no sorting necessary. That began to change in fall 1986, with the phase-in of what has become the current Recycling Program. Voluntary, newspaper-only recycling was launched that year in Community Board 2 in Manhattan. By the following summer, each borough had a single-district, newspaper pilot project. Recycling became mandatory with the passage of Local Law 19 of 1989, the *New York City Recycling Law*. (See Appendix II for complete text.) This set the stage for the introduction of the program we now have today.



Today, recyclables and trash are placed at the curb for collection by the NYC Department of Sanitation. Mixed paper is placed in clear bags. Corrugated cardboard is bundled and tied. Beverage cartons, bottles, cans, metal, and foil are placed in blue bags. Trash is set out in black bags.

The Department now collects materials from more than three million residences and five thousand institutions throughout the City's five boroughs. These efforts are supplemented with auxiliary programs that:

- Promote voluntary waste prevention through a Stuff Exchange hotline (1-877-NYC STUFF) and the NYC Wastele$$ website (www.nycwasteless.com).
- Collect thousands of tons of fall leaves and Christmas trees for composting.
- Encourage backyard composting and grass recycling (leaving clippings on the lawn) through the City's four botanical gardens and the Compost Project website (www.nyccompost.org).
- Centrally compost yard waste and discarded food from Riker's Island (the City's largest jail).
- Monitor and enforce commercial recycling regulations.

Extensive information about the Department's Composting Programs can be conveniently accessed on the Web.

Early Challenges to "Modern" Recycling in NYC

Out of necessity, recycling in New York developed in stages, undergoing revisions along the way. In the 1980's, there was little recycling infrastructure in place, nor was there much in the way of experience from other comparable large cities. Collection, processing, and marketing components had to be put in place during a time when local and national demand for the materials collected was changing. Budget constraints that emerged in the early and mid-1990's contributed added complexity.

On the collection side, systems had to be developed and tested for both truck types and labor changes associated with new collection routes. Overall, DOS had to balance operational factors (such as fewer trips and less material separation) that reduce costs, and in turn reduce the value of the materials collected, against factors that increase both cost and value.

Over the course of a decade, DOS experimented with collecting recyclables: separated and mixed together (commingled);

A DOS worker dumps mixed paper from a green bin into a recycling truck.

This containerized packer truck is able to collect metal dumpsters full of recyclables.

Some large apartment buildings, as well as some DOS-serviced public institutions, set out recyclables in metal containers (dumpsters) rather than in cans or bags at curbside.

in metal dumpsters; in bins and in bags; and in single- and dual-bin trucks, side-loaders, back-loaders, and containerized packer trucks (E-Z packs). The Department also negotiated route changes and productivity targets when labor contract renewals allowed.

On the processing and marketing side, infrastructure had to be developed or expanded. At the outset, the City lacked the facilities—known as material recovery facilities, or MRFs—to receive recyclables and prepare them for market. In addition, the Department had to decide whether to assume some or all of the market risk in selling secondary materials, or to pay the cost of letting other parties assume these risks. Ultimately, NYC opted for the latter.

The contractual system of private MRFs and market-linked prices in place today is very different from what was envisioned a decade ago, when there was discussion of having one or two city-managed MRFs in each borough. Over time, DOS developed an institutional understanding of secondary materials markets for paper, metal, glass, and plastic. These markets involved industries that were themselves changing as productive capacity was added around the country to address legislative and consumer demands, and to use the tens of thousands of tons of post-consumer "secondary raw" materials being generated through municipal recycling programs. Today we tend to take this capacity for granted, but industrial use of secondary materials from the residential waste stream was limited in the early 1990's.

At a material recovery facility (MRF), employees separate plastics from metal and glass on the "sort line."

Thousands of tons of recyclables are processed in New York City every day.

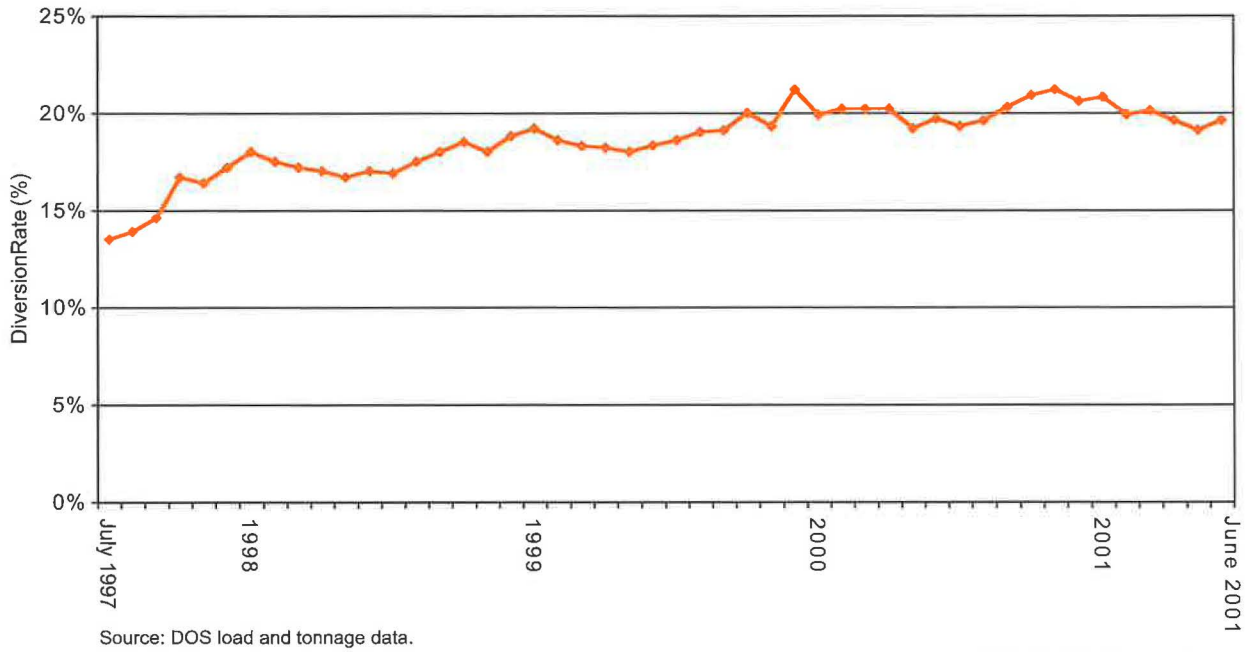
Given these challenges, the Department developed a recycling implementation strategy for each of New York's five boroughs. Uniform citywide advertising campaigns began in 1993 when entire boroughs—and, indeed, the City as a whole—began to standardize recycling.

As shown in Table 1, the Department started recycling certain materials in designated districts within each borough before going borough wide. Recycling was fully implemented in Staten Island in 1990, followed by Manhattan and the Bronx in 1992, and then Brooklyn and Queens in 1993. As of 1993, the Department collected citywide the following materials for recycling: newspapers, magazines, corrugated cardboard, metal cans, glass bottles and jars, and plastic bottles and jugs. From 1995 to 1997, the Department expanded the materials it collected for recycling to include mixed paper, beverage cartons, and household and bulk metal.

Other additions to the Recycling Program that were phased in include the collection of fall leaves and Christmas trees for composting and a move to weekly collection of recyclables. Depending upon population density and waste generation rates, some districts received weekly recycling collection while others had their recyclables collected every other week. Beginning in 1998, the Department began to expand recycling collection frequency. It is now weekly throughout the City, and daily for many public schools.

Figure 1 below shows that as Expanded Recycling and weekly collection have become part of New York City living, there has been a slow but steady improvement in the recycling rate (which is referred to in NYC as the "diversion rate"). The diversion rate has climbed from 13% in 1997 to its current rate of 20% today.

Figure 1
Diversion Rate for Waste Managed by the NYC Dept. of Sanitation
(July 1997 through June 2001)



Source: DOS load and tonnage data.
Note: Data shown here begin in 1997, rather than earlier, because it was in this year that "Expanded Recycling" was implemented citywide.

Table 1

NYC Recycling History: The Gradual Phase-in of a Program Citywide

1986	Municipally coordinated **voluntary** recycling begins in NYC with newspaper recycling in Manhattan's Community District 2.
1987	At least **one district in each borough** receives voluntary newspaper recycling collection.
1988	A total of four districts in Staten Island, Brooklyn, and Queens receive voluntary metal and glass recycling collection. An additional district is added for newspaper collection in Queens.
1989	**Local Law 19** is passed and establishes the following materials to be collected for recycling: (1) **newspaper,** (2) **magazines/corrugated cardboard**, (3) **metal/glass**, and (4) **plastic**. Three additional districts are added in Staten Island and the Bronx for newspaper and metal/glass recycling. A district in Brooklyn is added for newspaper and magazines/corrugated-cardboard recycling. In Manhattan, magazine/corrugated-cardboard recycling is added to the two existing districts receiving newspaper collection.
1990	The entire borough of **Staten Island**, five districts in Queens, and one district in Brooklyn receive recycling collection for all of the mandated materials. All of Manhattan receives collection for two of the four mandated materials. Five districts in Brooklyn and two districts in the Bronx recycle three of the four mandated materials. **Fall Leaf** and yard waste collection for composting starts in Staten Island.
1992	**Manhattan and the Bronx** receive recycling collection for all of the mandated materials. The Department releases its first Comprehensive Solid Waste Management Plan.
1993	**Brooklyn and Queens** receive recycling collection for all the mandated materials. **Christmas tree collection** for composting begins in Manhattan and Staten Island.
1994	Christmas tree collection for composting is now **citywide**.
1995	The Department introduces **"Expanded Recycling,"** adding three additional material groups: (1) mixed paper, (2) beverage containers, and (3) household and bulk metal to the mandatory Recycling Program. Once again, this is phased in borough by borough, starting in **Staten Island**.
1996	**The Bronx** begins Expanded Recycling.
1997	**Manhattan, Brooklyn, and Queens** join Expanded Recycling—the full program is now citywide. Parts of the Bronx added to the fall leaf and yard waste collection program.
1998	Parts of Brooklyn added to the fall leaf and yard waste collection program.
1999	**Weekly**, rather than biweekly, recycling collection is made uniform throughout Brooklyn, Manhattan, Queens and Staten Island. All of Queens added to the leaf collection program. Now **all areas** of the city that generate large quantities of fall leaves are collected.
2000	Weekly recycling comes to the Bronx. **All of New York City is now serviced with full-scale recycling collection at this frequency.**

As this brief program history shows, recycling has been already implemented full-scale throughout the City's five boroughs, with each household serviced every week. The next section of this report will examine how other cities structure their recycling programs and assess their success. This will provide a launching point for New York's own evaluation of its recycling future.

A DOS truck is weighed on a scale before and after tipping its recyclables or refuse load. The data is fed into a computer and tracked daily.

Comparing New York's Recycling Rate to Other Cities

Recycling Rate Basics

As shown in the formula below, the recycling rate (which NYC refers to as the "diversion rate") is a measure of the tonnages of recyclables collected, divided by all waste (trash plus recyclables) generated. Because it is standard procedure for facilities to weigh the trash and recyclables that are delivered to them, data on these tonnages are generally accurate and up-to-date. The recycling rate has consequently been used since the 1970's to evaluate the success of recycling programs. The national recycling rate has climbed from 7% to 20% since municipal recycling programs began to be introduced throughout the U.S.[8]

One should note that this standard formula does not account for "contamination," or the presence of non-recyclable items in the loads that are collected for recycling. Ideally, one would subtract the weight of such items from the numerator of this formula. But in contrast to the routine ease of weighing trucks, this would require frequent waste composition studies—quite a costly, disruptive, and time-consuming proposition. For this reason, *none* of the cities we examined, nor the EPA's national recycling rate estimates, account for contamination. Rates are therefore comparable in formula, if imperfect.[9]

Yet while calculation of the recycling rate has nearly always followed the same formula, what is included in its numerator and denominator varies. Some cities calculate residential and commercial recycling rates separately because their public sanitation department handles residential waste, while private haulers service industries and businesses. In such cases, the municipality may publish its

What Is the Recycling Rate?

The recycling rate is known from daily weighing of garbage and recycling trucks, and is calculated as:

$$\frac{\text{Tons collected for recycling}}{\text{Tons of all waste generated (recyclables + garbage)}}$$

It is the same as the "diversion rate" when it measures how much waste is being "diverted" from disposal to recovery for beneficial use.

Other municipalities call the rate at which waste is "diverted" from landfilling (through recycling OR incineration) as the diversion rate. In the case of New York City, however, diversion refers specifically to tonnages of waste diverted from disposal (including landfilling and incineration) to recycling.

DOS workers tip blue bags full of metal, glass, and plastic recyclables at a material recovery facility (MRF) for processing by private contractors.

own data as the "residential rate," but will rely on periodic reporting from private waste generators, transporters, or processors for the commercial numbers.

In other cases, municipalities may choose to aggregate data on residential and commercial tonnages into one overall rate. This is often done because the service of both waste streams (residential and commercial) is privatized and separate records are not kept. For example, the city of Jacksonville, Florida, which reports a commercial-residential recycling rate at around 40%, uses data from privately operated disposal facilities and MRFs to calculate combined residential-commercial tonnages and rates.

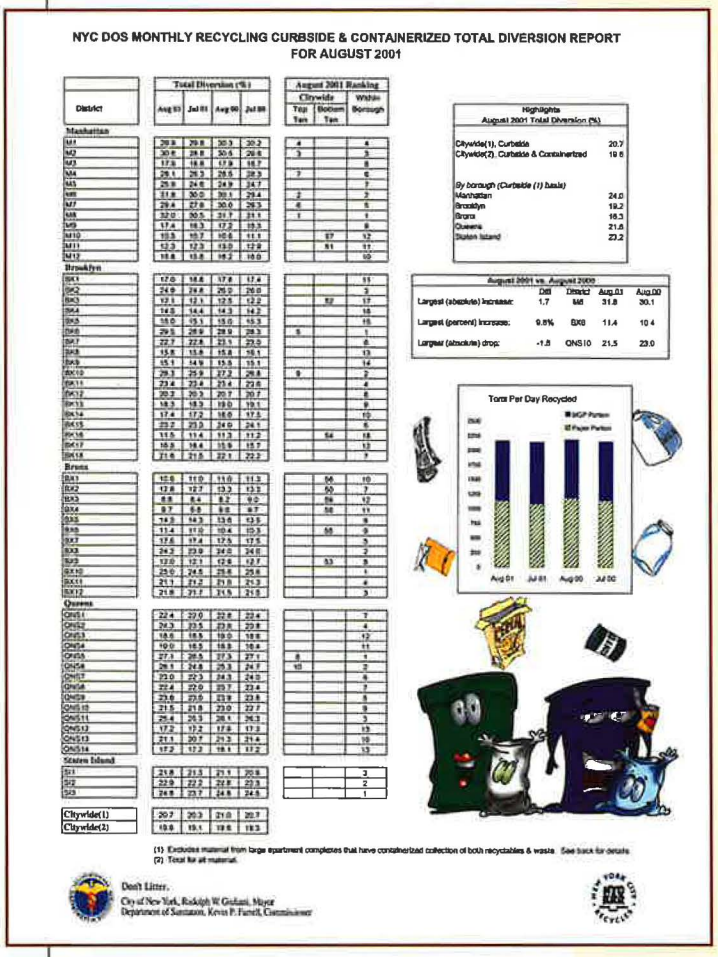
Still other cities report *some* household recycling as "residential," but fold other portions of it into the commercial stream. As will be detailed later, this is frequently the case when the municipality provides waste collection and recycling to smaller scale housing (single family homes and buildings up to four units) while commercial carters serve the larger apartment buildings. Portland, Oregon and Los Angeles, California represent two examples of this common division of responsibility and labor. In such cases, "residential" recycling actually refers to "small-scale residential" recycling, while "large-scale residential recycling" (if it takes place at all) gets aggregated with other commercial recovery figures.

In New York, by contrast, *all* residential (and some institutional)[10] waste collection is tracked by weighing-in and weighing-out each and every sanitation truck as it tips its load at an MRF or waste transfer station. Since apartment buildings and single-family homes receive the same service, "residential waste tonnages" reflect what all NYC households generate.

After NYC Sanitation trucks weigh in and out, net weights are fed directly into a centralized computer system, providing a detailed historical record of tonnages passing through the system each day. Because trucks are coded according to where they collect, tonnage information is also linked to data about where it was generated. This forms the basis for the diversion rate that the Department reports—broken down by community district—each month. (See Appendix III for a breakdown of NYC's diversion rate by community district for fiscal year 2001.)

Private carters (as opposed to the Department of Sanitation) handle NYC commercial waste disposal and recycling. This activity falls under only partial jurisdiction of the Department of Sanitation and, due to the differences in waste streams and management methods, is not aggregated with residential data.[11]

Such differences in the way cities calculate their diversion rates make it difficult to definitively claim that one city's recycling program is better than another's—although such comparisons are nevertheless often made.



NYC DOS MONTHLY RECYCLING CURBSIDE & CONTAINERIZED TOTAL DIVERSION REPORT
FOR AUGUST 2001

Highlights
August 2001 Total Diversion (%)

Citywide(1), Curbside 20.7
Citywide(2), Curbside & Containerized 19.6

By borough (Curbside (1) basis)
Manhattan 24.0
Brooklyn 19.2
Bronx 16.3
Queens 21.6
Staten Island 23.2

August 2001 vs. August 2000

	Diff	District	Aug.01	Aug.00
Largest (absolute) increase:	1.7	M8	31.8	30.1
Largest (percent) increase:	9.8%	BX8	11.4	10.4
Largest (absolute) drop:	-1.8	QNS10	21.5	23.0

Tons Per Day Recycled

(1) Excludes material from large apartment complexes that have containerized collection of both recyclables & waste. See back for details.
(2) Total for all material.

Don't Litter.
City of New York, Rudolph W. Giuliani, Mayor
Department of Sanitation, Kevin P. Farrell, Commissioner

Each month, DOS publishes data on the diversion rates attained in each of the City's 59 Sanitation districts. The report also shows change from past months and over the course of a year.

As will be detailed in the sections to follow, residential and commercial waste have very different characteristics in terms of their composition and measurement. For this reason, it is important to be careful about comparing residential, commercial, and aggregated residential-commercial rates.

How Waste Composition and What Is Collected for Recycling Can Influence a City's Recycling Rate

The magnitude of a municipality's recycling rate (be it residential, commercial, or aggregate) is fundamentally limited by two essential and interrelated local factors—its waste stream composition and what is included in its recycling program. The mix of these two features influence the maximum recycling rate that a municipality can achieve independent of citizen participation.

This idea can be illustrated by considering the example of four imaginary cities, labeled A through D in Table 2 on the next page. All the communities have the same amount of paper, metal/glass/plastic, food, and other materials in their waste. They differ, however, in the quantity of feathers in their waste stream and whether this material is included in their recycling programs. To avoid confusion with existing recycling programs, the scenario presented in Table 2 involves a material (such as feathers) which is not typically collected for recycling.

In this fictitious scenario, City A has a great deal of feathers in its waste stream, and collects feathers under its recycling program, capturing 70% for recycling. City B has the same proportion of feathers, but does not collect them for recycling. As would be expected, City B has a much lower recycling rate. City C, however, has *no* feathers in its waste, and consequently collects none for recycling. Note that City C's recycling rate is 16 points lower than City A, purely due to the lack of feathers in its waste stream! Moreover, consider the case of City D, which collects the same proportion of its feathers (70%) for recycling as City A. The fact that City D has fewer feathers in its overall waste means that it underperforms City A by 6 points.

Clearly, these examples are over-simplified. But they serve to highlight the importance of making consistent comparisons among localities based on both what is in their waste stream and what their recycling programs accept. In other words, this means

Table 2

Diversion Achieved Under Different Materials-Collection Scenarios (for four imaginary cities)

City	A	B	C	D
included in recycling program	**paper, MGP, feathers***	**paper, MGP**	**paper, MGP**	**paper, MGP, feathers***
waste stream (tons per day)				
feathers	100	100	0	50
paper	30	30	30	30
MGP	50	50	50	50
food	60	60	60	60
other	10	10	10	10
all waste *(tons per day)*	**250**	**250**	**150**	**200**
recyclables collected (tons per day)				
paper	15	15	15	15
MGP	30	30	30	30
feathers	70	0	0	35
all recycling *(tons per day)*	**115**	**45**	**45**	**80**
recycling rate	**46%**	**18%**	**30%**	**40%**

* To avoid confusion with existing recycling programs, the scenarios presented involve feathers, an item that is typically not collected for recycling.

comparing "apples to apples" instead of "apples to oranges."

As will be shown in the following discussion, the composition of NYC's residential waste stream reflects its unusual density and housing characteristics, giving it a profile unlike many other jurisdictions. Thus, calculations from other jurisdictions need to be adjusted before accurate comparisons to NYC can be made.

Real Cross-City Comparisons

In February 2001, *Waste News* published a review of thirty municipal recycling programs in major cities across the U.S. (Table 3 shows the reported recycling rates.) These rankings, however, do not tell the whole story.

Simple comparison of reported recycling rates without accounting for important measurement differences (such as commercial service coverage, yard waste and "other" recycling, as well as housing density) is indeed a case of comparing "apples to oranges."

Table 4 shows how NYC's ranking changes from seventeenth to ninth when additional information (from the *Waste News* survey, the U.S. census, and the cities

themselves) is accounted for quantitatively. Moreover, when other factors such as population size and the age and density of the housing stock are taken into account, New York emerges as doing as well or better than most U.S. cities.

The following sections will show that when differences in measurement mechanisms, waste composition, and housing density are taken into account, New York's program turns out to rank among the most successful nationwide. This will be important to keep in mind as we look to the future of recycling in New York City.

Research Note

*The information in the **Waste News** survey (reproduced in its entirety in Appendix I) forms the base of the comparison to follow. In writing this report, we also conducted additional research, contacting localities in some cases with specific questions. This information supplements the **Waste News** data and is cited where relevant.*

Commercial-Residential Measurement Discrepancies

As Table 4 shows, ten out of the thirty municipalities reported their "recycling rate" as reflecting aggregated commercial and residential sources, while the remaining twenty cities (including New York) limited their reporting to residential waste only.[12]

Table 3

City Recycling Rates as Reported in *Waste News*, February 2001

	Recycling rate reported in *Waste News*	Rank
Portland	53.6%	1
Seattle	52.0%	2
Chicago	47.9%	3
San Jose	47.0%	4
San Diego	46.0%	5
San Francisco	42.0%	6
Los Angeles	40.9%	7
Jacksonville	39.0%	8
Baltimore	35.3%	9
Philadelphia	32.5%	10
Austin	28.5%	11
Milwaukee	28.0%	12
San Antonio	26.3%	13
Indianapolis	24.0%	14
Charlotte	24.0%	14
Oklahoma City	23.6%	15
Memphis	19.9%	16
New York	19.7%	17
Dallas	19.0%	18
Phoenix	18.0%	19
Washington	17.0%	20
Houston	16.0%	21
Boston	14.0%	22
Columbus	9.7%	23
Nashville	8.0%	24
Denver	7.5%	25
Fort Worth	7.2%	26
Detroit	7.2%	26
El Paso	4.0%	27
Cleveland	2.0%	28

Table 4

Comparison of Cities by Recycling Rate Adjusted to Exclude Yard and "Other Waste" Recycling
(information on commercial recycling and density provided for context)

	Recycling rate for Paper/MGP only (not counting yard waste and "other" recycling)	Rank	Percentage points of reported recycling rate that come from yard waste recycling	Percentage points coming from "other" recycling	Percent of housing 5 or more units	Rank	Density (people/ square mile)	Rank	Includes commercial?
Portland	35.7%	2	12.5%	4.1%	24.8%	20	3,508	14	y
Seattle	39.9%	1	20.1%	0.0%	36.5%	10	6,153	12	y
Chicago	21.7%	7	3.7%	29.8%	39.9%	8	12,252	3	y
San Jose	23.1%	6	27.0%	4.0%	19.1%	28	4,566	13	y
San Diego	27.0%	4	26.1%	0.0%	33.0%	12	3,428	15	
San Francisco	19.4%	8	0.9%	27.2%	41.9%	6	15,502	2	y
Los Angeles	14.4%	16	26.9%	4.1%	43.5%	3	7,427	8	
Jacksonville	30.8%	3	9.2%	2.7%	20.6%	25	837	29	y
Baltimore	8.8%	20	1.9%	24.6%	20.4%	26	9,109	7	y
Philadelphia	6.2%	24	0.0%	0.0%	16.7%	30	11,736	5	y
Austin	18.8%	10	10.1%	1.8%	35.8%	11	2,138	24	
Milwaukee	17.2%	13	11.1%	1.9%	22.5%	23	6,536	11	
San Antonio	15.6%	15	0.0%	12.7%	25.4%	18	2,811	20	
Indianapolis	9.2%	18	4.9%	11.4%	25.9%	17	2,022	26	y
Charlotte	9.1%	19	10.9%	3.9%	28.1%	15	2,272	23	
Oklahoma City	23.6%	5	0.0%	0.0%	21.9%	24	731	30	
Memphis	3.1%	28	17.4%	0.0%	25.2%	19	2,384	21	
New York	**19.2%**	**9**	**0.6%**	**0.0%**	**62.5%**	**1**	**23,705**	**1**	
Dallas	18.1%	11	1.1%	0.0%	42.9%	5	2,941	19	
Phoenix	18.0%	12	0.0%	0.0%	27.3%	16	2,342	22	
Washington	15.8%	14	0.0%	1.4%	50.1%	2	9,884	6	
Houston	5.2%	26	7.4%	4.0%	40.7%	7	3,020	18	
Boston	13.0%	17	1.0%	0.0%	43.0%	4	11,865	4	
Columbus	4.1%	27	5.8%	0.0%	29.5%	14	3,316	16	
Nashville	8.0%	21	0.0%	0.0%	30.5%	13	1,032	28	
Denver	7.3%	22	0.1%	0.1%	37.2%	9	3,050	17	
Fort Worth	7.2%	23	0.0%	0.0%	24.5%	21	1,592	27	
Detroit	6.1%	25	1.2%	0.0%	16.9%	29	7,411	9	
El Paso	1.2%	30	2.7%	0.1%	23.1%	22	2,100	25	y
Cleveland	2.0%	29	0.0%	0.0%	19.7%	27	6,566	10	

Among the cities surveyed by *Waste News*, the following cities included recycling from commercial sources in their overall rate: Baltimore, Chicago, El Paso, Indianapolis, Jacksonville, Philadelphia, Portland, San Francisco, San Jose, and Seattle. In most cases we were able to find data (either from *Waste News* or directly from the cities themselves) on the residential rate, but for Baltimore, El Paso, Indianapolis, and Jacksonville, only aggregate data was available.

In addition, while Chicago and San Jose did report a recycling rate specific to residential waste, they did not make data available on the breakdown of materials in their residential stream (as opposed to the commercial stream). For all of these cities, we had no choice but to use aggregate commercial-residential data to compare against our own residential-only information. In the context of this report, therefore, comparisons between those cities and New York should be interpreted with some caution.

In most cases, however, cities reported recycling rate and materials breakdown for their residential waste streams. The cities of Austin, Boston, Charlotte, Cleveland, Columbus, Dallas, Denver, Detroit, Fort Worth, Houston, Los Angeles, Memphis, Milwaukee, Nashville, Oklahoma City, Phoenix, San Antonio, San Diego, and Washington were like New York in considering "residential" recycling alone as making up their city's "official rate." In addition, Seattle, Portland, and San Francisco had extensive waste stream data available on the Web, enabling us to go beyond the aggregate figures reported in the *Waste News* survey. Comparisons between NYC and these cities are therefore on firmer ground.

A note is in order here about commercial recycling in NYC. Businesses are required under City law to recycle and are subject to recycling and other sanitation-related enforcement by the Department of Sanitation. They must also adhere to requirements set out by the City's Trade Waste Commission and the Department of Environmental Conservation in addition to the State Department of Environmental Protection. Commercial refuse and recycling collection in NYC is handled through private carters and does not involve the Department of Sanitation. During the 1990's, the City's Trade Waste Commission created a competitive and economically efficient private carting industry in New York City and ensured that private carters provide their customers with information on recycling and how recycling can reduce hauling costs.

WHAT TO RECYCLE

Food or Beverage Service Establishments
(Restaurants, Delicatessens, Bars, Caterers, Cafeterias, etc.)

Must Recycle:

- Corrugated Cardboard (flattened boxes)
- Metal Cans
- Glass Bottles and Jars
- Plastic Bottles and Jugs
- Aluminum Foil Products

Corrugated Cardboard (flattened boxes) · Metal Cans · Glass Bottles and Jars · Plastic Bottles and Jugs · Aluminum Foil Products

If your customers clear their own tables, provide labeled containers for their recyclables.

Bundle cardboard. Mix cans, bottles, and foil TOGETHER in the same blue translucent or clear plastic bag, recycling dumpster, or labeled container.

Check with your building manager or private carter/

ALL NEW YORK CITY BUSINESSES MUST RECYCLE

All Other Businesses
(Offices, Retail Stores, Supermarkets, Manufacturers, etc.)

Must Recycle:

- Corrugated Cardboard (flattened boxes)
- Office Paper
- Magazines, Catalogs, Phone Books
- Newspapers
- Textiles (if over 10% of your waste stream; for example, textile and garment industries)

Corrugated Cardboard (flattened boxes) · Office Paper · Magazines, Catalogs, Phone Books · Newspapers · Textiles (if over 10% of your waste stream)

Check to see if your building recycles other kinds of paper, too.

Place paper materials TOGETHER in a clear plastic bag, recycling dumpster, or labeled container.

recycler to find out how your building recycles.

ALL NEW YORK CITY BUSINESSES MUST RECYCLE

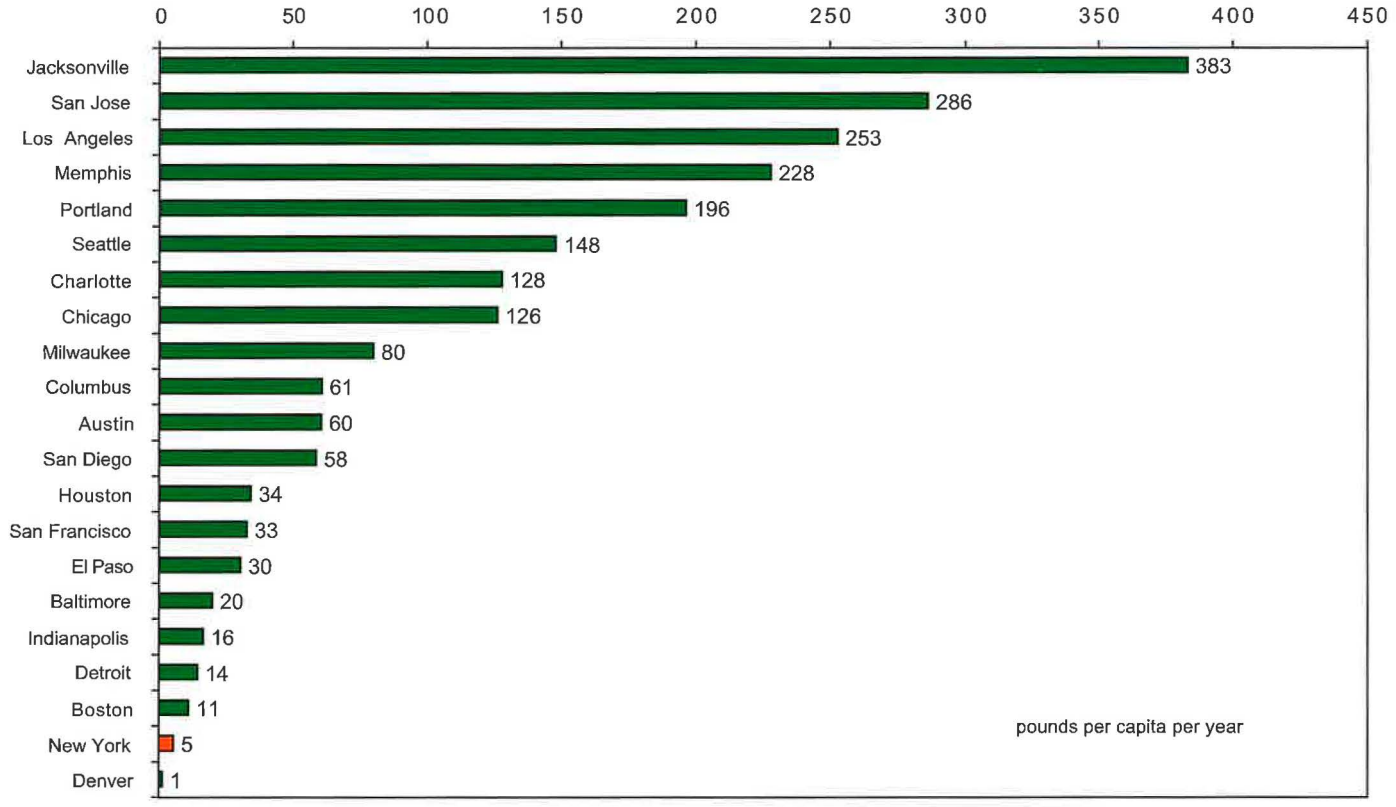
The Department distributes information to all commercial waste generators (including food and beverage establishments as well as offices, manufacturers, retail stores, and supermarkets) which details the recycling arrangements that they are required by law to establish.

Why does NYC opt to report its "official" rate as that for residential (and other Department-managed) recycling, and not aggregate commercial recycling into its overall rate? The commercial recycling rate was, overall, around 63% for 2000 and is estimated at 71% for 2001. The reason that these data are kept separate relates in part to the structure of State and local legislation, which gives the Department operational jurisdiction over only the "public" portions of the waste stream. Another reason has to do with the incomparability of commercial and residential waste. Most of NYC's commercial recycling comes from the reuse of clean fill and construction/demolition (C&D) debris. As will be detailed in the sections that follow, such recycling is simply not comparable to the sort of recycling that residents and public institutions carry out.

Yard Waste

A major finding of our review is that cities vary greatly in how much yard waste recycling (i.e., composting) contributes to their overall diversion figures. It comes as no surprise that cities with more yards generate more yard waste. And it is equally obvious that if they count composting as part of overall diversion, their rates get a boost. In fact, twenty-one out of thirty cities reported some amount of yard waste recycling in the *Waste News* survey (tonnages are summarized in Appendix III).

Figure 2
Annual Pounds of Recycled Yard Waste, per capita



Source: 2000 US Census, *Waste News*, and City of Portland tonnage data.
Note: The cities not included on this chart do not collect yard waste for recycling.

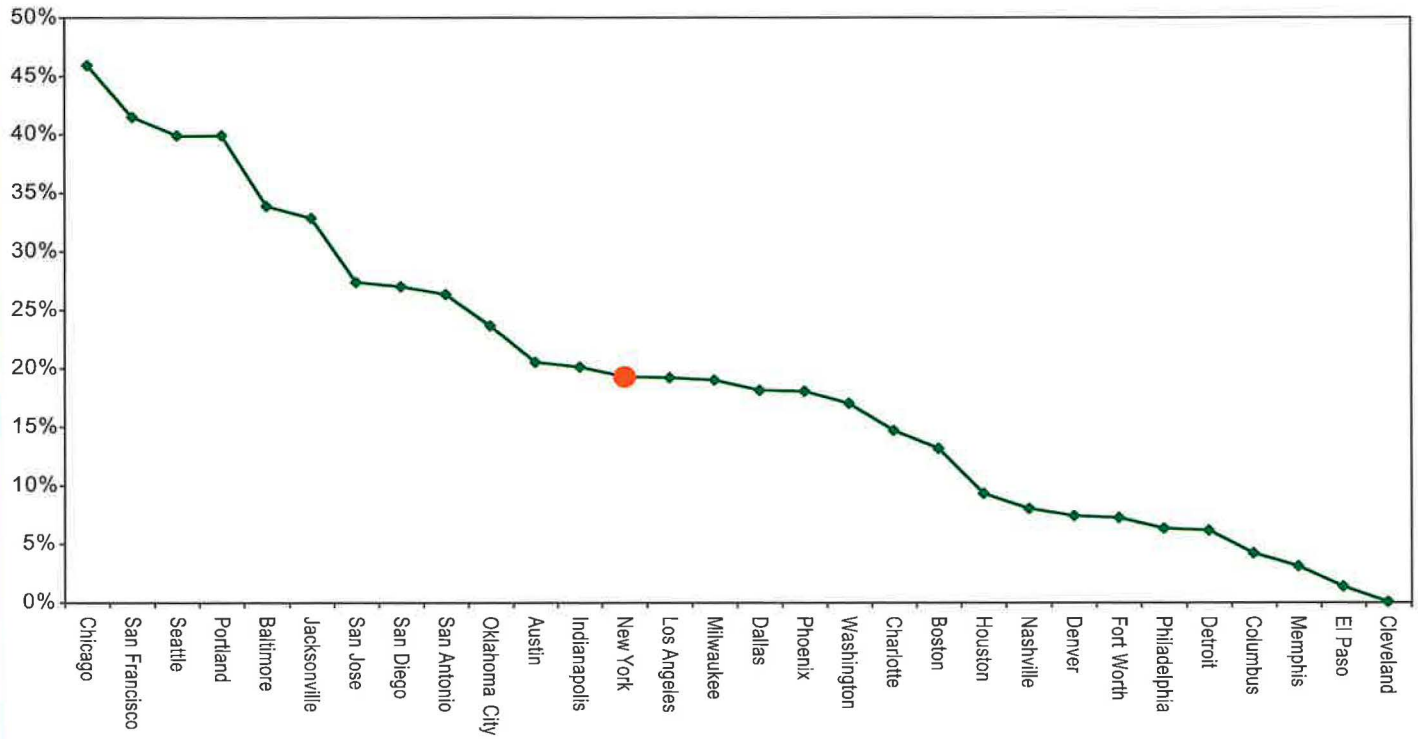
A comparison of yard waste tonnages per capita (see Figure 2) shows that New York has one of the lowest annual *generation rates* among cities that accept this material as part of their recycling program. In other words, New Yorkers recycle less yard waste because they have far less of it to begin with.

Moreover, the extent to which yard waste contributed to the calculation of recycling varies greatly. For example, 87% of Memphis's 19.9% recycling rate overall is due to the recycling of yard debris; while only 0.4% of New York's similar 19.7% rate comes from recycling this material. In order to get a sense of how recycling rates compared without the highly variable influence of yard waste, we recalculated the recycling rate without it (i.e., we subtracted reported yard waste tonnages from the numerator *and* denominator of the recycling rate). After doing so, New York's performance in comparison to other cities improved (see Figure 3).[13]

Although yard waste composting is an important part of any municipality's recycling program, it is nevertheless more accurate to make comparisons between New York and other cities independent of this material. This is because, overall, yard waste makes up about 20% of all waste nationwide, yet it accounts for less than 5% of NYC's waste stream.[14]

With over 23,000 persons per square mile, New York is by far the densest city in the United States, and has correspondingly fewer lawns, gardens, and unpaved yards to generate residential yard debris. In the City's most recent citywide waste composition study (conducted in 1990) yard waste accounted for only 4.1% of

Figure 3
Reported Recycling Rates, Excluding Yard Waste



Notes: Materials tonnages were not available for the cities of Nashville and Cleveland. Their overall reported recycling rates are shown instead. See endnote 13 for calculation methodology.

In the fall, residents leave bags of leaves and yard waste at the curb for special DOS collection. DOS trucks transport the leaves and yard waste to special composting sites. Every spring and fall DOS funds compost giveback programs which distribute the finished compost to City residents.

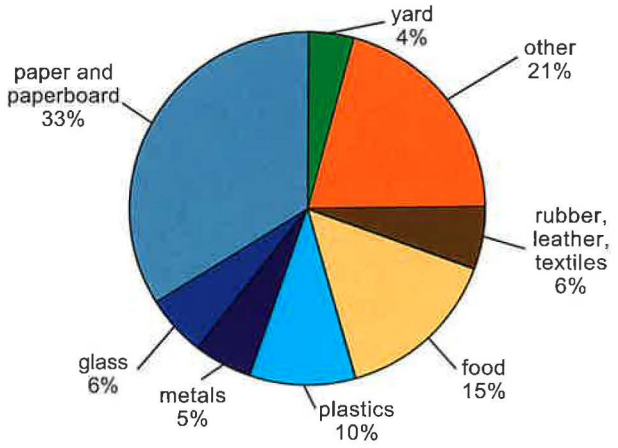
New York's total waste stream. Subsequent sub-studies of different fractions of NYC's waste stream have confirmed that although there is a higher presence of yard debris in suburban-style neighborhoods of the outer boroughs, most areas of the City show a dearth of this material.[15]

Figures 4 and 5 also show that paper, metal, glass, and plastic make up the bulk of recyclable consumer products in the residential waste stream nationwide, accounting for close to half of all waste generated. Although their proportion may vary somewhat according to income or economic conditions, these materials generally represent consistent percentages across municipalities.

It is obvious that cities with more yard waste are able to report higher recycling rates—provided they have programs to collect such materials for composting. In fact, yard waste programs implemented in the last half-decade have boosted overall recycling rates considerably. *Resource Recycling* magazine reports that in Seattle, "the ban on disposing of yard waste at the curb...increased diversion rates significantly, [Waste Reduction and Recycling Manager Jeff] Gaisford says. 'Almost half of what we recycle is yard waste.'"[16]

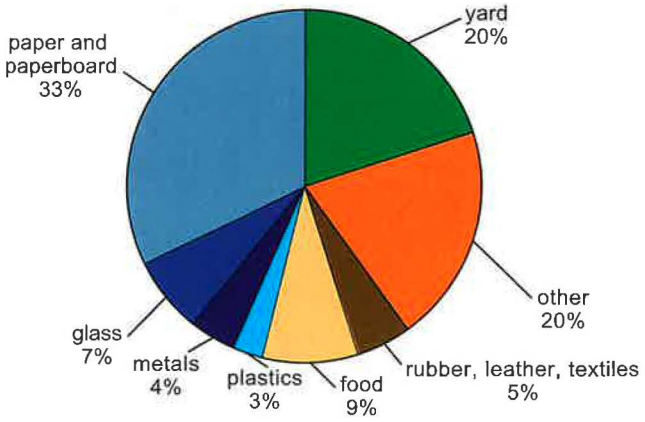
The "shot-in-the-arm" that yard waste has given recycling rates recently has not gone unnoticed outside of New York. Franklin Associates, the consulting firm that regularly derives national estimates of municipal solid waste (MSW) and recycling for the U.S. Environmental Protection Agency (EPA),

Figure 4
Materials Breakdown of Residential MSW in NYC



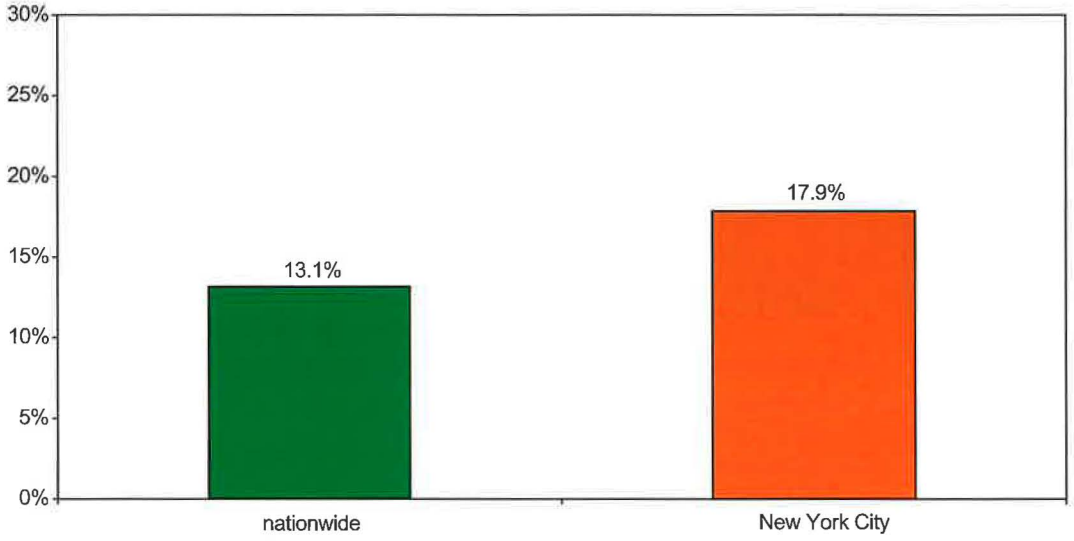
Source: 1990 NYC Waste Composition Study.

Figure 5
Materials Breakdown of Residential MSW Nationwide



Source: Franklin and Associates, 1999.

Figure 6
New York City vs. National Average
Recycling without Yard Waste, 1998



Source: Franklin and Associates, 1997 and 1999.

published data in 1996 estimating that nine percentage points of the 23% residential recovery rate comes from composting yard waste. In other words, excluding yard waste, the national residential recycling rate was around 14%.[17] Franklin Associates also performed a special study comparing New York's recycling rate to the nation's average, and found that the *national* recycling rate, not counting yard waste, was only 13.1% at a time when New York's rate was 17.9% (see Figure 6).[18]

"Other" Recycling

In addition to yard waste, some cities count the recycling of materials *other* than paper, metal, glass, and plastic in their diversion rates. For example, Baltimore, which reports a 35% recycling rate for residential and commercial waste combined, recycles roughly 156,000 tons per year in total. According to their records, around 83,000 of this tonnage consists of materials such as C&D debris, wood, and ash that come from commercial and in some cases industrial sources.[19] Chicago, which states a 47.9% rate, recycles over 1.4 million tons of materials classified as "other," almost all of which is C&D debris from the commercial sector.[20] Table 5 lists cities with the highest proportion of such "other" materials in their overall recycling, and contrasts them with NYC.

There are two major reasons why, as with yard waste, it is a good idea to set aside reports of "other" recycling and focus solely on paper, metal, glass, and plastic when assessing residential recycling programs. The first has to do with the problems associated with comparing residential-only to commercial or combined residential-commercial programs. In residential MSW, "other" waste consists of a hodgepodge of mixed materials, hygiene products, ceramics, residue, and other miscellaneous substances that are extremely difficult to recycle. In commercial waste, however, the much more recyclable C&D debris makes up the bulk of

Table 5

Cities with the Highest Proportion of "Other" Recycling (compared to NYC)

City	Tonnage of "other" recycling	"Other" as fraction of all recycling
Baltimore	83,271	69.6%
San Francisco	367,422	64.7%
Chicago	1,423,631	62.2%
San Antonio	21,961	48.4%
Indianapolis	14,000	47.5%
Houston	16,350	24.8%
New York City	0	0%

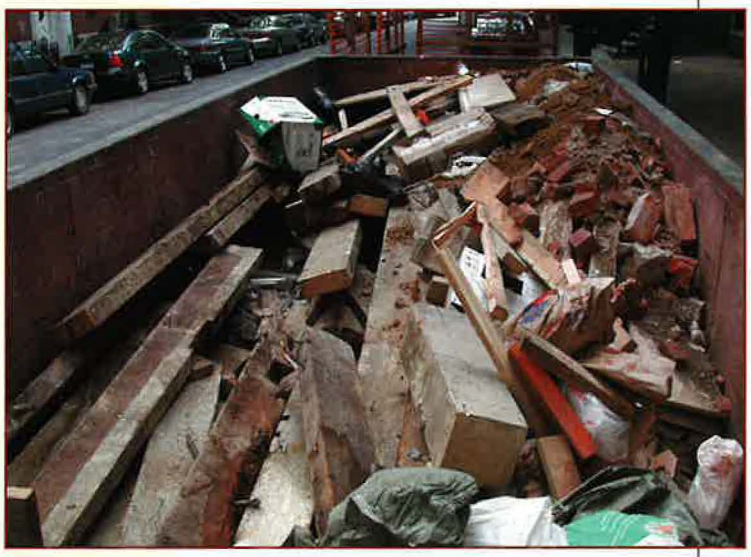
what is classified as "other." (This is reflected in the fact that the cities in Table 5 who recycle the largest amounts of "other," all report commercial *and* residential recycling as their city's aggregate rate.) It does not make sense, therefore, to compare "other" recycling under residential programs with "other" recycling in programs that also include commercial waste.

A second reason to exclude "other" waste from recycling rate calculations has to do with New York's legislative requirements for how to calculate diversion rates. Although some 600,000 tons of C&D debris (collected at residential drop-off centers and from City Agency infrastructure projects) are reused each year by the Department of Sanitation, City law excludes counting this tonnage as part of New York City's official diversion rate. According to some estimates, NYC's diversion rate would reach approximately 40% if such materials were taken into account.[21]

Additional Adjustments for Bottle Bill Recycling

A final discrepancy with regard to how municipal recycling rates are calculated involves counting bottle bill recycling as part of MGP diversion. The EPA calculates the overall national recycling rate by factoring in the recycling that occurs through state deposit systems. Some, but not all, cities follow suit. Portland, for example, includes over 12,000 tons per year of bottle bill recyclables in its calculation, which accounts for almost 5% of residential diversion.

Franklin Associates has estimated that NYC's diversion rate would increase by more than 1.5 percentage points if its own "bottle bill material" were taken into account.[22] But under Local Law 19, cans and bottles returned for deposit cannot be counted as part of NYC's diversion.



DOS collects around 600,000 tons of construction and demolition debris from City building projects each year. None of this is counted towards the City's recycling rate.

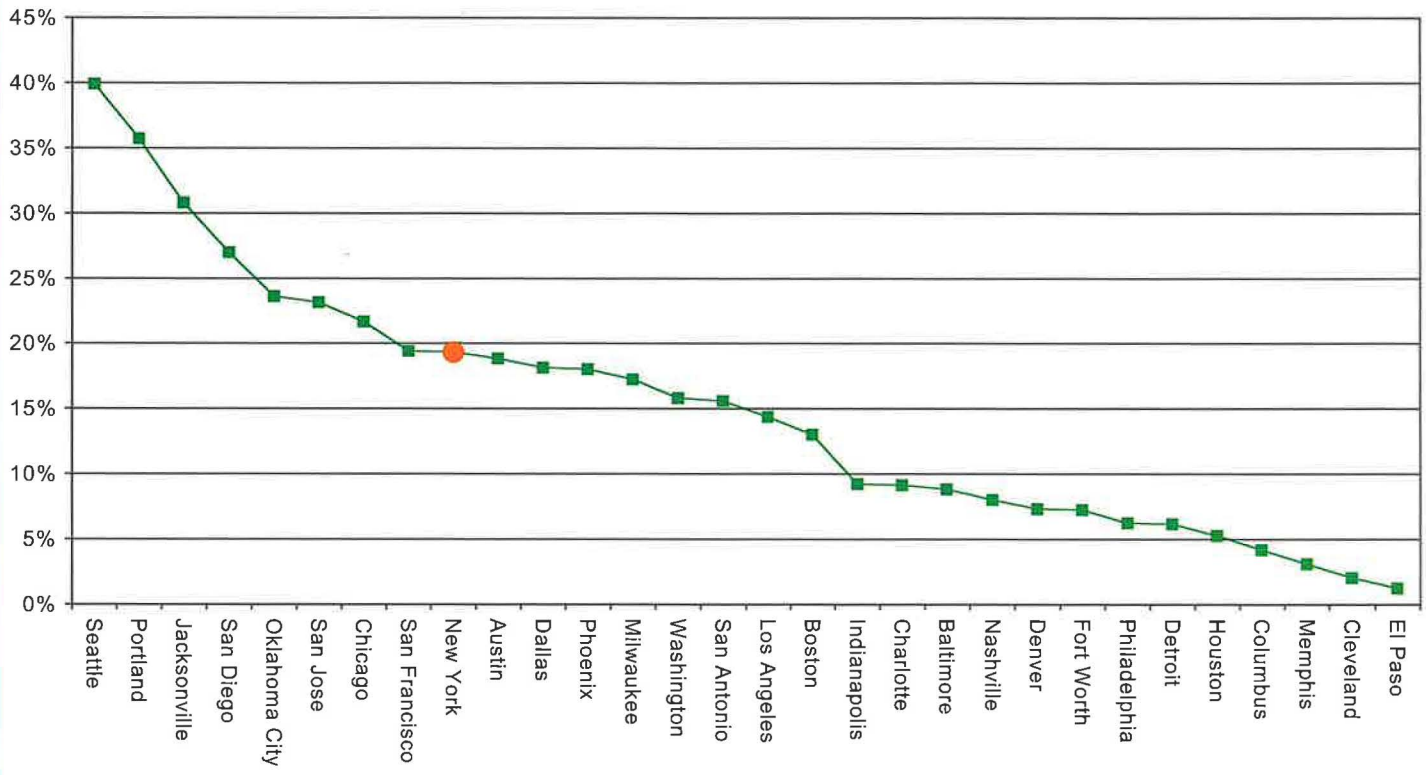
New York State's bottle bill imposes a 5-cent deposit on all beer and soft drink containers. To redeem the 5-cent deposit, individuals return the containers to retail outlets. This form of recycling is not counted in the City's overall recycling rate.

In sum, recalculating diversion without yard, "other," or bottle bill recycling allows for a more realistic comparison of recycling rates. Looking at recycling rates for paper and MGP alone makes it possible to evaluate New York's program versus its counterparts across the country in an "apples to (Big) Apple" fashion.

Explaining Remaining Differences

With the problematic yard waste, "other," and bottle bill recycling excluded, it becomes clear that New York City with its 19.3% adjusted recycling rate is doing better than many of its urban cousins (see Tables 6 and 7). At the same time, the adjusted rates of several cities still appear to exceed that of NYC (Table 8).

Figure 7
Adjusted Diversion Rate
(for Metal, Glass, Plastic, and Paper Recycling Only)



Source: DOS calculations based on *Waste News* and Portland City data.

Table 6

Major U.S. Cities with Lower Paper/MGP Diversion Rates than NYC

	Paper/MGP Diversion Rate
Dallas	18.1%
Washington	15.8%
Los Angeles	14.4%
Boston	13.0%
Philadelphia	6.2%
Detroit	6.1%

Table 7

Smaller U.S. Municipalities with Lower Paper/MGP Diversion Rates than NYC

	Paper/MGP Diversion Rate
Austin	18.8%
Phoenix	18.0%
Milwaukee	17.2%
San Antonio	15.6%
Indianapolis	9.2%
Charlotte	9.1%
Baltimore	8.8%
Nashville	8.0%
Denver	7.3%
Fort Worth	7.2%
Houston	5.2%
Columbus	4.1%
Memphis	3.1%
Cleveland	2.0%
El Paso	1.2%

What more can be learned by comparing NYC to other U.S. cities with higher paper/MGP diversion rates? Given the fact that NYC already collects the full range of major recyclables in the waste stream and provides comprehensive and frequent service to all residents, it is unlikely that variation in recycling program design explains the differences in recycling rates. Seattle, Portland, and the other municipalities listed in Table 8 all collect the same categories of paper, metal, glass, and plastic that New York City does, and in some cases provide less, rather than more, service coverage to residents.

A comparison of basic census data reveals an important characteristic in terms of

Table 8

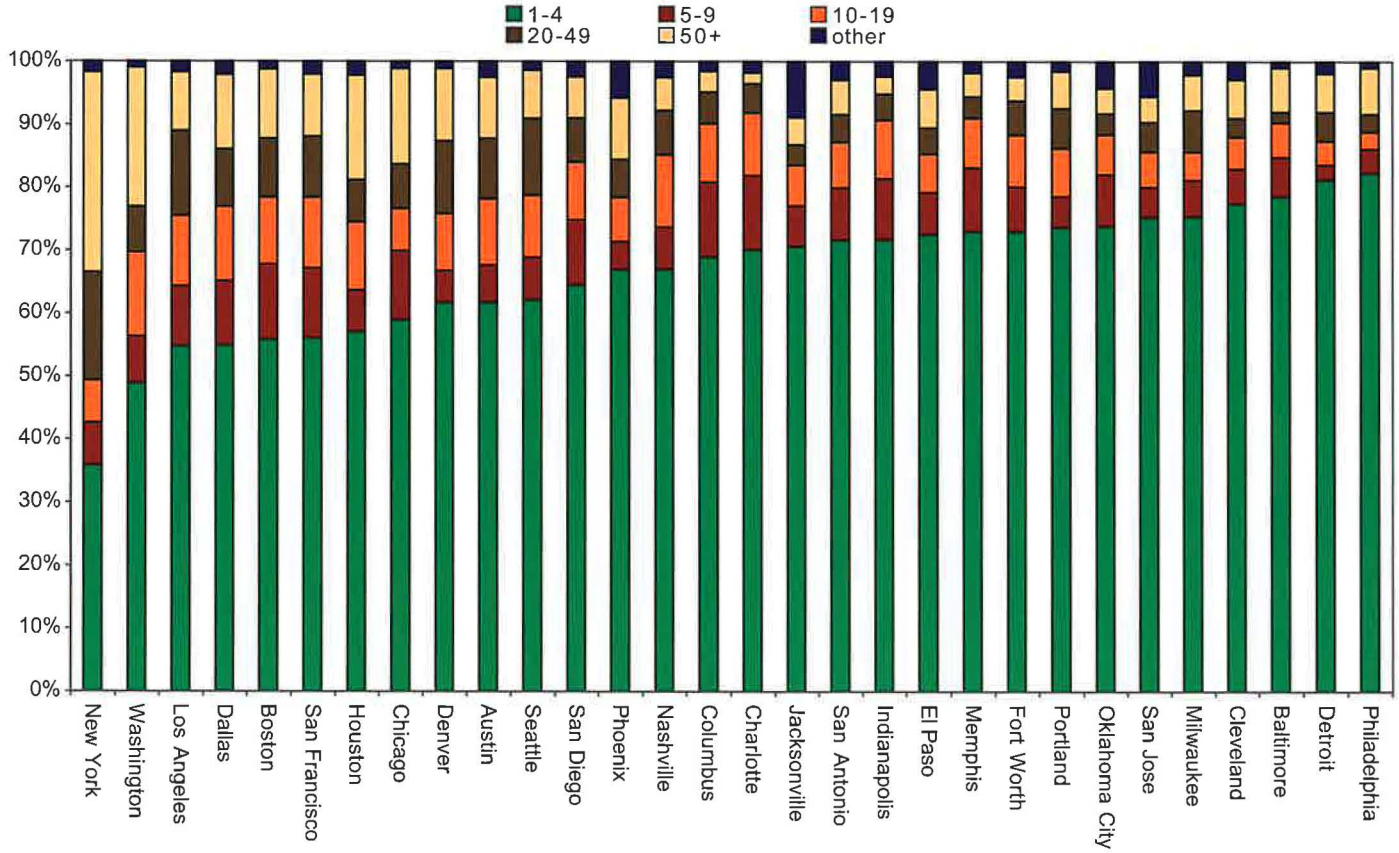
U.S. Cities with a Higher Paper/MGP Recycling Rate than NYC

	Paper/MGP Diversion Rate	*as compared to...*	
Seattle	39.9%		
Portland	35.7%	New York	19.3%
Jacksonville	30.8%		
San Diego	27.0%	*and...*	
Oklahoma City	23.6%		
San Jose	23.1%	San Francisco	19.4%
Chicago	21.7%		

Around 60% of NYC's housing stock is multi-unit. High-rises are typical of Manhattan and many areas of the outer boroughs.

recycling rates which distinguishes NYC from all other cities: multi-unit housing. As shown in Figure 8, New York leads other cities in proportions of residential housing containing 20-49 units *and* 50+ units, and correspondingly shows the lowest rate of single-, two-, and three-family occupancy in the nation.

Figure 8
Breakdown of Housing Stock, by Units in Structure



Source: 1990 US Census.
Note: "Other" includes trailers and mobile homes.

Multi-Family Units

It is well known in the recycling evaluation literature that recycling in multi-unit apartment buildings is particularly difficult. For instance, the EPA writes that:

> ...recovering recyclables...from multi-unit buildings is typically more challenging than collecting recyclables from single-family units. Variables such as space and layout, waste hauling contracts, length of resident tenancy, and janitorial work agreements differ from building to building.[23]

A study by the Province of Ontario confirms the common finding that "participation and material capture rates in [multi-unit buildings] vary dramatically from building to building and are generally lower than in single family household recycling programs."[24] They note that recycling arrangements requiring residents to bring materials to a central area, carry bins or bags on stairs or in elevators, and/or store recyclables may discourage residents from participating. This is especially true in buildings in which, "residents may take their waste to a garbage room or chute on each floor while they are asked to take their recyclable materials to a storage area on the ground floor, in basements or in outdoor sheds, *making the waste system more convenient than the recycling system for residents*" [emphasis added].[25]

In addition, the Canadian study notes that recycling in multi-unit buildings requires cooperation not only of residents, but of building owners, superintendents, and/or property managers. And because recycling (and throwing out trash) is more anonymous within buildings than in front of houses, "social peer pressure has little effect on participation or capture rates."[26]

Such observations are common in research conducted by public agencies, and are confirmed in academic work. In an article in the *Journal of Applied Social Psychology*, Richard Katzev observes that:

> There can be little doubt that multi-family residents make a large and growing contribution to the nationwide solid waste problem. In addition, because it is often difficult for occupants of these buildings to recycle their waste materials, there is good reason to believe they contribute considerably more to the waste stream than their numbers alone suggest.[27]

Katzev mentions the same barriers that EPA and Ontario reports describe, including "variations in physical structure, management operations, and collection systems...[and] the problems faced by haulers servicing such widely different situations."[28] Moreover, he identifies an additional difficulty in "providing information and managing a program for highly transient individuals."[29]

Based on his study of determinants of recycling in multi-family residences in Portland, Katzev concludes that recycling participation is highly determined by what he terms three "system support variables," which include "'user-friendliness' of the recycling system, its spatial location within the complex, and the degree to which the manager supported the program."[30] User-friendliness is measured in terms of "convenience, safety (i.e., lighting), cleanliness, signage, accessibility, capacity for recycled materials, and adequacy of separated bins."[31]

Multi-Unit Apartment Conditions in NYC

The research findings stated above correspond to the observations made by NYC Department of Sanitation personnel who regularly witness recycling on-site. To them, it comes as no surprise that house-dwellers and residents in apartment buildings experience recycling very differently. Although both groups face similar requirements *within the home* (having to separate waste into three categories corresponding to mixed paper, MGP, and garbage) and receive the same amount of service *at the collection end* (house-dwellers and apartment tenants alike receive the same number of weekly garbage and recycling collections), it is in *getting recyclables from the household to the curb* that the apartment building recycling experience diverges from that of the householder.

It is important to keep in mind that "multi-unit housing" in New York City can mean many things and each variation entails a different way that waste is handled. In some cases multi-unit housing refers to three-story brownstones (originally townhouses and now broken up into a number of units), or to four- and five-story "tenements" built before elevators. Both of these types of buildings require tenants to bring their own garbage and recyclables to the street and place them out for collection.

Multi-unit housing can also refer to small elevator buildings where tenants bring material to a centralized area and a custodian (who may be in charge of several buildings) carries material out to the street. In larger buildings tenants put garbage down a compactor chute but must bring recyclables to a centralized area on each floor or to the basement. In some full-service, high-rise buildings tenants put garbage and recycling outside their apartment door and the building staff brings it to the basement (and in some cases sorts it) before it goes out onto the street.

In all of these cases, the building staff represents an important link between the home and the curbside, and can help or hurt

Common forms of housing in NYC (about 30%) consist of tenement buildings (three- to six-story walkups), brownstones (townhouses), and small apartment complexes.

Large apartment buildings (50+ units) represent about 32% of the housing stock in NYC.

the recycling effort. Where consolidation of recyclables takes place within a building, the staff must be properly trained and equipped for tasks such as sorting and consolidating recyclables correctly into the proper bags and

Smaller buildings usually require tenants to bring their recyclables to a central area either outside or inside the building. These indoor and outdoor recycling areas have been properly labeled by building maintenance staff, using NYC Department of Sanitation decals.

This garbage chute is typical of larger apartment buildings constructed in the mid to late 20th century. Originally used to drop refuse into incinerators (which are now banned), these chutes now route refuse into trash compactors. When there is space, recycling containers are located next to garbage chutes.

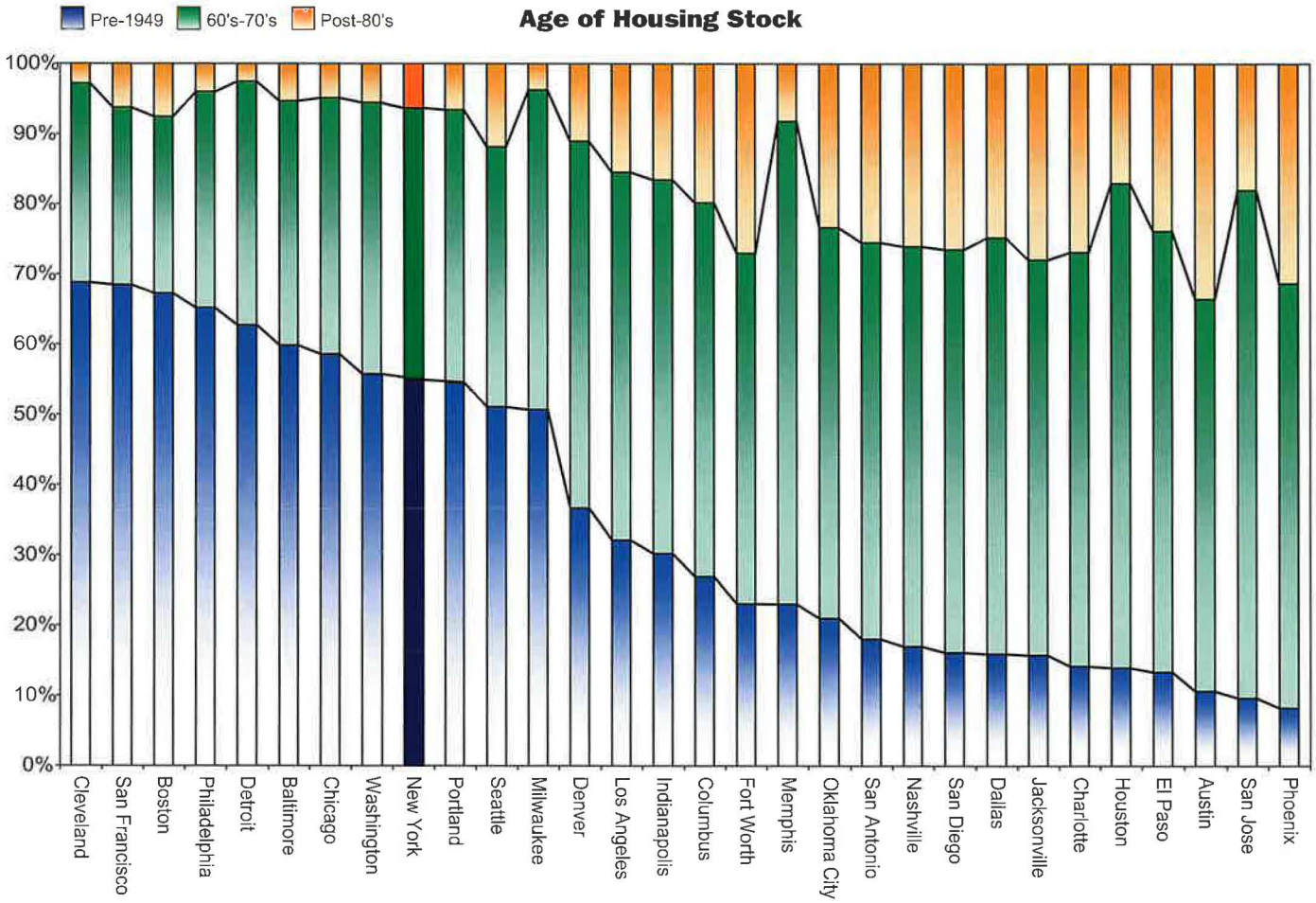
containers, and keeping recycling areas clear and sufficiently labeled.

Even where tenants themselves bring material to containers outside the building, the extent to which there is proper labeling of bins, provision of clear or blue bags, and periodic review of bins directly affects the quality of recyclables. If, for example, a tenant brings down a bundle of newspaper but does not see a bin labeled for paper, that bundle may end up in the garbage. Similarly, if one person carelessly or inadvertently places newspaper in a bin labeled for bottles and cans, this will confuse other tenants about where they should place their recyclables. Without some supervision, early mistakes can cause additional problems with proper separation of recyclables.

These phenomena are not unique to New York, but they certainly are more pronounced here than anywhere in the country. As mentioned before, New York has the highest representation of multi-unit buildings in the nation. And as shown in Figure 9, New York's housing is also among the oldest in American cities.

In New York, older apartment buildings are likely to be tenements or brownstones. Structures built from the 1940's to the 1970's

Figure 9
Age of Housing Stock



Source: 1990 US Census.

will likely be fitted with an "incinerator chute" (now used to deliver garbage to a compactor) that dates back to an era when residential incineration was legal and widely practiced in New York. Only the newest buildings have had the opportunity to integrate recycling into their original design.

The Garbage Chute: a New York Phenomenon

Most multistory buildings built between the 1940's and late 1970's have garbage chutes for tenants on each floor. Getting rid of trash is as easy as opening the hatch and dropping in a bag. But tenants usually have to bring their recyclables to the basement or to an outdoor area themselves. Some buildings with extensive staff (usually in the more affluent areas) allow tenants to leave recyclables in the chute room or outside their door. In either case, the relative ease of throwing things away vs. recycling them represents an added impediment to multi-unit recycling.

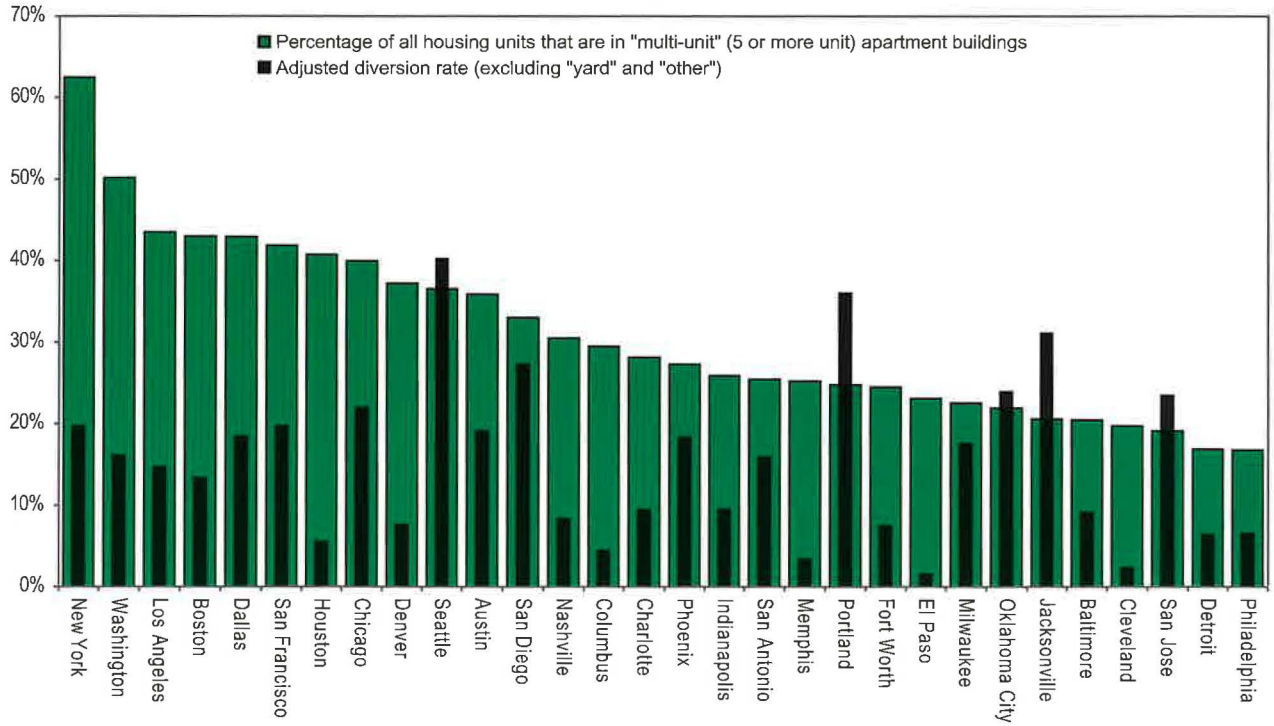
Comparisons in Context

A realistic comparison of NYC's recycling rate to that of other U.S. cities can only be made after the following is taken into account:

- How a city calculates its recycling rate.
- The density and age of its housing stock.

What becomes overwhelming clear is that cities vary so much in what they choose to count as their "official recycling rate," that no simple comparison between NYC and other cities makes sense. New York is the only city to report a recycling rate that covers 100% of its residents—single-family and multi-unit alike. Taking this into account reveals that New York is doing at least as well, if not better, than other American cities.

Figure 10
Diversion vs. Composition of Housing Stock



Source: DOS calculations based on *Waste News*, Portland City data, and 1990 US Census.

Figure 10 (on the previous page) highlights cities where the diversion rate appears considerably higher (i.e., exceeding NYC by more than four points). These include Seattle, Portland, Jacksonville, Oklahoma City, and San Diego. But just what are these seemingly high-diverting cities counting as "residential recycling?"

Recall that New York is the only city in the country to publicly provide uniform recycling collection to 100% of residences—multi-unit buildings and smaller houses alike. Its diversion rate therefore reflects everyone, including 1.9 million multifamily units and 1.1 million units consisting of single-, two-, or three-family homes. The recycling rate New York achieves and reports therefore heavily reflects the most challenging type of recycling.

In contrast, Oklahoma City and San Diego simply don't require, count, or report multifamily recycling at all. Their reported residential recycling rates—before or after being adjusted for yard waste and "other"—are really "four units and under" residential rates.

Jacksonville, in contrast, does require multi-unit complexes to contract with private haulers for some or all multi-unit recycling collection, leaving smaller scale housing to be serviced by City crews. But in that city, multi-unit recycling is counted as part of "commercial recycling," meaning again that its reported residential recycling rate reflects only small-scale housing. Jacksonville's multi-unit recycling rate is not disaggregated from the overall commercial reporting, leaving no way of determining the diversion rate for this small segment of the housing stock.

Portland—the city reporting the highest paper/MGP recycling rate—has a garbage and recycling collection system that is privately run, though overseen by the city administration. There, "residential recycling" also refers only to single-, two-, and three-unit dwelling recycling. Multi-unit buildings (which account for a quarter of the city's units) are monitored and reported as part of commercial recycling, which Portland officials say is "structured much differently from the residential program, with...apartments required to recycle but able to choose their hauler and negotiate rates."[32] The service coverage for these buildings seems quite good. As of 1997, a study by Portland State University reported that over 90% of all multifamily units had some recycling access—mostly in the form of "shelters" or drop-off stations located outside the complexes. Yet Portland's impressive 34.5% Paper-MGP recycling rate does not reflect recycling in multifamily residences—for which no separate data are available.

In fact, among the cities surveyed, only Seattle reports a separate, multifamily diversion rate. According to data on its website, apartment-building diversion in this city stands at 30%.[33] Yet even this multi-unit rate doesn't count everyone; it only reflects the recycling rate among the 58% of apartment buildings who choose to participate in the city's program—and who may be more motivated to recycle in the first place.[34]

For years, Seattle Public Utilities (the entity overseeing the privately provided trash and recycling collection in this city) has carried out intensive efforts to encourage apartment-building recycling.[35] But as it stands currently, however, 42% of Seattle apartment buildings don't recycle at all. No wonder that its "partial" multi-unit rate is so much higher than the national average, which was estimated in a recent study of apartment-house recycling in forty cities as 14.6%, excluding yard waste.[36]

With so much of its housing multi-unit, New York's 20% rate for 100% residential coverage is a real accomplishment. But what about cities that are more like New York demographically than San Diego, Portland, Seattle, or Jacksonville? For example, take the case of a somewhat similar city to New York (in terms of density and age of housing stock)—Boston.

According to the Boston Neighborhood Recycling Coalition, "though the city provides free recycling collection to large apartment buildings if they request it, over 60% of all apartment buildings do not provide convenient recycling to their tenants. As a result, over 20% of Boston residents cannot recycle easily."[37] This means that the 14% residential recycling rate that Boston reports excludes roughly 100,000 units in multifamily housing in that city.

The same situation applies in Chicago, another densely populated, older city. It doesn't count multi-unit recycling in its 27% diversion rate either (and bear in mind that without yard waste, this rate is 21.7%). In addition, Chicago does not keep data about diversion, or even compliance rates with its recycling ordinance, for the close to 40% of its housing stock that is multi-unit.

Los Angeles resembles NYC along different lines. With over three million residents, it is second only to New York in population. And like New York, its sanitation history has been one of public collection of residential waste, paired with private handling of the commercial sector. Yet in this city, very few multi-unit buildings recycle.[38] Mechanized curbside collection (described in the box at right) is inconvenient for multi-unit complexes, most of which prefer to contract with private waste carting services for dumpster collection. But because recycling is not mandatory in LA (and there are no private fee-based incentives to hiring separate recycling collection), these buildings generally do not opt to recycle. As a result, Los Angeles doesn't count waste from these buildings in its 40.9% overall diversion rate (14.4% for paper and MGP alone).

Recycling in L.A.

Several years ago, L.A. implemented mechanized curbside collection, meaning that all waste must be put in standard-issue bins to be collected. Residents using the Bureau of Sanitation's (BOS) services are tracked through the city's water and sewerage database, and assessed a yearly sanitation maintenance fee. The BOS issues each householder one black bin for garbage, one blue bin for commingled paper and MGP recycling, and one green bin for yard trimmings. Extra garbage and yard waste bins are available for a monthly fee of $10-15; extra recycling bins are free. Residents can also purchase one-time use tags to place on bagged trash if they generate an unusual amount once in a while. Scheduled bulk pickup and expanded "moving-day" collections are provided free.

In a number of other densely populated older cities, multi-unit buildings have simply been ignored. Washington, DC doesn't provide or require any recycling service to its 140,000 units of multifamily housing. Nor do newer high-density urban areas (Dallas, Houston); older industrial cities with some pockets of higher density housing (Detroit, Baltimore, Milwaukee); or other more diffusely populated localities (Indianapolis, Phoenix, San Antonio). The residential rates they report don't take multi-unit recycling into account at all.

Finally, there is San Francisco. With 40% of its housing stock multi-unit, a large portion of its buildings historic, and recycling

Through the City's four botanical gardens, the Department encourages backyard composting.

The Department promoted the NYC Stuff Exchange hotline using advertisements on public transportation outlets such as the NYC subway.

available to close to 90% of apartment houses, it may be the most comparable city to New York in terms of the examples reviewed in this report. The city's privately serviced system attains a 50% diversion rate in the industrial sector, a 40% rate for the commercial sector, and a 35% rate overall for residential waste—suggesting at first glance a possible model for New York to follow.[39] Yet the San Francisco Recycling Program reports a diversion rate for apartment buildings of only 10%,[40] adding that:

> materials are diverted in other ways: backyard composting, garage sales, the Bulky Item Collection Program, and additional bottle and can recycling at buy back and drop-off centers. We estimate that with these additional source reduction and recycling activities, the apartment recycling-rate is closer to 30%.[41]

NYC, of course, cannot by law count such diversion (with the exception of bulk metal) as part of its official rate. At the same time, its voluntary waste reduction programs provide many of the same options to apartment dwellers as San Francisco does. Backyard composting is promoted throughout the five boroughs. And the Department provides extensive information about reuse, repair, materials donation, and second-hand markets through its automated "Stuff Exchange" hotline (1-877-NYC STUFF).

Implications for NYC

There are several lessons that can be drawn from this report's analysis of municipal recycling in thirty major U.S. cities. First and foremost, there is great variation in program designs, private/public service mixes, recycling rate calculation methods, housing stocks, and population sizes among cities. This means that no two recycling programs are completely alike. So simply comparing New York City's 20% diversion rate to the rates of other places, based on what they refer to as their "official" recycling rate, will always mean comparing "apples to oranges." Therefore, this is not an accurate way to either evaluate the success of NYC's Recycling Program or to plan for future improvements.

Second, when the features that set NYC and its Recycling Program apart are taken into proper context, it becomes clear that achievement of a 20% recycling rate is quite remarkable. To recap, these features include:

1. Population Density. NYC's population roughly equals the population of Los Angeles, Chicago, and Houston (the next three most populous cities) and is *nearly twice as dense* as the second densest city in the nation (San Francisco).
2. Multi-Unit Housing. Close to 63% of NYC's housing stock is multi-unit.
3. Age of Housing Stock. Over 90% of its housing dates from before "modern" recycling was implemented in the 1980's.
4. Citywide Recycling Service. NYC is the only city whose Sanitation Department services 100% of all residences (which include free-standing homes, attached houses, brownstones, tenements, small apartment houses, massive complexes, and skyscraping high-rises) with the same full-service, weekly curbside recycling collection.
5. Citywide Recycling Rate Calculation. NYC is correspondingly the only city that covers *all* residences—from single family to multi-unit—in its reported residential recycling rate.
6. Yard Waste. NYC has by far the lowest amount of yard waste relative to other waste components in the nation.
7. Recycling Rate Calculations. By law, NYC excludes reuse of "other" materials (like C&D debris and bottle bill material) from its recycling rate.

Of course, recognizing that NYC is doing well, given these realities, doesn't mean that the City should rest on its laurels. Clearly, recycling can always be improved. But the goal of this report is to demonstrate that consideration of ways to increase the diversion rate should be undertaken with the City's unique characteristics in mind. This means accounting for what has already been done, rather than simply comparing NYC to other cities that superficially appear to be doing "better."

The remainder of this report will explore ways that NYC might realistically increase its diversion. These include:

- Quantity-Based User Fee or "Pay-As-You-Throw" systems.
- Enhancing individual participation in recycling through education and enforcement.
- Adding materials to the Recycling Program.
- Waste prevention.

Alternatives

Quantity-Based User Fees

A 1996 study of recycling in over 500 communities found that *charging residents directly* for garbage pickup (and not for recycling pickup) was the single most important program innovation for increasing diversion.[42] The report noted that such an arrangement, known as a "Quantity-Based User Fee" (QBUF) system, represents "the single strongest variable of all...[and] lead(s) to significantly more recycling, *holding all other program features, demographics, etc. constant.*"[43]

Seattle, Portland, San Francisco, and Los Angeles—among others—all utilize some form of QBUFs in their waste management systems. In these cities, residents pay according to the quantity of trash they generate, but benefit from subsidized or free recycling collection.

There are, however, drawbacks to imposing QBUFs in densely populated urban areas. It is easy enough to charge residents of single-, two-, and even three-unit housing based on the waste they put out at curbside, but beyond that size, building management must take over the responsibility of consolidating tenants' trash and recyclables. And unlike gas, electricity, or even water, there are no "meters" that can monitor waste generation apartment by apartment. Thus, at best, hauling-cost savings from QBUFs can be passed on communally to tenants, but not in proportion to their individual efforts.

Furthermore, multi-unit tenants don't directly experience financial gains from their participation, as sociologist Peter Collier of Portland State University notes:

> ...non-recycling behavior does not have a direct cost to multifamily dwellers. In a single-family study conducted by [Portland State University's] Recycling Education Project (REP), 43% of the respondents reported being motivated to recycle by the prospect of saving money on their garbage service fee...Since non-recyclers report that the lack of economic rewards is a major reason not to recycle, not having the opportunity to experience direct savings on garbage serviced fees due to increased levels of personal recycling works against recycling in multifamily dwellings.[44]

In addition, there are significant community or "peer" pressure differences between single- and multifamily recycling:

> Another motivational issue relates to the absence of community reinforcers in regard to promoting recycling in multifamily complexes. One advantage of [single-family] curbside programs is that the placement of materials in front of homes provides a prompt for other homeowners to recycle, as well as an opportunity for the modeling of "ideal" behavior. This opportunity is missing in multifamily complexes; even if other tenants are recycling, there is no way for an individual to be aware of this unless the behavior is observed accidentally.[45]

In Portland (where 90% of multifamily housing has access to recycling), participation is promoted through some revenue-sharing arrangements between landlords and tenants, and in other cases simply through

general appeals to "goodwill" and civic commitment.

While there is no data on the diversion actually achieved, it is conceivable that this mix of approaches works in a city with 25%—or around 50,000 units—of its housing multi-family. In the more populous and denser Seattle, however, we see only 58% of apartment buildings even signing up to reap the cost-benefits of QBUFs. San Francisco, which is unlike most densely populated, older cities in that it has always had a private, quantity-priced waste management system, seems to be achieving a lower multi-unit diversion rate with QBUFs than New York does without them. And Los Angeles reports very few apartment buildings taking advantage of its lower cost curbside service, due to the economy of having everything hauled away in one large dumpster.

In fact, New York's characteristics make it difficult to imagine how QBUFs would work here, if applied to residents. Because of a number of density-related considerations—including the impossibility of accounting for each multi-unit resident's waste separately, and the need to pick up everything to keep sidewalks and streets clear and clean—the City's sanitation system has always been paid for out of general tax revenues rather than user fees. Nevertheless, as one of the few proven means of increasing recycling, it may be realistic to consider QBUFs here in the future for targeted sectors, such as public institutions and City agencies—provided there is political consensus for their introduction.

Enhancing Participation

Another obvious method to increase diversion of residential waste is to get *more* people to recycle *more*, and recycle *better*. In practical terms, this means increasing the participation, diversion, and capture rates, respectively. Clearly, no one would disagree that these are good goals for any city. Yet to understand how achievable such increases could be *in a real-world context* requires, first of all, examining the overall composition of the waste stream. This is because waste composition, regardless of citizen participation, *fundamentally determines* the maximum attainable diversion and capture rates.

What Is the Capture Rate?

The capture rate can only be estimated.

It is calculated as:

$$\frac{\text{Tons of recycling placed out for recycling collection}}{\text{Tons of all recyclables in the waste stream}}$$

It basically measures "how well" people are recycling by estimating how much of what should be recycled actually is recycled (as opposed to the diversion rate, which just measures how much people are putting in the recycling bin).

NYC's Current Waste Composition—Roughly 35% Paper/MGP

In the past decade or so, the Department has conducted four separate waste composition studies of NYC trash and recycling.[46] Their results vary quite a bit, in no small part because they examine different segments of the NYC residential population. However, taken together they suggest that somewhere between 24 and 45% of the waste stream consists of paper and MGP materials currently designated as recyclable under the curbside program (see Table 9).

Each of the estimates cited in Table 9 on the following page has its problems. The 1989 Study (in addition to being ten years

Table 9

Estimates of the Percentage of Recyclables in New York City's Waste Stream
(including recyclables correctly recycled, and those thrown out with refuse)
A summary of four separate waste composition studies

Study Year	1989	1997	1997	1997
Study Population	**Citywide**	**Staten Island**	**Low-diversion districts in the Bronx and Brooklyn**	**Low-density "suburban" housing in the outer boroughs**
Recyclable Material				
Paper	31%	21%	14%	24%
Metal + Glass	12%	7%	7%	12%
Recyclable Plastic	2%	1%	2%	2%
Beverage Cartons	n.a.	0.3%	0.5%	n.a.
Total Percentage of Recyclables in the Waste Stream	**45%**	**30%**	**24%**	**38%**

Note: "n.a." indicates that this category was not assessed in this waste composition study.

out-of-date) was conducted before recycling began in NYC and likely over-counted the fraction of recyclable paper and glass—since it included fine glass shards and soiled paper (napkins, etc.) in its totals. The 1997 Staten Island study and the 1997 low-density suburban study looked at recyclables in higher income neighborhoods with many freestanding houses. The 1997 low-diversion study, in contrast, examined recyclables generated in densely populated, low-income areas.

None of these sub-studies, therefore, paints an accurate picture of NYC as a whole. Still, they do present a range of percentages of metal, glass, plastic, and paper that are "potentially recyclable" in New York's waste stream. With this information, and given that we know (from actual truck weights) that around 2,200 tons per day are actually recycled, New York's overall capture rate can be calculated in a range that averages roughly 50% (see Table 10).

Of course, the capture rate varies widely from person to person. It allows us, however, to envision what changes in individual behavior would be needed to boost the City's diversion rate, given the underlying composition of the waste stream. Table 11 shows that capture rates of 73% and 88% would be needed to boost NYC's diversion rate to 25% and 30% respectively.

Looking at the scenarios presented in Table 11, a number of questions arise. Is it realistic to assume that *on average* people will recycle close to 75% or 90% of everything they should? Bear in mind that this would have to mean either:

1. That *everyone* (100% of citizens!) would be recycling at this desired capture rate, or

Table 10

Estimates of the Average New Yorker's Capture Rate
A summary of four separate waste composition studies
in tons per day (tpd)

Study Year	1989	1997	1997	1997
Study Population	**Citywide**	**Staten Island**	**Low-diversion districts in the Bronx and Brooklyn**	**Low-density "suburban" housing in the outer boroughs**
if this much is actually recycled...	2,200 tpd	2,200 tpd	2,200 tpd	2,200 tpd
and this many recyclables are in the waste stream...	6,352 tpd	4,193 tpd	3,310 tpd	5,362 tpd
the estimated average capture rate is...	36%	55%	69%	35%

2 That some people would have to recycle at *even higher* rates.

Let's say New York City aimed for a 75% capture rate, given a waste stream of 14,000 tons per day (tpd) and potentially recyclable fraction of 4,800 tpd. This would yield 3,600 tpd of recyclables—and a diversion rate of a 25% (3,600/14,000)—assuming each and every New Yorker recycled three-quarters of the recyclables they threw out each week.

But what if not everyone recycled at this rate? What if, for example, 20% of City residents only recycled 50% of the recyclables in their waste stream? Let's call this 20% the "low compliance portion." This would mean that, to achieve a citywide capture rate of 75%, the rest of the population (let's call them the

Table 11

Comparison of Alternative Scenarios
The capture rate needed to achieve 25% or 30% diversion
in tons per day (tpd)

A	B		C	D = A x C	D/B
assuming the total waste stream is...	**and the recyclable portion of the waste stream (averaged from the estimates in Table 10) is around...**	**THEN**	**a diversion rate of...**	**would mean a recycled tonnage of...**	**which requires a capture rate of...**
14,000 tpd	4,800 tpd		25%	3,500 tpd	73%
14,000 tpd	4,800 tpd		30%	4,250 tpd	88%

"high compliance portion") would have to make up the difference. In this case, the remaining 80% of residents would have to recycle (or capture) 81% of all their recyclables.

Doing the Math

If NYC aims for a 75% Capture Rate, the "high compliance portion" of the population must achieve a capture rate that equals:

$$\frac{75\% - [\text{"low compliance portion"} \times \text{"low compliance capture rate"}]}{\text{"high compliance portion"}}$$

Let's consider some other scenarios. If only 10% of the NYC population didn't recycle *at all*, then the rest of the population would need to achieve a capture of 83%. If half of the population recycled with a capture rate of 50%, the remaining half, it turns out, would have to recycle *everything* (100%) that could be recycled. And if 40% of New Yorkers captured recyclables at 50%, the rest of the City would have to capture at 110%—a logical impossibility.

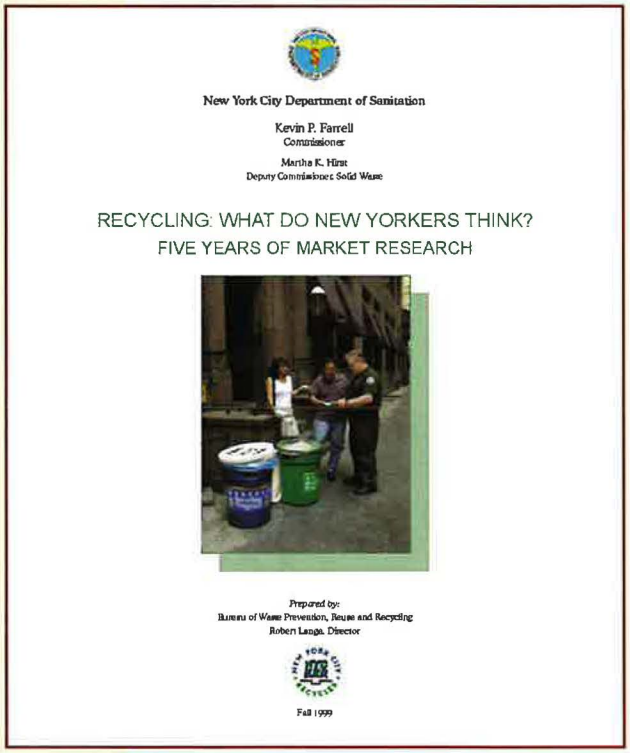
Even if NYC expected all of its residents to capture 75% of their recyclables, such a goal would be extremely difficult to attain. Seattle, for example, shows a capture rate of around 60% for paper and MGP for the year 1999.[47] The same capture rate (60%) in NYC would mean a diversion rate increase to only 21%.

What should one draw from all these calculations? A better understanding of the relationship between participation and diversion will lead to more realistic program planning. Under the present Recycling Program, the City may be nearing the limit for attainable diversion. This does not mean we should stop trying to increase participation, just that we should know what to expect from it.

What We Know from Market Research

The only way to increase the capture rate for residential waste is to increase recycling participation in the home. This means, through persuasion or legal sanction, getting more people to recycle more, and recycle better. How might people respond to additional "persuasion" or stepped up enforcement?

Fortunately, we have a good idea about the former from five separate surveys—each administered to over 1,000 randomly selected New Yorkers by telephone—which the Department has conducted over the last three years. Results of these surveys are discussed in detail in the Department's fall 1999 report, *Recycling: What Do New Yorkers Think?*


New York City Department of Sanitation

Kevin P. Farrell
Commissioner

Martha K. Hirst
Deputy Commissioner, Solid Waste

RECYCLING: WHAT DO NEW YORKERS THINK?
FIVE YEARS OF MARKET RESEARCH

Prepared by:
Bureau of Waste Prevention, Reuse and Recycling
Robert Lange, Director

Fall 1999

Published in 1999, this report details the extensive market research conducted on the Department of Sanitation's behalf about what NYC residents think about recycling.

The surveys show that year after year, over three-quarters of residents rate the Recycling Program positively, and most say that the Program has made New York City cleaner, cut down on pollution from landfills, and made productive use of materials that otherwise would have gone to waste.

A more recent trend (seen since 1998) has been growing approval of the Program's organizational aspects—its color-coordinated source separation system, its cartoon-based ad campaign, the variety of materials that can be recycled, and the Program's overall efficiency.

The Department of Sanitation's Recycling Checklist Flyer uses cartoon images to explain how to handle 40 of the most commonly disposed of items in NYC.

The surveys also show that the public is well informed. Majorities correctly identify the major recyclables, most at very high rates (over 90%). High knowledgeability is seen regardless of where residents live, what type of housing they reside in, or whether English or Spanish is their primary language. This is very good, but not surprising news for the Department, which has consistently geared its public education towards explaining Program basics.

In fact, the most common complaint among those surveyed does not concern the Program itself, but centers around the perception that not all New Yorkers are doing their "fair share." This impression exists despite the fact that research shows that since 1995, the reported levels of nonparticipation have dropped dramatically, declining from 20% in that year to close to 5% as of 1999. (This finding is supported by the upward trend in the citywide diversion rate over this same period.) And residents continue to report increases in their own compliance. As of the last survey in February 2000, they reported a "perceived" diversion rate of 50%, and capture rate of 75%, up slightly from prior surveys.

Of course, these self-assessed compliance rates do not match the measured diversion rate of 20% and capture of 50% for NYC. The latter are real measures, taken from actual truck weights and direct analysis of the composition of the waste stream, and are clearly more accurate than citizens' self-perception.

The persistence of higher figures in people's minds, however, is arguably more relevant when considering what it means to ask people to "recycle more," when in fact they believe themselves to be recycling very well (and in addition think compliance problems reside with others).[48] Furthermore, that the

majority of measures of Program acceptance—in terms of approval, knowledge, and behaviors—are holding steady suggests that the messages about what to recycle, how to recycle, and why recycling is important have made their way into the "New York state of mind."

This does not mean that the Department should relent in its public education. The practical nuisance of recycling, the continual influx and out-migration of residents in this City, and the pressures that waste export will place upon the City in the years to come all point to the urgency of continuing to promote recycling in NYC. What it does mean, however, is that there may be limits to what public education (i.e., "persuasion") can achieve in terms of further improvements in diversion.

Enforcement

Enforcement of residential recycling compliance is another story. While the vast majority of New Yorkers know that recycling is mandatory (and many cite "obeying the law" as their main reason for recycling) it remains an inescapable fact that the Program cannot be enforced evenly in multifamily buildings. Because it is not generally possible to attribute what is in the trash and recycling to particular tenants in multi-unit buildings, enforcement in such dwellings is very difficult. As it stands, building management can only be fined if recycling is not *set up or set out* properly (i.e., if a recycling area is not labeled and maintained, or recyclables are placed out for collection in improper containers).

This leaves recycling enforcement efforts in NYC somewhat at an impasse. To increase recycling, how much of an incentive would more frequent and stiffer fines be? In apartment houses, who should be ticketed? Should the Department refuse to pick up garbage bags if they contain recyclables? These questions all relate to the level of *sanction* that is appropriate to bring to bear on New York City citizens, and corresponding *expectations* of citizen compliance. In this regard, it's interesting to compare NYC's recycling ordinance, Local Law 19, to other laws that regulate citizen behavior.

Most such laws—like anti-litter or dog waste ordinances—regulate *public* behavior. Recycling, on the other hand, is one of the very few private, household activities dictated by administrative law. In fact, for apartment dwellers the structure of the recycling ordinance most closely resembles decency laws that in some states regulate personal behavior in the home. At the same time, with recycling there is a measurable outcome of this behavior—tons of recyclables—that is constantly evaluated (clearly not the case with other statutes governing private behavior). But while it's possible to know that the recycling law is not being complied with in a quantitative manner (if the expected tons aren't coming in), it's generally not possible to identify individual offenders.

To compound this problem, consider the unique way that compliance is quantified under Local Law 19. Under most administrative laws, data on compliance come from records of the number of tickets issued, summonses written, or the like. These laws simply prohibit certain actions. There are no direct measurements of how many people *are* complying, and consequently the standards by which to judge whether the law is "working" are indistinct. With recycling, on the other hand, the fact that each recycling truck is weighed means that there is daily, measured data against which to evaluate a desired level

of compliance—albeit abstractly (i.e., not at the level of the individual complying citizen).

In sum, the particular qualities of the recycling law mean that the tons of recyclables collected are "read" as an indicator of compliance that can never really be directly measured—or controlled. This is not because of a deliberate intention on the part of the legislators who drafted Local Law 19, but merely due to the nature of recycling as an operational phenomenon. How does all this relate to making decisions about what to expect in the way of compliance, and what levels of enforcement are appropriate? It only highlights that achievement of diversion rate improvement should not be expected to come about as a result of extraordinary control of private behavior, or over and above what is assumed under other similar laws.

With such an enforcement picture, and given a decade of sustained and varied public education, it may well be possible that the City is reaching the upper limits of what can reasonably be expected in the way of residential compliance. The Department recognizes that there are no easy solutions to the dilemma of how to get people to recycle more or better. Yet government programs are unlikely to work without general public consensus of their appropriateness and fairness. In fact, a lack of general consensus could actually hurt recycling.

Recycling Additional Materials

Given that improvements in the diversion rate are probably going to be marginal under the current Program, the next logical question is whether there is potential for the inclusion of *additional* materials in NYC's Recycling Program. If one imagines the NYC waste stream after the removal of items that are designated as recyclable under the current NYC Recycling Program, what remains?

The four waste composition studies cited previously in this report shed some light. Table 12 shows fractions of *nonrecyclable*[49] *MGP, organic waste,* and *residue* in the total waste stream. Variations in the sorting methods employed in the different studies mean that some of the categories are not comparable (for example, the 1997 Low-Diversion District study categorized food with "residue"). Still, these studies' results do provide some general estimates of the composition of the City's waste stream as a whole.

What Is Designated as "Recyclable" under NYC's Current Recycling Program?

ALL types of metal, including: aluminum cans, steel "tin" cans, aluminum foil products, bulk metal, and any item containing more than 50% metal

Plastic bottles and jugs

Glass jars and bottles

Beverage cartons (milk cartons, aseptic juice packs, etc.)

Corrugated and smooth cardboard, newspaper, office paper, magazines, junk mail, phone books, paper bags, wrapping paper, and other types of mixed (not tissue) paper

As Table 12 (on page 45) shows, around 9 to 22% of all waste is what the Department considers "non-recyclable" MGP and paper. This includes plastics other than HDPE and PET bottles and jugs,[50] paper that is likely to be soiled with food or other matter (tissues, paper plates, etc.), glass that breaks easily and which is dangerous to handle (shards, plate glass, mirrors) and "mixed-material" items (like toys or home furnishings).

Food likely makes up another 6 to 17% of garbage, with other organic materials at lower rates. Yard waste clearly varies from area to area—in Staten Island and in suburban areas of the outer boroughs, it stands at around 17%, close to the national average. In the context of the City as a whole, however, it accounts for much less (4%). Textiles, a category some have argued for inclusion in the NYC Recycling Program, account for about 3 to 5% of the stream, while wood, another highly variable category, probably represents 2 to 6%. Finally, "residue"—a mixture of materials such as diapers and other hygiene products; household hazardous waste; rubber, ceramics and other unusual materials; and "fines" (pieces of waste so small and mixed they defy categorization)—probably accounts for about 14 to 17% of the waste stream.

Can any of these "leftovers" be targeted for recycling? In particular, is it realistic to think that any of the "lost" MGP or paper could be safely recovered for recycling, without prohibitive cost? For the organic fraction of the stream, composting comes to mind—can more yard waste composting be done, and should the Department collect source-separated food and tissue paper (napkins, etc.)? Should textiles be designated and collected along with paper or MGP? And does it make sense to target anything in the residue category? In formulating answers, it is once again important to review what the Department is already doing.

"Non-Recyclable" Plastics and Other Inorganics

In the U.S.'s free-market economy, the *prices* that recyclable materials command largely determine what municipalities collect. This explains why all cities designate HDPE and PET plastics in their recycling program, yet very few collect other resins.

Similarly, because markets for substances like ceramics and Styrofoam are severely limited or nonexistent, they are uniformly excluded from municipal programs. These materials are present in relatively small quantities in the waste stream but cost a great deal to accept and process. Weighed against the marginal benefit of preventing their disposal, the costs of adding them to a recycling program are usually too great.

For instance, San Francisco explains that "less than 2% of the 85 million pounds of plastic we use every year is recycled...[because] even though most plastics are technically recyclable, the recycling infrastructure for plastics is still in its infancy."[51] These limitations are especially important in large cities like New York that depend on private processors to accept and process recyclables continuously. With very little space available to store collected materials, processors cannot stockpile unmarketable items, which can easily clog the waste management system and lead to recycling infrastructure failure.

Yard Waste

In suburban and semi-suburban neighborhoods throughout New York City, the Department already collects leaves, brush, and pumpkins seasonally; it also picks up Christmas trees citywide. This results in over 20,000 tons per year of material composted in windrows at four sites throughout the City. This represents a recovery rate of around 27%—leaving a remaining 100,000 tons of yard trimmings to be either handled at home, or collected as refuse.

Much of this tonnage consists of grass clippings—a heavy, seasonal material which the Department unfortunately cannot collect for windrow composting due to the potential odor problems that would affect communities

Table 12

Estimates of the Composition of the NYC Waste Stream After Currently Designated Recyclables Are Removed
A summary of four separate waste composition studies

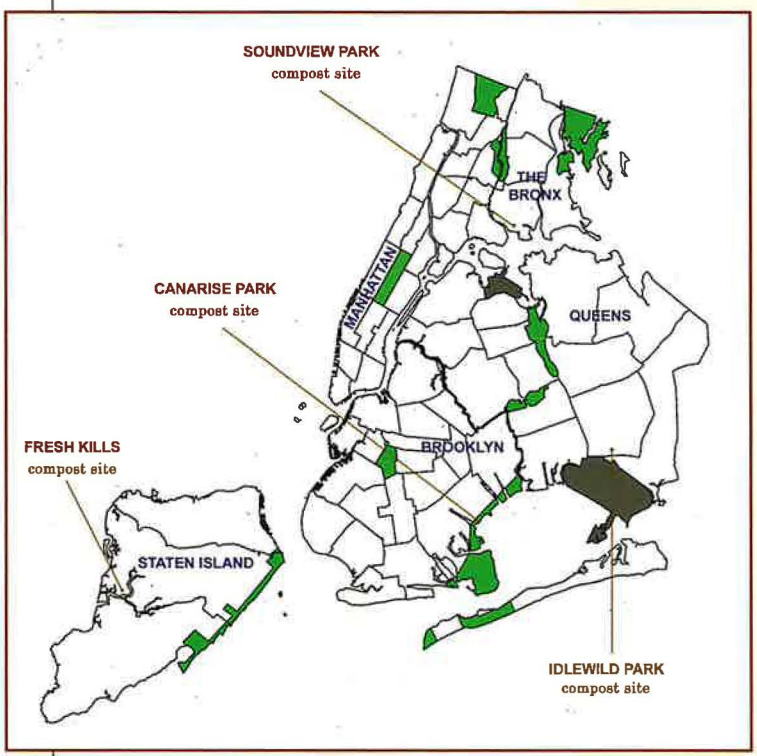
Study Year	1989	1997	1997	1997
Study Population	Citywide	Staten Island	Low-diversion districts in the Bronx and Brooklyn	Low-density "suburban" housing in the outer boroughs
Composition				
Non-recyclable MGP and paper				
metal	0.00%	0.00%	0.00%	0.70%
plastic	7.30%	n.a.	n.a.	4.80%
paper (contaminated or non-designated)	n.a.	6.40%	0.59%	7.20%
non-metal bulk	7.23%	7.53%	1.49%	3.80%
non-specified MGP (including plate glass)	n.a.	7.60%	7.05%	n.a.
subtotal	**14.53%**	**21.53%**	**9.13%**	**16.50%**
Organic				
food	12.70%	5.55%	see notes	17.00%
textiles	4.70%	3.37%	4.05%	n.a.
wood	2.20%	5.70%	2.36%	n.a.
yard	4.10%	16.70%	0.00%	16.00%
subtotal	**23.70%**	**31.32%**	**6.41%**	**33.00%**
Residue				
ceramics	0.20%	n.a.	n.a.	n.a.
hazardous waste	0.40%	n.a.	n.a.	n.a.
hygiene	3.40%	n.a.	n.a.	2.50%
other organic	10.30%	n.a.	n.a.	0.50%
other inorganic	2.10%	n.a.	n.a.	11.00%
"general residue," including glass shards	n.a.	17.22%	see notes	n.a.
subtotal	**16.40%**	**17.22%**	**61.00%**	**14.00%**
TOTAL	***54.63%***	***70.07%***	***76.54%***	***63.50%***

Notes: "n.a." indicates that this category was not assessed in this waste composition study.
The "low diversion" study categorized residue and food together at 61% of total.

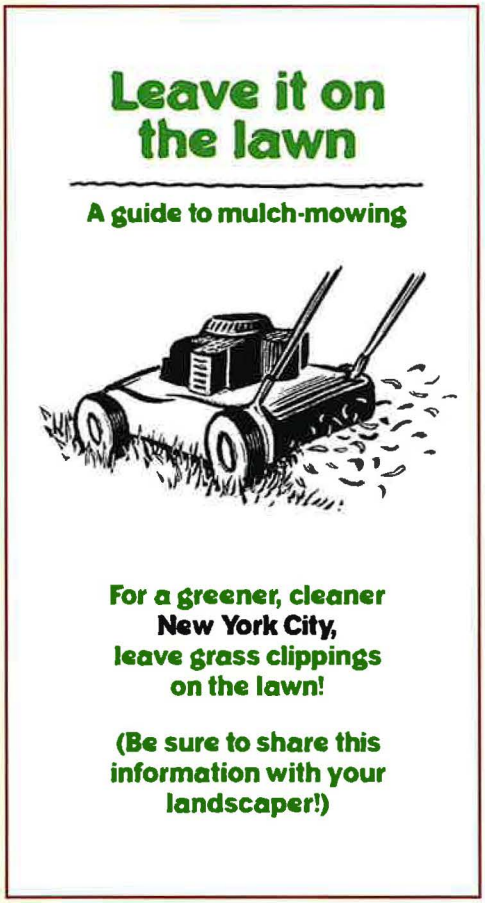
NYC Department of Sanitation workers load bags of leaves as part of the Department's fall leaf collection program.

DOS workers load discarded Christmas trees as part of the Department's Christmas tree collection program.

located near compost sites. However, the Department does actively promote grass recycling or "leaving it on the lawn," and in a recent survey found that about a quarter of all New Yorkers with lawns to mow utilize this method to dispose of their clippings.[52]

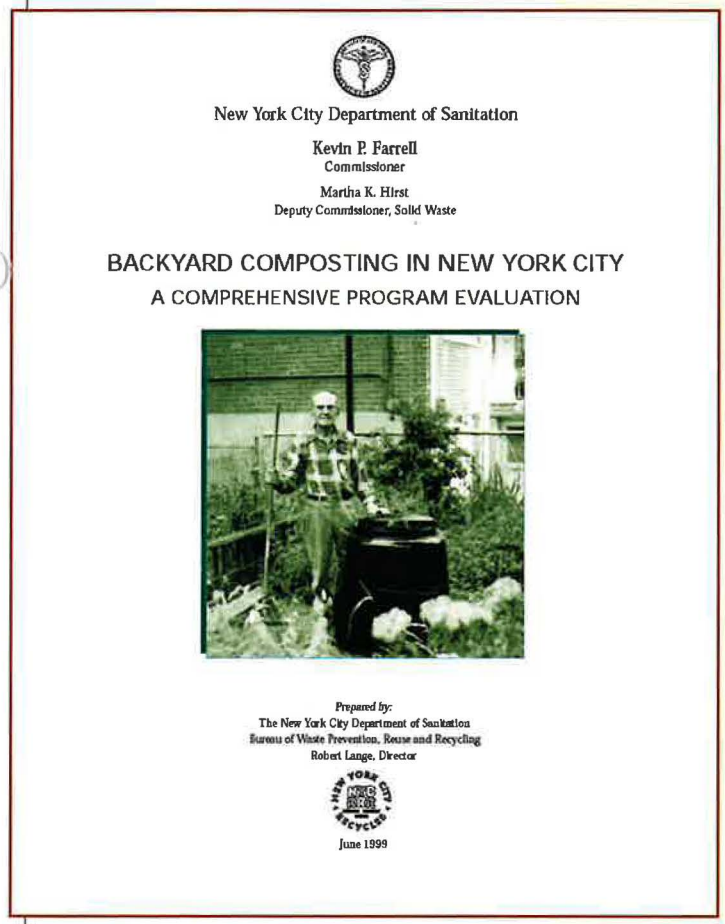


Each of the outer boroughs has a composting site.



The Department's "Leave it on the lawn" brochure encourages residents to prevent yard waste by letting clippings break down on the lawn, rather than bagging them for disposal.

Clippings and other forms of yard waste can also be handled through backyard composting, which the Department has promoted citywide since 1997. Though it is hard to measure the number of participants or the diversion it is achieving, the Department's extensive and sustained outreach in this area guarantees that all New Yorkers with yards and gardening interest have resources to backyard compost if they choose. Details of the Department's efforts in this regard can be found in its fall 1999 report, *Backyard Composting in New York City: A Comprehensive Program Evaluation.*



New York City Department of Sanitation

Kevin P. Farrell
Commissioner

Martha K. Hirst
Deputy Commissioner, Solid Waste

BACKYARD COMPOSTING IN NEW YORK CITY

A COMPREHENSIVE PROGRAM EVALUATION

Prepared by:
The New York City Department of Sanitation
Bureau of Waste Prevention, Reuse and Recycling
Robert Lange, Director

June 1999

The Department's comprehensive evaluation of backyard composting, summarized in this 1999 report, concludes that backyard composting is cost-effective and educational, but won't significantly increase the diversion rate, no matter how intensely it is promoted.

Information about the Department's composting efforts in general is available at the Department's Compost Project website, at www.nyccompost.org, and in a forthcoming report reviewing the Department's composting efforts over the past decade (not yet issued).

Additional yard waste diversion might be achieved by:

1. Banning the collection of grass clippings outright.
2. Adding a special spring yard waste collection for brush and leaves that were missed in the fall.
3. Allowing landscapers to use DOS composting sites.

In addition, improving the Department's wood-composting capability beyond current levels (the Department's chippers and sites can only handle light brush and small trees) might enable it to compost some or all of the 45,000 tons of large trees and heavy brush that the Parks Department currently disposes each year.

A combination of such programs might increase the overall diversion rate by a few percentage points, if communities were willing to host expanded compost facilities—which is by no means assured given the protracted difficulties the Department has experienced in siting existing leaf composting stations in Queens and Brooklyn.

Food Waste

Food waste, representing around 15% of the overall waste stream, would seem another obvious category to target for composting. In some countries (Germany, the Netherlands) residents are in fact required to source-separate food, which is collected and transported to

centralized, enclosed composting facilities. In the U.S. this is much less common.

Seattle hopes to add food composting to its recycling program in the future, but currently reports that "only the Backyard Composting Program helps residents to get food waste out of their garbage cans."[53] Portland has a voluntary food-waste composting program, but it is limited only to businesses. San Francisco, on the other hand, has successfully completed a pilot program for organic waste collection, and is now providing single-family homes and small multi-unit residences with a green cart into which they place food and yard waste. According to initial results, the program has boosted diversion in the neighborhoods in which it is being tested by 10-15 percentage points.[54] Yet in buildings with greater numbers of units, participation in this program hinges on a volunteer tenant coordinator. As described by the program's manager, Jack Macy:

> Larger buildings (usually with six or more units) that do not have individual billing or trash and recycling service receive larger centralized black and blue bins to share, similar to their current citywide service. These large multiunit buildings do not get a green cart for compostables unless they requested one and identify a resident who will be responsible for the bin (additional outreach may be taken to bring these buildings into the program in the future).[55]

In considering whether a similar arrangement would be a viable alternative for New York City, two important facts should be kept in mind. First, the siting of composting facilities is extremely unpopular—community concerns about composting yard waste (which is considered relatively "clean") pale in comparison to the intense opposition that arises to stations that process discarded food. San Francisco's privately managed collection system has fortunately enabled private haulers to build upon existing relationships with established composting facilities near the city, who are willing to accept organics for processing. Consequently, no new facility siting has been required. Around NYC, in contrast, processing capacity would have to be created and/or contracted for by the City itself—a far more contentious process.

Second, there is evidence (even absent the serious siting problems that such a program would entail) that food-waste recycling would not fare well in NYC. In two separate pilot tests of food waste collection here in New York City, the Department found collection costs to far outweigh diversion benefits.[56]

The Department first initiated testing of source-separation of food waste in Park Slope, Brooklyn in 1992. The pilot demonstrated that residents in medium-density ("brownstone") housing, when educated through extensive and constant outreach programs, were willing to source-separate their organic waste. In fact, the Park Slope program achieved food-waste capture rates that approximated 50%.

However, the cost of adding a fourth truck route, at maximum load rates of five tons per truck (compared to an average of ten tons per truck for solid waste, eight tons per truck for paper recycling, and seven tons per truck for leaf collection) far exceeded the economic benefits of food waste recovery. Moreover, a similar pilot conducted in Starrett City, Brooklyn (which has higher density housing

more typical of the City) resulted in minimal food waste diversion that was so heavily contaminated it could not be composted.

Such findings indicate that the expense and difficulty of collecting source-separated food waste in densely populated areas make such programs unlikely for cities like New York. In fact, even in countries such as Germany and Holland, where source-separated composting plays a significant role as a waste management strategy, food-waste collection programs are not carried out with equal success in high-rise buildings in the larger, denser cities such as Berlin and Amsterdam.[57]

The Composting Unit of the Bureau of Waste Prevention, Reuse and Recycling supports pilot projects to foster on-site, in vessel composting of food and yard waste. These include not only an enclosed, agitated-bay composting facility for food waste on Riker's Island, but also in-vessel projects at New York Hospital in Queens and the New York Botanical Garden. But viewing food-waste composting as an option for a segment of, or for the entire residential stream, is not presently a realistic option for NYC.

In-vessel compost units at the New York Botanical Garden.

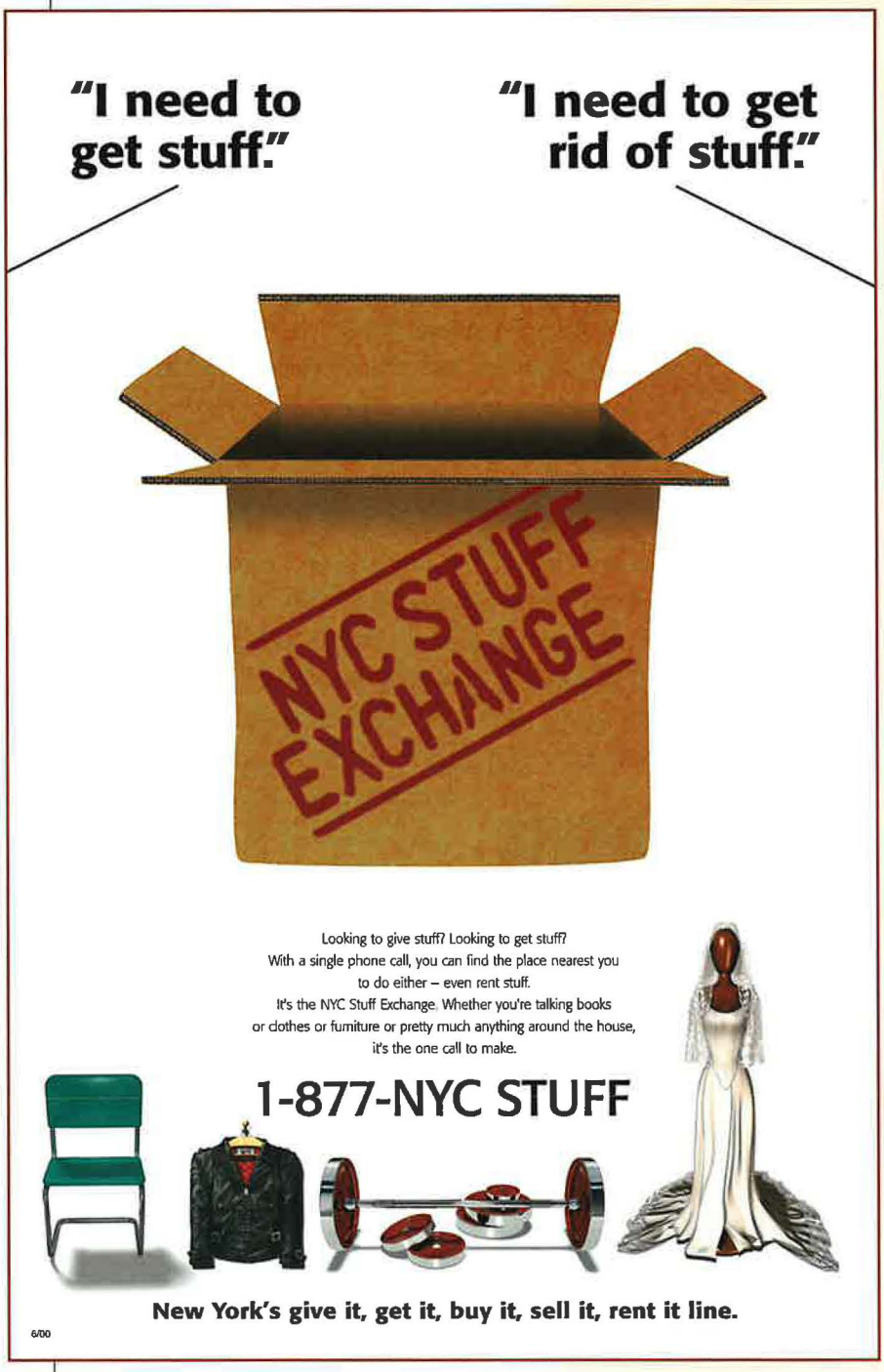
Textiles

Among the cities included in the *Waste News* survey, only San Jose collects textiles at curbside for recycling. Residents there are advised to place textiles in a separate clear bag in their recycling container along with the rest of their recycling, which is collected in one commingled stream, and heavily sorted at the recovery facility.[58]

But most cities (including New York) advise residents to donate unwanted textiles to charity. The city of Milwaukee, for instance, reminds residents that donating even stained or unusable items to thrift shops helps diversion, since these sources recycle their cast-offs as fiber. Many cities' websites provide lists of charitable organizations that will accept unwanted clothing, rugs, and other material. And surveys conducted by BWPRR have found that the majority of New Yorkers prefer to donate unwanted clothing to charity, rather than leaving it at curbside with recycling, because of concerns about scavenging.[59] Pilot tests of textile recycling in Park Slope confirmed this attitude, which resulted in minimal cloth left at the curb.

It is consequently unlikely that adding textiles to the Recycling Program would be received well,

complied with, or would increase New York's diversion rate. Capitalizing on a pre-existing and well-known system of charities makes much more sense. This is the spirit behind the Department's recently debuted "Stuff Exchange" (1-877-NYC-STUFF) which enables residents everywhere in the City to find out where to donate used textiles, as well as many other items.

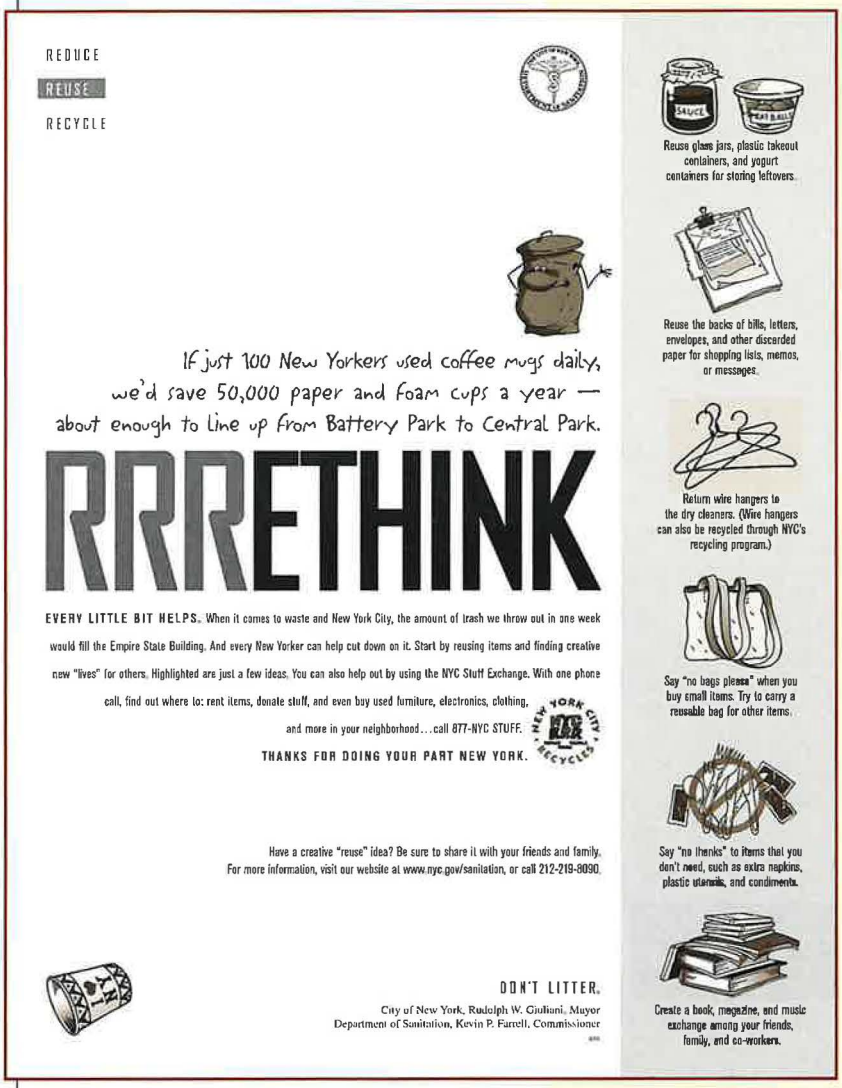


The Department recently promoted the "NYC Stuff Exchange" throughout New York City. This hotline provides residents with extensive information about reusing or renting items, rather than buying them new. It also tells residents how to donate or repair things instead of throwing them away.

Waste Prevention

Recycling additional materials is not the only option for waste reduction. Preventing waste at the source is another alternative. New York City's recycling law actually requires the Commissioner of Sanitation to establish programs to *reduce* or recycle specified tonnage amounts. Since 1991, the Department has initiated a number of waste prevention programs to reduce the volume and toxicity of waste generated, working with residents, consumers, businesses, and non-profit and government agencies in NYC.[60]

The methods the Department follows are similar to those used in other jurisdictions. To encourage waste prevention among residents, its Waste Prevention Unit distributes information on methods to reduce and reuse. Such recommendations encourage New Yorkers to purchase items with less packaging and in bulk; repair items rather than replace them; and bring their own shopping bags to the grocery store. It also explains how donating clothes, toys, furniture, and other durables for reuse, as well as patronizing second-hand stores, can help cut down on the amount of waste generated.



In the spring of 2001, the Department of Sanitation ran this full-page newspaper ad in the City's major daily papers to encourage NYC residents to practice waste prevention.

But unlike other cities, the Department has also made extensive efforts to actually *measure* the impacts such programs had on the tonnage of waste generated. Its research in this area is summarized in a series of reports entitled *Measuring Waste Prevention in New York City*.[61]

These reports present several important findings. The first highlights the inherent difficulty in measuring a desired policy outcome in terms of what does and does *not* happen. Such an effort requires that researchers make extensive yet tentative assumptions about what would occur in the *absence* of a program. Unlike directly measurable outcomes in recycling programs (such as tonnages or diversion rates), assumptions about the impacts of waste prevention rely on forecasting consumption patterns that are subject to a host of outside economic influences. It is consequently very hard to pin down just what the effect of a waste prevention program has been.

When reliable prevention measurement can be established, moreover, the results of the Department's research suggest that its programs have minimal impacts on the waste stream as a whole. Often the costs of measuring waste prevented actually outweigh any anticipated savings in collection and disposal costs.

Policy initiatives that might have a measurable impact—including those targeting packaging, materials composition, or producer buyback requirements—simply fall out of the purview of municipal policy. Influencing markets requires national legislation regulating producers, and involves influencing the national and international economy in a direction contrary to the economic trend that has occurred since the early nineties. General output of consumer products has increased, periodic recessions and source-reduction goals notwithstanding. For example, Americans used 10% more paper per capita in 1997 than a decade earlier, and 34% more than two decades earlier.[62] Even in the "Green" social

democracies of Germany and the Netherlands, where a tradition of stronger government regulation has enabled the imposition of producer taxes for waste reduction (such as Germany's Green Dot program), overall output of consumables has continued to grow.

Overall, the Department's research suggests that it is unfounded and unrealistic to assume reduction of a sizeable portion of NYC's waste stream through local waste prevention initiatives. The City's experience in this arena is not unique. New York State has suspended an assessment of whether a statewide 8-10% waste prevention goal has been met "because it is extremely difficult to quantify waste reduction achieved."

Even setting aside the difficulty of measurement, the quantity of waste prevented through programs aimed at household and institutional waste is relatively small. At best it is projected to be somewhat less than one percentage point of the current diversion rate.[63]

The consultant who derived these estimates for the Department (CalRecovery, Inc.) took great pains to stress their tenuousness at the time, writing that "it is important to recognize the[ir] speculative character," and noting that "three key factors make the assumptions...at best educated guesses." These factors included:

1. "A near complete absence of data—many of the strategies [upon which the estimates were based] have never been implemented anywhere";
2. The fact that "waste prevention activities are likely to have interdependent and cross-cutting impacts. Efforts to reduce one type of waste may increase the generation of another. [But] a model that could account for these interdependencies would be enormously expensive to develop and unwarranted given the dearth of data"; and
3. "The need to rely on composition data by material—[such data] simply do not provide the level of detail needed to make estimates of waste prevention impacts."

As a result, the consultant cautioned, "the assumptions that follow may err by considerable margins. *These assumptions should not be taken as estimates of likely programmatic impacts*, but as rough guesses intended to appraise the scale of impact of an aggressive waste prevention program, to uncover inconsistencies and to identify important subjects for future research."[64]

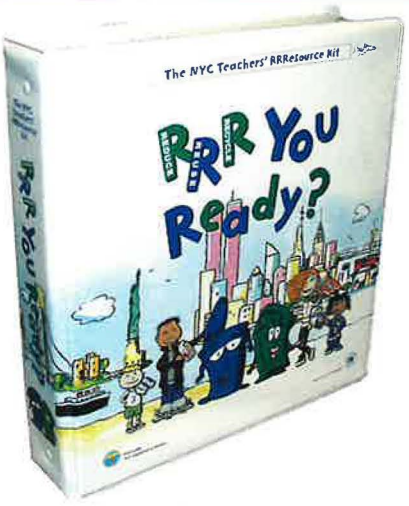
Overall, one might argue that without the Department's waste prevention efforts, disposal problems might be worse than they are now—but clearly, waste prevention is no cure-all. The Department believes that waste prevention is good materials management, and intends to continue to promote it. However, in the face of the driving forces of production and consumption in the national and now global economy, it would be bad policy for the New York City Department of Sanitation to plan as if its efforts could suffice to actually reduce consumption of things that end up in the local waste stream. Waste prevention is something that the Department (and others) should encourage, but since it cannot be accurately measured, it would be unwise to consider it any sort of "official" goal.

Next Steps

The information presented in this report should make it clear that there are many complex questions to keep in mind when thinking about how to increase diversion in New York City—and few easy answers. Finding those answers will involve a public process of consensus building, accompanied by continued research and reliance on measured data. Legislators, policy advisors, citizen groups, community coalitions, and experts in academia need to come together to advance recycling proposals that take into account the facts presented here, and which go beyond simply comparing NYC's diversion rate to that achieved elsewhere.

Specifically, the Department advocates setting aside, for the moment, expectations of significant waste reduction in the *residential* sector through waste prevention, backyard composting, Quantity-Based User Fees (QBUFs), or alternative-material recycling programs. While such initiatives certainly won't interfere with diversion rates already achieved, planning as if they will make a significant dent in the tonnages of waste New York City will have to export in coming years is, at present, unwarranted and unrealistic.

The Department strongly believes, however, that the *educational* value of such strategies *is* significant, and in future years may lead to realistic and substantial programs for reducing waste. For this reason, discussion of waste prevention, composting, and materials in the waste stream has been woven into the recently issued *RRR You Ready? The NYC Teachers' RRResource Kit* for public elementary schools. These themes also continue to be a part of the Department's ongoing programs (as seen, for example, in the promotion of backyard composting through the Botanical Gardens).



In January 2001, the Department of Sanitation began distributing these Kits to NYC public elementary schools to promote education on recycling and waste prevention. The Kits contain original videos, lesson plans, extensive background information, and helpful resources.

This guide explains how to set up an outdoor compost bin and is widely distributed through NYC's four botanical gardens. Copies can also be ordered through the Department's Sanitation Action Center.

It may well be possible to implement QBUFs in the smaller and more diverse *institutional* sector. In this sector, linking collection to direct costs for certain agencies (such as schools and the Housing Authority) would be a bold step that could, potentially, increase citywide diversion by a measurable amount.

What New Ideas Should Be Pursued?

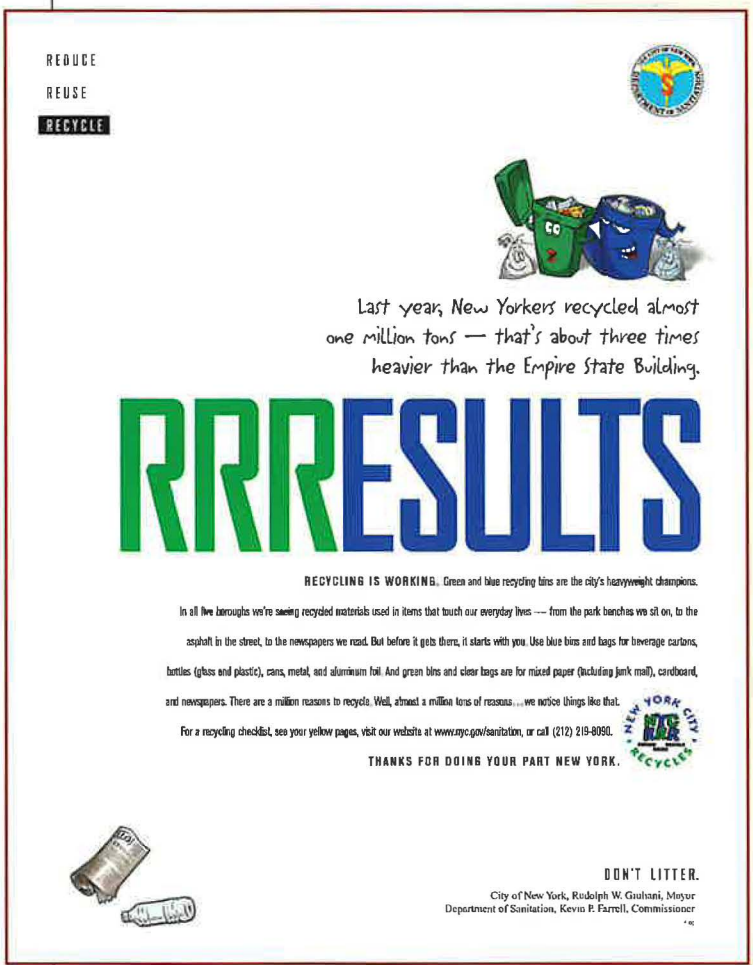
At the residential level, the Department recommends stepped-up enforcement for repeat violations, including escalating fines to residents—both in single-family homes and in apartment buildings—as well as to apartment building owners.

A ban on the collection of grass clippings would be a means of increasing organics diversion without the problems of community opposition to new composting facilities. This, of course, is contingent upon attaining the necessary political consensus to implement such a proposal.

Overall, it is essential that ongoing advertising and other public outreach programs be maintained at current levels; these efforts expand and reinforce knowledge about recycling, which is the strongest tool for making it work.

The Department is currently in the planning stages for an updated, comprehensive citywide waste composition study, which it expects to complete sometime in or around 2005. The data from this study will enable a fresh look at New York City's residential waste stream, with an eye towards:

- Identifying additional materials that might realistically be recycled in a cost-efficient, operationally sound manner.
- Better understanding the relationship between housing characteristics and recycling compliance.



As part of its spring 2001 ad campaign, the Department of Sanitation ran this full-page ad in the City's major daily papers to encourage New Yorkers to continue their recycling efforts.

Endnotes

[1] Department of Sanitation, Bureau of Planning and Budget. *Residential Recycling Diversion Report*, December 2000.

[2] Some larger buildings place material in centralized containers for mechanized collection rather than at curbside; five-day-a-week collection is provided to public school routes.

[3] Past education and outreach efforts are summarized in: Department of Sanitation, Bureau of Waste Prevention, Reuse and Recycling. *NYC Recycles: More than a Decade of Outreach Activities by the NYC Department of Sanitation FY 1986-1999*, Fall 1999.

[4] Department of Sanitation, Bureau of Waste Prevention, Reuse and Recycling. *Recycling: What Do New Yorkers Think?*, Fall 1999.

[5] Clinton, William J. 2000. "America Recycles Day Presidential Message." November 15, 1999 White House Proclamation.

[6] Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1998 Update*, September 1999 (EPA530-R-99-021).

[7] Burrows, Edwin G. and Wallace, Mike. *Gotham, A History of New York City to 1898*, 1999 (Oxford University Press, New York).

[8] Franklin Associates, Ltd. *Solid Waste Management at the Crossroads*, December 1997 (Franklin Associates, Ltd.: Prairie Village, KS).

[9] Civic and environmental advocates in NYC have often called for adjustment of the City's diversion rate to account for contamination. A visit to the website of any other U.S. municipality will show that this is unprecedented in recycling program evaluation.

[10] The Department also tracks institutional waste in this manner. Some previous waste composition studies have estimated NYC institutional waste as making up between 10 to 20% of the "Department-managed" waste stream, though as of yet there is no good data on this breakdown. Due to the subject matter of this report—which focuses on residential characteristics of cities—we will focus on residential waste collection and recycling.

[11] Businesses are required under City Law to recycle and are subject to enforcement by the Department of Sanitation. They must also adhere to requirements set out by the City's Trade Waste Commission and the Department of Environmental Conservation as well as the State Department of Environmental Protection. The commercial recycling rate was around 63% for 2000 and 71% for 2001. However, much of this consisted of clean fill and construction and demolition (C&D) debris.

[12] Note that NYC's reporting also includes some recycling by public institutions. Data on institutional and residential waste are not kept separately, but residential waste makes up the vast bulk (at least 80%) of Department-managed waste.

[13] Based on available data on yard waste recycling, we subtracted yard waste tonnages from the numerator (representing recycling) and the denominator (representing recycling plus trash) for each city. In an optimal situation in which we had data on yard waste in the overall waste stream, we would have subtracted yard waste *recycling* from the numerator and yard waste overall *(recycled and disposed of)* from the denominator. However, we did not have access to data on disposed yard waste for most of the other cities. It should be noted that we used this alternate, approximate method uniformly, even for New York for which we had full information. Comparisons using this technique are therefore consistent overall if not entirely accurate for each case.

[14] Franklin and Associates, Ltd. *Characterization of Municipal Solid Waste in the United States: 1960 to 2000 (1998 Update)*, March 1998 (Franklin Associates, Ltd.: Prairie Village, KS); Cascadia Consulting Group, Inc. *City of Seattle, Home Organics Waste Management Survey*, March 1996; Metropolitan Service District, Portland, OR. *Metro's Home Composting Demonstration Program*, 1992.

[15] **Yard Waste Percentage Findings for NYC Residential Waste**

Study Year	Population %	Yard Waste	Study Year	Population %	Yard Waste
1989	Citywide	4.10%	1997	Staten Island	16.70%
	Brooklyn	4.00%	1997	Low-recycling rate districts in the Bronx and Brooklyn	0.00%
	Bronx	3.11%			
	Manhattan	1.81%	1997	Suburban-style neighborhoods in the outer boroughs	16.00%
	Queens	7.54%			
	Staten Island	11.19%			

[16] Staff. "King County Strives for Recycling Crown," *Recycling Today*, November 2000, pp. 80, 82, 90.

[17] Franklin Associates, Ltd. *Solid Waste Management at the Crossroads*, December 1997 (Franklin Associates, Ltd.: Prairie Village, KS).

[18] The U.S. rate is for 1997; the New York rate is for 1998, the first full calendar year under the expanded program. Source: Franklin Associates, Ltd. *Municipal Solid Waste Recycling Rates; New York City and the United States; Comparison and Analysis*, June 1999 (Franklin Associates, Ltd.: Prairie Village, KS), pp. 1-2.

[19] Telephone interview with Baltimore city recycling office, July 6, 2001.

[20] Telephone interview with Erin Keane of the City of Chicago, Dept. of the Environment, July 6, 2001.

[21] New York City Department of Sanitation. *Comprehensive Solid Waste Management Plan: Final Update and Plan Modification*, February 15, 1996.

[22] Franklin Associates, Ltd. *Municipal Solid Waste Recycling Rates; New York City and the United States; Comparison and Analysis*, June 1999 (Franklin Associates, Ltd.: Prairie Village, KS), pp. 1-2.

[23] Environmental Protection Agency, *Waste Prevention, Recycling, and Composting Options: Lessons from 30 Communities*, 1992 (EPA530-R-92-015), p. 52.

[24] Recycling Council of Ontario. *Assessment of Multi-Unit Recycling in Ontario*, August 2000, p. 6.

[25] Ibid.

[26] Ibid.

[27] Katzev, Richard; Blake, Gerald; and Messer, Barry. "Determinants of Participation in Multi-Family Recycling Programs," *Journal of Applied Social Psychology*, 1993, 23, 5, p. 375.

[28] Ibid.

[29] Ibid.

[30] Ibid, p. 374.

[31] Ibid, p. 378.

[32] City of Portland, Office of Sustainable Development, *Solid Waste and Recycling Division Management Report for 2000 Activities*, April 2001, p. 9.

[33] www.cityofseattle.net/util/solidwaste/default.htm.

[34] Seattle Public Utilities, *1999 Solid Waste Annual Report*, March 2000.

[35] Seattle Public Utilities, *City of Seattle Residential Solid Waste Services, Request for Proposals*, October 30, 1998.

[36] Stevens, Barbara. *Multi-Family Recycling: Costs, Diversion, and Program Characteristics*, May 1999 (prepared for US Conference of Mayors/US EPA).

[37] Boston Neighborhood Recycling Coalition, *Boston Recycling Report*, May 2000, at http:/www.bostonrecycles.org/reportmay00.html, p. 9.

[38] Telephone interview with Richard Wozniak of the Los Angeles Bureau of Sanitation, July 30, 2001.

[39] www.sfrecycles.org/Publications/publications_content/summary.htm, "Recycling Summary."

[40] E-mail communication from Lisa Schiller, Residential and Special Projects Associate, San Francisco Recycling Program, July 30, 2001.

[41] E-mail communication from Lisa Schiller, Residential and Special Projects Associate, San Francisco Recycling Program, July 30, 2001.

[42] Skumatz, Lisa (SERA, Inc.), *Quantitative Effects of Program Choices on Recycling and Green Waste Diversion: Beyond Case Studies*; July 1996.

[43] Ibid, p. 21.

[44] Collier, Peter J. "Applying Social Psychology to Recycling in Multi-Family Apartment Buildings," paper presented at the 64th meeting of the Pacific Sociological Association, Portland, Oregon, April 1993.

[45] Ibid, p. 6.

[46] New York City Department of Sanitation. *A Comprehensive Solid Waste Management Plan for New York City and Final Generic Environmental Impact Statement, Appendix Volume 1.1, Waste Stream Data*, August 1992; New York City Department of Sanitation Operations Planning Evaluation and Control, *New York City Waste Composition Study 1989-1990* (four volumes); HDR Technologies, *Report on Staten Island District 3 Waste Composition Analysis*, June 1997; New York City Department of Sanitation, *Mixed Waste Processing in New York City: A Pilot Test Evaluation*, October 1999; and New York City Department of Sanitation, *Backyard Composting in New York City: A Comprehensive Program Evaluation*, June 1999.

[47] Calculations based on www.cityofseattle.net/util/solidwaste/default.htm, "Solid Waste at a Glance."

[48] Sociological research has shown a tendency of individuals to construct and reinforce their identity as "law abiding citizens" by contrasting themselves with others who they perceive as flouting the law.

[49] "Non-recyclable" of course means here "non-recyclable under NYC's current program." All materials are, in theory, recyclable at some level of technology and cost.

[50] In fact, in its public education material the Department instructs residents to recycle "plastic jugs and bottles" rather than specifying HDPE and PET plastics. This results in the *de facto* recycling of most of the HDPE and PET in the waste stream, while minimizing confusion and possible contamination with plastic items that are typically not made of PET or injection-molded HDPE (which interferes with processing of the more common blow-molded PET). These items include tubs, cups, take-out containers, caps, packaging, piping, hoses, toys, bags, films, cookware, and many other products.

[51] www.sfrecycles.org/Publications/publications_content/plastics.htm, "Plastics."

[52] New York City Department of Sanitation. *Recycling: What Do New Yorkers Think?*, Fall 1999, p. 102.

[53] Seattle Public Utilities, *1999 Solid Waste Annual Report*, March 2000, p. 8.

[54] www.sfrecycles.org.

[55] Macy, Jack. "San Francisco Takes Residential Organics Collection Fullscale," *Biocycle,* February 2000, p. 51.

[56] New York City Department of Sanitation. *Recycling: What Do New Yorkers Think?,* Fall 1999, p. 94.

[57] Cornell Waste Management Institute. *Roundtable Two: Reducing the NYC Waste Stream: The Potential Role for Composting*, April 3, 1999.

[58] Calls to the San Jose recycling bureau were not returned, so we have no data on the effectiveness of this program.

[59] New York City Department of Sanitation, *Recycling: What Do New Yorkers Think?,* op. cit., p. 83.

[60] For details on these initiatives, see: New York City Department of Sanitation, *New York City Recycles: More Than a Decade of Public Education and Outreach by the NYC Department of Sanitation, FY 1986-1999*, Fall 1999.

[61] Available online at the Department's website www.nyc.gov/html/dos/home.html.

[62] Miller Freeman. *Pulp & Paper 1999 North American Factbook*, 1998, p. 16. Calculations based on "consumption" (production plus net imports), a measure of domestic use.

[63] In fact, there is reason to believe that the potential effects of waste prevention are considerably smaller than optimistic predictions of a decade ago, when New York's recycling programs were just getting started. In 1992, the City's first Solid Waste Management Plan estimated that by the year 2000, New York would be achieving a residential waste reduction level of 340,000 tons per year, and an institutional waste reduction level of 23,000 tons. While there is no way to test whether or not this level has been achieved, it is doubtful that New York residents and institutions are "preventing" the creation of this much waste. These estimates—derived before the Department had implemented any of its many material-specific waste prevention programs—were based on an envisioned (but never realized) scenario in which: (1) widespread packaging and other legislation aimed at producers existed throughout the U.S., (2) quantity-based user fees (QBUFs) were imposed on the residential and institutional sectors in New York City, and (3) a host of material-specific programs, implemented at the City, State, or federal level, were in place.

[64] New York City Department of Sanitation. *Comprehensive Solid Waste Management Plan*, August 1992. Volume 4.1, pp. 22-76.

Appendices

MUNICIPAL RECYCLING SURVEY

Report comes from information supplied by the largest 30 municipalities in the United States, based on city population, not metropolitan areas

	NEW YORK	LOS ANGELES	CHICAGO	HOUSTON	PHILADELPHIA
Population	7,420,166	3,597,556	2,802,079	1,786,691	1,436,287
Recycling rate (%)	19.7%	40.9%	47.9%	16.0%	32.5%
Calculated for year ended:	June 2000	June 2000	June 2000	December 2000	December 2000
Rate includes:					
Residential	✓	✓	✓	✓	✓
Commercial			✓		✓
Other					
Rates by category:					
Residential	19.7%	40.9%	26.8%	16.0%	6.3%
Commercial	N.A.	N.A.	N.A.	N.A.	N.A.
Materials included: *(See key below)*					
Paper	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,TB,MP,OP	NP,MG,TB,MP
Metal	ALC,TC,APP	ALC,TC,APP	ALC,TC	ALC,TC,APP	ALC,TC
Plastic	PET,HDPE,BVC	PET,HDPE	PET,HDPE,PB	PET,HDPE	
Glass	GCON	GCON	GCON	GCON	GCON
Bulk	FRN		WOOD,CND	WOOD	
Automotive				ABAT,TIRE,OIL	TIRE
Hazardous		ESRP		HH,FLP	
Organic	YARD	YARD	YARD	YARD	
Other					
Total tonnage collected:	749,000	691,870	2,287,708	66,000	44,794
By city	749,000	691,870	294,909	66,000	44,794
By contracted haulers	0	0	1,992,799	0	0
Tonnage collected per material:					
Paper	423,000	137,499	545,499	15,000	32,314
Metal	305,000 metal, plastic and glass combined	8,112	117,168	2,450	12,480 metal and plastic combined
Plastic		2,900	2,197	1,350	
Glass		19,224	22,741	350	0
Yard trimmings	21,000	454,803	176,472	30,500	0
Other	0	69,332	1,423,631	16,350	0
Collection methods:					
Curbside	Yes	Yes	Yes	Yes	Yes
Frequency	Weekly	Weekly	Weekly	Biweekly	Weekly/biweekly
Number of households	3 million	750,000	740,000	140,000	520,000
Is program mandatory?	Yes	N.A.	No	No	Yes
How are materials collected:	Single source	Commingled, single source	Single source	Commingled	Single source
Program operated by:	City crews	City crews	City crews	City crews	City crews
Dropoff	Yes	Yes	No	Yes	Yes
Number of sites	4	Varies	N.A.	11	3
Program operated by:	City crews	City crews	N.A.	City crews	N.A.
Multifamily dwelling	Yes	Yes	Yes	No	Yes
Program operated by:	City crews	City crews	Private haulers	N.A.	City crews, private haulers
Other	None	None	None	Yard trimmings, weekly, 340,000 households served, operated by city crews and private haulers	None
Commercial recycling program offered:	Commercial establishments must recycle and have it collected by private carters	N.A.	Recycling programs mandatory for owners, property managers	N.A.	N.A.
Recycling goals:					
Mandated goal	3,400 tons per day by 1999	50% diversion by 2000	25% by 2001	No	No
Nonmandated goal	No	No	40% by 2002	No	40% by 2002
Goals met	Yes	No	Yes	N.A.	No
Financial information:					
Recycling budget	$95,000,000	$80,000,000	N.A.	$6,000,000	$10,744,000
Overall solid waste budget	$1,000,000,000	$121,000,000	$144,152,637	$55,000,000	$86,226,000
Recyclables revenue	$3,000,000	$1,729,680	$0	$550,000	$49,608
Amount spent per resident on recycling:	$12.80	$22.24	N.A.	$3.36	$7.48
Recycling budget percentage of solid waste budget:	9.5%	6.6%	N.A.	10.9%	12.5%
Recycling contact:	Steven Lawitts	John de la Rosa	Erin Keane	Edward T. Chen	David Robinson
Title	Deputy Commissioner	Recycling Manager	Recycling Coordinator	Assistant Director	Recycling Coordinator
Telephone number	(212) 788-3993	(213) 473-7930	(312) 744-5918	(713) 837-9136	(215) 686-5504
Fax number	(212) 788-3783	(213) 473-7945	(312) 744-6451	(713) 387-9246	(215) 686-5455
Web site	www.nyc.gov/sanitation	www.cityofla.org	www.cityofchicago.org	www.ci.houston.tx.US/departme/sdid/recycling.htm	www.phila.gov

NOTES: The recycling rate is not a diversion rate and does not include methods such as incineration. Population is based on 1998 figures from the Bureau of the Census, U.S. Commerce Department. N.A. — Not available or not applicable.

MATERIALS KEY: NP—newspaper; OCC—old corrugated containers; MG—magazines; TB—telephone books; MP—mixed paper; OP—office paper; ALC—aluminum cans; TC—tin cans; APP—appliances; PET—polyethylene terephthalate; HDPE—high density polyethylene; PB—plastic bags; BVC—beverage cartons, drink boxes; GCON—glass containers; TEX—textiles; WOOD—wood waste; CND—construction debris; FRN—furniture; AUTO—automobiles; ABAT—automobile batteries; TIRE—tires; OIL—oil, oil filters, grease; FLP—Fluorescent lamps; HH—household hazardous waste; ESRP—electronic scrap; FOOD—food waste; YARD—yard trimmings

MUNICIPAL RECYCLING SURVEY

Report comes from information supplied by the largest 30 municipalities in the United States, based on city population, not metropolitan areas

	SAN DIEGO	PHOENIX	SAN ANTONIO	DALLAS	DETROIT**
Population	1,220,666	1,198,064	1,114,130	1,075,894	970,196
Recycling rate (%)	46.0%	18.0%	26.3%	19.0%	7.2%
Calculated for year ended:	December 1999	June 2000	September 2000	September 2000	December 1998
Rate includes:					
Residential	✓	✓	✓	✓	✓
Commercial					
Other				Dropoff sites	
Rates by category:					
Residential	46.0%	18.0%	26.3%	19.0%	7.2%
Commercial	N.A.	N.A.	N.A.	N.A.	N.A.
Materials included: *(See key below)*					
Paper	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,MP,OP	NP,TB	NP,MG,MP,OP	NP
Metal	ALC,TC,APP	ALC,TC,APP	ALC,TC,APP	ALC,TC,APP	TC
Plastic	PET,HDPE,PB,BVC	PET,HDPE,BVC	PET,HDPE	PET,HDPE	PET,HDPE
Glass	GCON	GCON	GCON	GCON	GCON
Bulk	TEX,WOOD,CND,FRN		WOOD,FRN		
Automotive	AUTO,ABAT,TIRE,OIL		ABAT,TIRE,OIL		
Hazardous	HH,ESRP,FLP		HH		
Organic	YARD				YARD
Other				Aerosol cans, PVC	
Total tonnage collected:	N.A.	106,970	45,408	8,387	42,649
By city	62,953[1]	53,485	43,483	5,692	42,649
By contracted haulers	N.A.	53,485	1,925	2,695	0
Tonnage collected per material:					
Paper	23,400	92,422	17,953	6,506	162
Metal	604	5,241	945	269	35,578
Plastic	860	4,493	1,877	229	32
Glass	2,424	4,814	2,672	897	10
Yard trimmings	35,665	N.A.	N.A.	486	6,826
Other	0	0	21,961	0	41
Collection methods:					
Curbside	Yes	Yes	Yes	Yes	No
Frequency	Biweekly	Weekly	Weekly	Weekly	N.A.
Number of households	153,000	325,000	294,000	232,000	N.A.
Is program mandatory?	No	No	No	No	N.A.
How are materials collected:	Commingled	Commingled	Commingled	Commingled	N.A.
Program operated by:	City crews	City crews, private haulers	City crews	Private haulers	N.A.
Dropoff	Yes	Yes	No	Yes	Yes
Number of sites	50	3	N.A.	47	1
Program operated by:	City crews	City crews, private haulers	N.A.	City crews, private haulers	N.A.
Multifamily dwelling	No	No	No	No	No
Program operated by:	N.A.	N.A.	N.A.	N.A.	N.A.
Other	None	None	Phone books, brush, appliances	Office paper	None
Commercial recycling program offered:	Technical assistance	N.A.	N.A.	N.A.	N.A.
Recycling goals:					
Mandated goal	50% diversion by 2000	No	No	No	No
Nonmandated goal	No	No	No	No	No
Goals met	No	N.A.	N.A.	N.A.	N.A.
Financial information:					
Recycling budget	$17,700,875	$5,291,345	$2,563,403	$2,116,648	N.A.
Overall solid waste budget	$78,229,956	$59,047,000	$42,278,641	$43,694,000	N.A.
Recyclables revenue	$391,518	$6,800,000	$942,795	N.A.	N.A.
Amount spent per resident on recycling:	$14.50	$4.42	$2.30	$1.97	N.A
Recycling budget percentage of solid waste budget:	22.6%	9.0%	6.1%	4.8%	N.A.
Recycling contact:	Kip Sturdevan	Wanda Wildman	Stephen Haney	Jody Puckett	Michael Brinker
Title	Recycling Program Manager	Solid Waste Contracts Administrator	Assistant Solid Waste Manager	Director of Sanitation	General Manager
Telephone number	(858) 694-7000	(602) 262-7949	(210) 207-6413	(214) 670-3555	(313) 876-0141
Fax number	(858) 492-5021	(602) 534-9864	(210) 207-6401	(214) 670-0198	(313) 876-1457
Web site	www.sannet.gov	www.ci.phoenix.az.us/garbage	www.ci.sat.tx.us	dallascityhall.org	www.ci.detroit.mi.us/dpw

NOTES: The recycling rate is not a diversion rate and does not include methods such as incineration. Population is based on 1998 figures from the Bureau of the Census, U.S. Commerce Department. N.A. — Not available or not applicable. (1) Tonnage collected by residential program only. ** Detroit did not update information from last year's survey.

MATERIALS KEY: NP—newspaper; OCC—old corrugated containers; MG—magazines; TB—telephone books; MP—mixed paper; OP—office paper; ALC—aluminum cans; TC—tin cans; APP—appliances; PET—polyethylene terephthalate; HDPE—high density polyethylene; PB—plastic bags; BVC—beverage cartons, drink boxes; GCON—glass containers; TEX—textiles; WOOD—wood waste; CND—construction debris; FRN—furniture; AUTO—automobiles; ABAT—automobile batteries; TIRE—tires; OIL—oil, oil filters, grease; FLP—Fluorescent lamps; HH—household hazardous waste; ESRP—electronic scrap; FOOD—food waste; YARD—yard trimmings

MUNICIPAL RECYCLING SURVEY

Report comes from information supplied by the largest 30 municipalities in the United States, based on city population, not metropolitan areas

	SAN JOSE	SAN FRANCISCO	INDIANAPOLIS	JACKSONVILLE	COLUMBUS
Population	861,284	745,774	741,304	693,630	670,234
Recycling rate (%)	47.0%	42.0%	24.0%	39.0%	9.7%
Calculated for year ended:	December 1999	December 1999	December 2000	December 1999	December 1999
Rate includes:					
Residential	✓	✓	✓	✓	✓
Commercial	✓	✓	✓	✓	
Other	Industrial	City government, Industrial	✓		
Rates by category:					
Residential	46.0%	N.A.	N.A.	N.A.	9.7%
Commercial	47.0%	N.A.	N.A.	N.A.	N.A.
Materials included:					
(See key below)					
Paper	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,TB,MP,OP
Metal	ALC,TC,APP	ALC,TC	ALC,TC,APP	ALC,TC,APP	ALC,TC,APP
Plastic	PET,HDPE,PB,BVC	PET,HDPE	PET,HDPE,PB	PET,HDPE	PET,HDPE,BVC
Glass	GCON	GCON	GCON	GCON	GCON
Bulk	TEX,WOOD,CND,FRN		WOOD,CND,FRN	TEX,WOOD,CND	WOOD
Automotive	OIL		OIL	AUTO,TIRE	TIRE
Hazardous	HH		HH		HH
Organic	YARD		YARD	FOOD,YARD	YARD
Other			Batteries		
Total tonnage collected:	214,260	568,138	29,452[1]	563,696	34,211
By city	0	0	N.A.	4,213	1,129
By contracted haulers	214,260	568,138	N.A.	559,483	33,082
Tonnage collected per material:					
Paper	62,919	144,317	9,452 paper, metal, plastic, and glass combined	148,096	8,581
Metal	N.A.	18,638		221,436	1,944
Plastic	N.A.	2,659		5,028	1,038
Glass	9,813	22,954		17,453	2,189
Yard trimmings	123,277	12,148	6,000	132,918	20,316
Other	18,251	367,422	14,000	38,765	143
Collection methods:					
Curbside	Yes	Yes	Yes	Yes	Yes
Frequency	Weekly	Weekly	Weekly/Biweekly	Weekly	Weekly
Number of households	N.A.	333,000	220,000	250,000	20,000
Is program mandatory?	No	No	No	Yes	No
How are materials collected:	Commingled, single source	Commingled, single source	Commingled, single source	Commingled	Single source
Program operated by:	Private haulers	Private haulers	City crews, private haulers	City crews, private haulers	Private haulers
Dropoff	Yes	Yes	Yes	Yes	Yes
Number of sites	3	24	28	N.A.	68
Program operated by:	Private haulers	Private haulers	N.A.	Private haulers	Private haulers
Multifamily dwelling	Yes	Yes	No	Yes	Yes
Program operated by:	Private haulers	Private haulers	N.A.	Private haulers	Private haulers
Other	None	Bulky items, oil	None	None	None
Commercial recycling program offered:	Technical assistance, financial incentives	N.A.	N.A.	N.A.	N.A.
Recycling goals:					
Mandated goal	50% diversion by 2000	50% diversion by 2000	No	30% by 1994	No
Nonmandated goal	No	No	No	No	15% diversion by 2005
Goals met	N.A.	N.A.	N.A.	Yes	N.A.
Financial information:					
Recycling budget	N.A.	N.A.	N.A.	N.A.	$2,506,938
Overall solid waste budget	$61,000,000	$3,900,000	N.A.	$65,325,018	$33,000,000
Recyclables revenue	N.A.	N.A.	N.A.	$1,195,839	$24,172
Amount spent per resident on recycling:	N.A.	N.A.	N.A.	N.A.	$3.74
Recycling budget percentage of solid waste budget:	N.A.	N.A.	N.A.	N.A.	7.6%
Recycling contact:	Ellen Ryan	Paul Horcher	Michele Gosnell	Jackie Eldridge	Gerald Edwards
Title	Division Manager	Director of Solid Waste Management Program	Contract Compliance Officer	Recycling Coordinator	Administrator of Refuse Collection Division
Telephone number	(408) 277-5533	(415) 554-3400	(317) 327-2988	(904) 665-4732	(614) 645-7620
Fax number	(408) 277-3669	(415) 554-3434	(317) 327-2984	(904) 665-4471	(614) 645-7296
Web site	www.sjrecycles.org	www.sfrecycle.org	www.indygov.org	www.coj.net	cityofcolumbus.org

NOTES: The recycling rate is not a diversion rate and does not include methods such as incineration. Population is based on 1998 figures from the Bureau of the Census, U.S. Commerce Department. N.A. — Not available or not applicable.
(1) Tonnage collected by residential program only.

MATERIALS KEY: NP—newspaper; OCC—old corrugated containers; MG—magazines; TB—telephone books; MP—mixed paper; OP—office paper; ALC—aluminum cans; TC—tin cans; APP—appliances; PET—polyethylene terephthalate; HDPE—high density polyethylene; PB—plastic bags; BVC—beverage cartons, drink boxes; GCON—glass containers; TEX—textiles; WOOD—wood waste; CND—construction debris; FRN—furniture; AUTO—automobiles; ABAT—automobile batteries; TIRE—tires; OIL—oil, oil filters, grease; FLP—Fluorescent lamps; HH—household hazardous waste; ESRP—electronic scrap; FOOD—food waste; YARD—yard trimmings

MUNICIPAL RECYCLING SURVEY

Report comes from information supplied by the largest 30 municipalities in the United States, based on city population, not metropolitan areas

	BALTIMORE	EL PASO**	MEMPHIS	MILWAUKEE	BOSTON
Population	645,593	615,032	603,507	578,364	555,447
Recycling rate (%)	35.3%	4.0%	19.9%	28.0%	14.0%
Calculated for year ended:	December 1999	September 1999	June 2000	December 1999	June 2000
Rate includes:					
Residential	✓	✓	✓	✓	✓
Commercial	✓	✓			
Other					
Rates by category:					
Residential	N.A.	N.A.	19.9%	28.0%	14.0%
Commercial	N.A.	N.A.	N.A.	N.A.	N.A.
Materials included: *(See key below)*					
Paper	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,TB,MP,OP	NP,TB,OP	NP,OCC,MG,TB	NP,OCC,MG,TB,MP,P
Metal	ALC,TC,APP	ALC,TC,APP	ALC,TC,APP	ALC,TC,APP	ALC,TC,APP
Plastic	PET,HDPE	PET,HDPE,PB,BVC	PET,HDPE	PET,HDPE	PET,HDPE,BVC
Glass	GCON		GCON	GCON	GCON
Bulk	WOOD		WOOD	TEX,WOOD	WOOD
Automotive	AUTO,ABAT,TIRE,OIL	ABAT,TIRE,OIL		ABAT,TIRE,OIL	
Hazardous	HH	HH			
Organic	YARD,FOOD	YARD	YARD	YARD	YARD
Other					PVC, junk mail
Total tonnage collected:	156,936[1]	13,850	78,808	58,128	42,000
By city	120,478	13,850	78,151	58,128	14,000
By contracted haulers	36,458	0	657	0	28,000
Tonnage collected per material:					
Paper	19,156[2]	3,556	6,039	23,418	15,000
Metal	10,825	347	705	1,501	24,000 paper, metalnd glass combird
Plastic	0	180	1,107	1,490	
Glass	44	0	2,214	4,727	
Yard trimmings	6,369	9,333	68,743	23,119	3,000
Other	83,271	434	N.A.	3,873	N.A.
Collection methods:					
Curbside	Yes	No	Yes	Yes	Yes
Frequency	Weekly	N.A.	Weekly	Monthly	Weekly
Number of households	233,000	N.A.	195,000	193,000	250,000
Is program mandatory?	No	N.A.	No	Yes	No
How are materials collected:	Commingled	N.A.	Commingled	Single source	Commingled
Program operated by:	City crews	N.A.	City crews	City crews	Private haulers
Dropoff	Yes	Yes	Yes	Yes	Yes
Number of sites	6	13	1	2	5
Program operated by:	City crews, private haulers	N.A.	City crews	City crews	City crews, private haers
Multifamily dwelling	No	No	No	No	Yes
Program operated by:	N.A.	N.A.	N.A.	N.A.	Private haulers
Other	None	None	None	None	None
Commercial recycling program offered:	N.A.	N.A.	N.A.	N.A.	N.A.
Recycling goals:					
Mandated goal	20%	N.A.	No	106 lbs. per person annually	No
Nonmandated goal	No	N.A.	25% reduction annually	No	40,000 tons by 2005
Goals met	Yes	N.A.	Yes	Yes	N.A.
Financial information:					
Recycling budget	$900,000	$767,943	$1,500,000	$9,000,000	$2,200,000
Overall solid waste budget	$55,000,000	$24,686,395	$42,000,000	$32,000,000	$26,000,000
Recyclables revenue	N.A.	$117,063	$370,000	0	N.A.
Amount spent per resident on recycling:	$1.39	$1.25	$2.49	$15.56	$3.96
Recycling budget percentage of solid waste budget:	1.6%	3.1%	3.6%	28.1%	8.5%
Recycling contact:	S. Dale Thompson	Richard Razo	Andy Ashford	Mike Engelbart	Susan Cascino
Title	Recycling Coordinator	Recycling Coordinator	Administrator of Recycling & Composting	Resource Recovery Manager	Recycling Director
Telephone number	(410) 396-5918	(915) 621-6720	(901) 576-6900	(414) 286-2355	(617) 635-4959
Fax number	(410) 396-2964	(915) 621-6711	(901) 576-6879	(414) 286-3344	(617) 635-3481
Web site	www.ci.baltimore.md.us	www.ci.el-paso.tx.us	www.memphiswaste.org	www.ci.mil.wi.us	www.ci.boston.ma.u:

NOTES: The recycling rate is not a diversion rate and does not include methods such as incineration. Population is based on 1998 figures from the Bureau of the Census, U.S. Commerce Department. N.A. — Not available, or not applicable (1) Tonnage collected by residential program only. (2) Baltimore included only curbside collection in its figures for tonnage collected per material. (3) Boston's nonmandated goal includes 10,000 tons of yard waste and 30,000 tons from curbside recycling. ** El Paso did not update information from last year's survey.

MATERIALS KEY: NP—newspaper; OCC—old corrugated containers; MG—magazines; TB—telephone books; MP—mixed paper; OP—office paper; ALC—aluminum cans; TC—tin cans; APP—appliances; PET—polyethylene terephthalate; HDPE—high density polyethylene; PB—plastic bags; BVC—beverage cartons, drink boxes; GCON—glass containers; TEX—textiles; WOOD—wood waste; CND—construction debris; FRN—furniture; AUTO—automobiles; ABAT—automobile batteries; TIRE—tires; OIL—oil, oil filters, grease; FLP—Fluorescent lamps; HH—household hazardous waste; ESRP—electronic scrap; FOOD—food waste; YARD—yard trimmings

MUNICIPAL RECYCLING SURVEY

Report comes from information supplied by the largest 30 municipalities in the United States, based on city population, not metropolitan areas

	AUSTIN	SEATTLE	WASHINGTON	NASHVILLE	CHARLOTTE
Population	552,434	536,978	523,124	510,274	504,637
Recycling rate (%)	28.5%	52.0%	17.0%	8.0%	24.0%
Calculated for year ended:	September 2000	December 1999	September 2000	June 2000	June 2000
Rate includes:					
Residential	✓	✓	✓	✓	✓
Commercial		✓			
Other					
Rates by category:					
Residential	28.5%	57.0%	17.0%	8.0%	24.0%
Commercial	N.A.	45.0%	N.A.	N.A.	N.A.
Materials included: *(See key below)*					
Paper	NP,OCC,MG,OP	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,TB,OP	NP,OCC,MG,TB,MP,OP	NP,OCC,MG,TB
Metal	ALC,TC	ALC,TC	ALC,TC	ALC,TC,APP	ALC,TC,APP
Plastic	PET,HDPE	PET,HDPE,PB,3VC	PET,HDPE	PET,HDPE	PET,HDPE
Glass	GCON	GCON	GCON	GCON	GCON
Bulk		WOOD		WOOD,FRN	WOOD,CND
Automotive					TIRE
Hazardous					
Organic	YARD	YARD	YARD	YARD	YARD
Other					
Total tonnage collected:	47,180	102,500	21,706	73,305	70,739
By city	47,180	0	0	68,505	70,739
By contracted haulers	0	102,500	21,706	4,800	0
Tonnage collected per material:					
Paper	22,105	46,800	15,045	N.A.	26,888 paper, metal, plastic and glass combined
Metal	1,105	2,300	473	N.A.	
Plastic	809	700	672	N.A.	
Glass	3,458	13,000	3,673	N.A.	
Yard trimmings	16,686	39,700	0	N.A.	32,231
Other	3,017	0	1,843	N.A.	11,620
Collection methods:					
Curbside	Yes	Yes	Yes	Yes	Yes
Frequency	Weekly	Biweekly	Weekly	Weekly	Weekly
Number of households	136,200	160,000	110,000	19,000	N.A.
Is program mandatory?	N.A.	No	Yes	N.A.	N.A.
How are materials collected:	Commingled	Commingled	N.A.	Commingled	N.A.
Program operated by:	City crews	Private haulers	N.A.	City crews	City crews
Dropoff	No	No	No	Yes	No
Number of sites	N.A.	N.A.	N.A.	N.A.	N.A.
Program operated by:	N.A.	N.A.	N.A.	City crews, private haulers	N.A.
Multifamily dwelling	No	Yes	No	No	Yes
Program operated by:	N.A.	Private haulers	N.A.	N.A.	City crews, private haulers
Other	None	None	None	Wood mulch, metal	None
Commercial recycling program offered:	Limited to small business	N.A.	N.A.	N.A.	N.A.
Recycling goals:					
Mandated goal	No	No	45% by 2000	No	No
Nonmandated goal	40%	60% by 2006	No	25% diversion by 2004	40% diversion by 2001
Goals met	No	N.A.	No	N.A.	N.A.
Financial information:					
Recycling budget	$3,431,487	$6,200,000	$4,000,000	$1,969,947	N.A.
Overall solid waste budget	$47,900,000	$88,500,000	$40,000,000	$26,330,021	$29,000,000
Recyclables revenue	$1,677,960	N.A.	N.A.	49,375	N.A.
Amount spent per resident on recycling:	$6.21	$11.55	$7.65	$3.86	N.A.
Recycling budget percentage of solid waste budget:	7.2%	7.0%	10.0%	7.5%	N.A.
Recycling contact:	William Rhodes	Ed Steyh	William Easley	Chace Anderson	Walter Abernathy
Title	Director of Solid Waste Services	SPU Contract Manager, Solid Waste and Recycling	Program Monitor	Director of Division of Waste Management	Division Manager
Telephone number	(512) 499-1943	(206) 684-5851	(202) 727-1000	(615) 862-8727	(704) 336-4213
Fax number	(512) 499-1999	(206) 684-4631	(202) 645-5066	(615) 862-8727	(704) 336-8015
Web site	www.austinrecycles.com	www.ci.seattle.wa.us	www.publicworks.co.washington.dc.us	www.nashville.org	www.ci.charlotte.nc.us/ciswaste

NOTES: The recycling rate is not a diversion rate and does not include methods such as incineration. Population is based on 1998 figures from the Bureau of the Census, U.S. Commerce Department. N.A. — Not available or not applicable.

MATERIALS KEY: NP—newspaper; OCC—old corrugated containers; MG—magazines; TB—telephone books; MP—mixed paper; OP—office paper; ALC—aluminum cans; TC—tin cans; APP—appliances; PET—polyethylene terephthalate; HDPE—high density polyethylene; PB—plastic bags; BVC—beverage cartons, drink boxes; GCON—glass containers; TEX—textiles; WOOD—wood waste; CND—construction debris; FRN—furniture; AUTO—automobiles; ABAT—automobile batteries; TIRE—tires; OIL—oil, oil filters, grease; FLP—Fluorescent lamps; HH—household hazardous waste; ESRP—electronic scrap; FOOD—food waste; YARD—yard trimmings

MUNICIPAL RECYCLING SURVEY

Report comes from information supplied by the largest 30 municipalities in the United States, based on city population, not metropolitan areas

	PORTLAND	DENVER	CLEVELAND	FORT WORTH	OKLAHOMA CITY
Population	503,891	499,055	495,817	491,801	472,221
Recycling rate (%)	53.6%	7.5%	2.0%	7.2%	23.6%
Calculated for year ended:	December 1999		December 2000	September 2000	June 2000
Rate includes:					
Residential	✓	✓	✓	✓	✓
Commercial	✓				
Other					
Rates by category:					
Residential	52.2%	7.5%	2.0%	7.2%	23.6%
Commercial	53.9%				
Materials included: *(See key below)*					
Paper	NP,OCC,MG,TB,MP,OP	NP	NP,OCC,TB	NP,OCC,MG,TB,OP	NP,MG
Metal	ALC,TC	ALC,TC	ALC,TC	ALC,TC	ALC,TC
Plastic	PET,HDPE,PB,BVC	PET,HDPE	PET,HDPE	PET,HDPE	PET,HDPE
Glass	GCON	GCON	GCON	GCON	GCON
Bulk	WOOD				
Automotive	OIL				
Hazardous					
Organic	YARD	YARD			
Other					
Total tonnage collected:	571,000	17,511	6,000	19,511	10,000
By city	0	17,511	6,000	0	0
By contracted haulers	571,000	0	0	19,511	10,000
Tonnage collected per material:					
Paper	N.A.	12,909	N.A.	13,635	7,400
Metal	N.A.	511	N.A.	1,405	600
Plastic	N.A.	339	N.A.	1,405	1,000
Glass	N.A.	3,227	N.A.	3,066	1,000
Yard trimmings	N.A.	270	N.A.	0	0
Other	N.A.	255	N.A.	0	0
Collection methods:					
Curbside	Yes	Yes	Yes	Yes	Yes
Frequency	Weekly	Biweekly	Weekly	Weekly	Weekly
Number of households	134,000	148,000	151,000	142,000	144,000
Is program mandatory?	N.A.	No	No	No	No
How are materials collected:	Commingled	Single source	Commingled	Commingled	Commingled
Program operated by:	Private haulers	City crews	City crews	Private haulers	Private haulers
Dropoff	Yes	Yes	Yes	Yes	Yes
Number of sites	10	N.A.	13	1	2
Program operated by:	Private haulers	Private haulers	City crews	City crews	City crews, private haulers
Multifamily dwelling	Yes	Yes	No	No	No
Program operated by:	Private haulers	Private haulers	N.A.	N.A.	N.A.
Other	Multimaterial nonresidential	Leaf, Xmas tree, household hazaradous waste, composting	None	None	None
Commercial recycling program offered:	N.A.	N.A.	N.A.	N.A.	N.A.
Recycling goals:					
Mandated goal	54% by 2000	No	No	No	No
Nonmandated goal	No	No	10% annual tonnage increase	N.A.	25% by 2001
Goals met	N.A.	N.A.	No	N.A.	N.A.
Financial information:					
Recycling budget	$3,200,000	$1,900,000	$175,983	N.A.	$2,699,706
Overall solid waste budget	N.A.	$18,000,000	$27,800,000	$23,227,496	$26,187,000
Recyclables revenue	$624,000	$780,981	$1.16	N.A.	0
Amount spent per resident on recycling:	$6.35	$3.81	$0.35	N.A.	$5.72
Recycling budget percentage of solid waste budget:	N.A.	10.6%	0.6%	N.A.	10.3%
Recycling contact:	Bruce Walker, Lee Barrett	Sue Cobb	Ken Johnson	Sandra Barba	Charles Lombardy
Title	Recycling Program Managers	Recycling Coordinator	Assistant Commissioner	Public Education, Program Coordinator	Unit Operations Leader
Telephone number	(503) 823-7772	(303) 640-1675	(216) 664-3711	(817) 871-5150	(405) 749-3092
Fax number	(503) 823-4562	(303) 640-3616	(216) 664-2655	(817) 871-5193	(405) 755-8946
Web site	wasteinfo@bes.ci.portland.or.us	www.denvergov.org/DenverRecycles	www.cityofcleveland.org	www.ci.fort-worth.tx.us	www.okc-cityhall.org

NOTES: The recycling rate is not a diversion rate and does not include methods such as incineration. Population is based on 1998 figures from the Bureau of the Census, U.S. Commerce Department. N.A. — Not available or not applicable.

MATERIALS KEY: NP—newspaper; OCC—old corrugated containers; MG—magazines; TB—telephone books; MP—mixed paper; OP—office paper; ALC—aluminum cans; TC—tin cans; APP—appliances; PET—polyethylene terephthalate; HDPE—high density polyethylene; PB—plastic bags; BVC—beverage cartons, drink boxes; GCON—glass containers; TEX—textiles; WOOD—wood waste; CND—construction debris; FRN—furniture; AUTO—automobiles; ABAT—automobile batteries; TIRE—tires; OIL—oil, oil filters, grease; FLP—Fluorescent lamps; HH—household hazardous waste; ESRP—electronic scrap; FOOD—food waste; YARD—yard trimmings

Chapter 3
Solid Waste Recycling

Subchapter 1
Short Title, Policy and Definitions

§ 16-301 Short title.

This chapter shall be known and may be cited as the "New York City Recycling Law."

§ 16-302 Declaration of policy.

It is hereby declared to be the public policy of the city to reduce environmental pollution and dangers to health, to decrease the demand for scarce landfill space, to minimize the size and cost of the proposed resource recovery program, and to encourage the conservation of valuable natural resources and energy. It is the policy of the city to promote the recovery of materials from the New York city solid waste stream for the purpose of recycling such materials and returning them to the economy. This chapter shall be liberally construed in order to effectuate the purposes set forth in this section.

§ 16-303 Definitions.

When used in this chapter:

a. "Buy-back center" means a recycling center that purchases and may otherwise accept recyclable materials from the public for the purpose of recycling such materials.

b. "Department-collected solid waste" means all solid waste that the department and its contractors collect and all solid waste that the department receives for free disposal.

c. "Department-disposed of solid waste" means all solid waste, including department-collected solid waste, disposed of at a department landfill, incinerator, resource recovery facility or other waste disposal facility owned, operated or used by the department.

d. "Drop-off center" means a recycling center that accepts and may otherwise purchase recyclable materials from the public for the purpose of recycling such materials.

e. "Household" means a single dwelling or a residential unit within a multiple dwelling, hotel, motel, campsite, ranger station, public or private recreation area, or other residence.

f. "Post-collection separation" means the dividing of solid waste into some or all of its component parts after the point of collection.

g. "Post-consumer material" means only those products generated by a business or a consumer which have served their intended end uses, and which have been separated or diverted

from solid waste for the purposes of collection, recycling and disposition.

h. "Private carter" means any person required to be licensed or permitted pursuant to subchapter eighteen of chapter two of title twenty of this code.

i. "Recyclable materials" means solid waste that may be separated, collected, processed, marketed and returned to the economy in the form of raw materials or products, including but not limited to types of metal, glass, paper, plastic, food waste, tires and yard waste.

j. "Recycled" or "recycling" means any process by which recyclable materials are separated, collected, processed, marketed and returned to the economy in the form of raw materials or products.

k. "Recycling center" means any facility operated to facilitate the separation, collection, processing or marketing of recyclable materials for reuse or sale.

l. "Recycling district" means any borough or smaller geographic area the commissioner deems appropriate for the purpose of implementing this chapter.

m. "Secondary material" means any material recovered from or otherwise destined for the waste stream, including but not limited to, postconsumer material, industrial scrap material and overstock or obsolete inventories from distributors, wholesalers and other companies, but such term does not include those materials and by-products generated from, and commonly reused within, an original manufacturing process.

n. "Solid waste" means all putrescible and non-putrescible materials or substances, except as described in paragraph three of this subdivision, that are discarded or rejected as being spent, useless, worthless or in excess to the owners at the time of such discard or rejection, including but not limited to garbage, refuse, industrial and commercial waste, rubbish, tires, ashes, contained gaseous material, incinerator residue, construction and demolition debris, discarded automobiles and offal.

1. A material is discarded if it is abandoned by being:

i. disposed of;

ii. burned or incinerated, including being burned as a fuel for the purpose of recovering useable energy; or

iii. accumulated, stored, or physically, chemically or biologically treated (other than burned or incinerated) instead of or before being disposed of.

2. A material is disposed of if it is discharged, deposited, injected, dumped, spilled, leaked, or placed into or on any land or water so that such material or any constituent thereof may enter the environment or be emitted into the air or discharged into groundwater or surface water.

3. The following are not solid waste for the purpose of this chapter:

i. domestic sewage;

ii. any mixture of domestic sewage and other wastes that passes through a sewer system to a publicly owned treatment works for treatment, except any material that is introduced into such system in order to avoid the provisions of this chapter or the state regulations promulgated to regulate solid waste management facilities pursuant to 6 NYCRR Part 360;

iii. industrial wastewater discharges that are actual point source discharges subject to permits under article seventeen of the environmental conservation law; industrial wastewaters while they are being collected, stored, or treated before discharge and sludges that are generated by industrial wastewater treatment are solid wastes;

iv. irrigation return flows;

v. radioactive materials that are source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended, 42 U.S.C. § 2011 *et seq.*

vi. materials subject to in-situ mining techniques which are not removed from the ground as part of the extraction process;

vii. hazardous waste as defined in section 27-0901 of the environmental conservation law; and

viii. regulated medical waste or other medical waste as described in section 16-120.1 of this title.

o. "Source separation" means the dividing of solid waste into some or all of its component parts at the point of generation.

p. "Yard waste" means leaves, grass clippings, garden debris, vegetative residue that is recognizable as part of a plant or vegetable, small or chipped branches, and similar material.

Subchapter 2
Citywide Recycling Program

§ 16-304 Department-disposed of solid waste.

The commissioner shall within nine months of the effective date of this chapter establish and implement programs to ensure that the amount of department-disposed of solid waste is reduced or recycled by at least:

a. one thousand four hundred thirty tons per day by the end of the first year following the enactment date of this chapter and during the year thereafter;

b. two thousand eight hundred seventy tons per day by the end of the second year following the enactment date of this chapter and during the year thereafter;

c. four thousand three hundred tons per day by the end of the third year following the enactment date of this chapter and during the year thereafter;

d. five thousand seven hundred forty tons per day by the end of the fourth year following the enactment date of this chapter and during the year thereafter; and

e. seven thousand one hundred eighty tons per day by the end of the fifth year following the enactment date of this chapter and during the year thereafter.

These programs may be designed to increase private sector or residential recycling, to increase the return and recycling of containers under the New York State returnable container law, to implement waste reduction or reuse measures, or to export waste for the purpose of recycling. The waste reduction and recycling requirements of this section shall include all the solid waste that is recycled pursuant to the recycling requirements of section 16-305 of this chapter, but shall not include the reduction or recycling of ash or residue from resource recovery facilities, or the reduction or recycling of sludges from

air or water treatment facilities. For the purpose of this section, "day" shall mean each working day in a three hundred sixty-five day calendar year. Should the level of recycling exceed the minimum quantities required in this section, the council may review the original mandate and increase the minimum requirements.

§ 16-305 Department-collected solid waste.

a. The commissioner shall, within nine months of the effective date of this chapter, adopt and implement regulations designating at least six recyclable materials, including yard waste to the extent required in section 16-308 of this chapter, contained in department-collected solid waste and requiring households to source separate the designated materials to ensure that the department and its contractors recycle at least:

1. seven hundred tons per day by the end of the first year following the enactment date of this chapter and during the year thereafter;

2. one thousand four hundred tons per day by the end of the second year following the enactment date of this chapter and during the year thereafter;

3. two thousand one hundred tons per day by the end of the third year following the enactment date of this chapter and during the year thereafter;

4. three thousand four hundred tons per day by the end of the fourth year following the enactment date of this chapter and during the year thereafter; and

5. four thousand two hundred fifty tons per day by the end of the fifth year following the enactment date of this chapter and during the year thereafter.

At the start of the second, third, fourth and fifth years following the enactment date of this chapter, the tonnage requirements of this section shall be increased by the average annual percentage increase in solid waste that the department and its contractors collected from households and institutions and solid waste that the department received for free disposal in the two previous consecutive fiscal years. The solid waste that the department and its

contractors are required to recycle pursuant to this subdivision shall include department-collected solid waste recycled pursuant to this subdivision, city agency waste recycled pursuant to section 16-307, yard waste collected by the department and composted pursuant to section 16-308, Christmas trees collected by the department and composted or recycled pursuant to section 16-309, and batteries and tires collected pursuant to section 16-310 that are recycled, but shall not include containers returned pursuant to the New York State returnable container law, commercial solid waste removed and recycled by private carters, reduction or recycling of ash or residue from resource recovery facilities, or reduction or recycling of sludges from air or water treatment facilities. For the purpose of this subdivision, "day" shall mean each working day in a three hundred sixty-five day calendar year. Should the level of recycling exceed the minimum quantities required in this subdivision, the council may review the original mandate and increase the minimum requirements.

b. The commissioner shall, within nine months of the effective date of this chapter, adopt and implement regulations establishing procedures requiring the placement of the designated materials at the curbside, in specialized containers, or in any other manner the commissioner determines, to facilitate the collection of such materials in a manner that enables them to be recycled.

c. The commissioner may stagger the source separation and collection of the designated recyclable materials, with the exception of yard waste, provided that the recycling of the materials that are source separated and collected shall be sufficient to achieve the recycling levels required in this section, and that all the designated materials shall be source separated and collected within four and one-half years of the effective date of this chapter.

d. In establishing the schedule by which residential source separation shall commence, the commissioner may stagger the commencement dates for different recycling districts. Any such staggered schedule shall provide that at least one-third of all households shall be subject to source separation within one year of the effective date of this chapter; at least two-thirds of all households shall be subject to source separation within three years of the effective date of this chapter; and all households shall be subject to source separation within four and one-half years of the effective date of this chapter.

e. Within any recycling district, the commissioner may exempt residential generators from the source separation requirement of this section if the department employs alternative recycling methods, including but not limited to the use of buy-back centers, drop-off centers, or post-collection separation devices, provided that participation in any alternative methods is sufficient to achieve for the recycling district a percentage of the recycling requirement in this section at least equal to the percent of the citywide department-collected solid waste that is collected within the district. The commissioner shall not exempt residential generators from the source separation requirement of this section unless he or she determines that for the recycling district source separation cannot otherwise achieve the recycling levels required in this section.

f. Where the department provides solid waste collection services to a building containing nine

or more dwelling units, the commissioner shall, within nine months of the effective date of this chapter, adopt and implement regulations requiring the owner, net lessee or person in charge of such building to:

1. provide for the residents a designated area and, where appropriate, containers in which to accumulate the source separated or other designated recyclable materials to be collected by the department;

2. notify all residents of the requirements of this chapter and the regulations promulgated pursuant thereto; and

3. remove non-designated materials from the containers of designated source separated recyclable materials before such containers are placed at the curbside for collection and ensure that the designated materials are placed at the curbside in the manner prescribed by the department.

With respect to solid waste generated by households in the aforesaid buildings, the obligations of an owner or a net lessee under this local law shall be limited to those set forth in this subdivision and subdivisions b and g of this section.

g. Eighteen months from the enactment date of this chapter, the commissioner shall adopt and implement regulations for any building containing nine or more dwelling units in which the amount of designated materials placed out for collection is significantly less than what can reasonably be expected from such building. These regulations shall require residential generators, including tenants, owners, net lessees or persons in charge of such building to use transparent bags or such other means of disposal the commissioner deems appropriate to dispose of solid waste other than the designated recyclable materials. Upon request of the owner, net lessee or person in charge of such building, and if the commissioner determines that such owner, net lessee or person in charge has complied with this subdivision and subdivision f of this section and that the amount of designated materials placed out for collection remains significantly less than what can reasonably be expected from such building, the department shall develop a schedule to conduct random inspections to facilitate compliance with the provisions of this chapter by tenants of such building, provided that lawful inspections may occur at reasonable times without notice to ensure compliance by the tenants, owner, net lessee or person in charge of such building.

§ 16-305 .1Weekly collection of designated recyclable materials.

a. Weekly collection of designated recyclable materials shall be maintained in all local service delivery districts in which such weekly collection was provided as of October thirty-first, nineteen hundred ninety-eight.

b. Weekly collection of designated recyclable materials shall be implemented and maintained, in accordance with the schedule set forth in this subdivision, in all local service delivery districts in which such weekly collection was not provided as of October thirty-first, nineteen hundred ninety-eight:

1. one district not receiving weekly collection as of October thirty-first, nineteen hundred ninety-eight shall receive such collection by March thirty-first, nineteen hundred ninety-nine;

2. one district not receiving weekly collection as of March thirty-first, nineteen hundred ninety-nine shall receive such collection by April thirtieth, nineteen hundred ninety-nine;

3. one district not receiving weekly collection as of April thirtieth, nineteen hundred ninety-nine shall receive such collection by May thirty-first, nineteen hundred ninety-nine;

4. eighteen districts not receiving weekly collection as of May thirty-first, nineteen hundred ninety-nine shall receive such collection by June thirtieth, nineteen hundred ninety-nine; and

5. twenty districts not receiving weekly collection as of June thirtieth, nineteen hundred ninety-nine shall begin to receive such collection during the period from October thirty-first, nineteen hundred ninety-nine to April fifteenth, two thousand.

c. For purposes of this section "designated recyclable materials" shall mean solid waste that has been designated by the commissioner as recyclable pursuant to section 16-305 or section 16-307 of this chapter.

d. Nothing in this section shall be construed to require weekly collection of designated

recyalable (1) materials in such parts of the city or during such times of the year that such materials are not otherwise collected.

§ 16-306 Private carter-collected waste.

a. The commissioner shall adopt and implement rules designating recyclable materials that constitute in the aggregate at least one-half of all solid waste collected by private carters, and additional materials if the commissioner determines that economic markets exist for them. Pursuant to subdivision b of this section, such rules shall require generators of private carter-collected waste to source separate some or all of the designated materials and to arrange for lawful collection for recycling, reuse or sale for reuse by private carters or persons other than private carters of such source separated materials. With regard to designated materials that are not required by such rules to be source separated, generators of private carter-collected waste may source separate these designated materials and, in any event, shall arrange for their lawful collection for recycling, reuse or sale for reuse by private carters or persons other than private carters. If a generator of private carter-collected waste has source separated the designated materials in accordance with the rules and arranged for the lawful collection for recycling, reuse or sale for reuse by private carters or persons other than private carters of such source separated materials and, with regard to designated materials that are not required by such rules to be source separated, arranged for lawful collection for recycling, reuse or sale for reuse by private carters or

persons other than private carters, such arrangement shall constitute an affirmative defense to any proceeding brought against the generator pursuant to section 16-324 of this chapter.

b. The rules promulgated pursuant to subdivision a of this section shall require that generators of waste collected by businesses required to be licensed pursuant to section 16-505 of this code source separate the designated materials in such manner and to such extent as the commissioner determines to be necessary to minimize contamination and maximize the marketability of such materials. However, in promulgating such rules the commissioner shall not require source separation of a material unless the commissioner has determined that an economic market exists for such material. For the purpose of this section, the term "economic market" refers to instances in which the full avoided costs of proper collection, transportation and disposal of source separated materials are equal to or greater than the cost of collection, transportation and sale of said materials less the amount received from the sale of said materials. The New York city trade waste commission shall adopt and implement rules requiring businesses licensed to remove, collect or dispose of trade waste to provide for the collection of, and ensure the continued separation of, designated materials that have been source separated, provide for the separation of all other designated materials, and provide for recycling of all the designated materials. Rules promulgated.

by the trade waste commission pursuant to this subdivision shall be enforced in the manner provided in section 16-517 of this code and violations of such rules shall be subject to the penalties provided in subdivision a of section 16-515 of this code for violation of the provisions of chapter 16-A. In addition, the commissioner shall have the authority to issue notices of violation for any violation of such rule and such notices of violation shall be returnable in a civil action brought in the name of the commissioner before the environmental control board which shall impose a penalty not to exceed ten thousand dollars for each such violation.

§ 16-307 City agency waste.

The commissioner shall, within six months of the effective date of this chapter, adopt and implement regulations requiring the source separation or post-collection separation, collection, processing, marketing, and sale of designated recyclable materials generated by city mayoral and non-mayoral agencies, including the council and the board of estimate.

§ 16-308 Yard waste.

a. Within eighteen months of the effective date of this chapter, the commissioner shall provide for the source separation, collection and composting of department-collected yard waste, with the exception of yard waste generated by the department of parks and recreation, any other city agency that generates a substantial amount of yard waste, or any person under contract with the department of parks and recreation or any other city agency, generated within designated areas of the city in which a substantial amount of yard waste is generated from October 15 to November 30 of each year, unless the generator otherwise provides for recycling or storage for composting or mulching. The commissioner may construct and operate one or more composting

facilities, or utilize the services of other facilities.

b. Within thirty-six months of the effective date of this chapter, the commissioner shall provide for the source separation, collection and composting of department-collected yard waste generated within designated areas of the city in which a substantial amount of yard waste is generated from March 1 to July 31 and September 1 to November 30 of each year, unless the generator otherwise provides for recycling or storage for composting or mulching. The commissioner may construct and operate one or more composting facilities, or utilize the services of other facilities.

c. Within eighteen months of the effective date of this chapter, the department of parks and recreation or any other city agency that generates a substantial amount of yard waste shall provide for the source separation, collection and composting of yard waste generated by the department of parks and recreation, any other city agency that generates a substantial amount of yard waste, or any person under contract with the department of parks and recreation or any other city agency.

d. Within eighteen months of the effective date of this chapter, no landfill, incinerator or resource recovery facility owned, operated or used by the department shall accept for final disposal from October 15 to November 30 of

each year truckloads primarily composed of yard waste, except that composted yard waste may be used as part of the final vegetative cover for a department landfull.

e. Within thirty-six months of the effective date of this chapter, no landfill, incinerator or resource recovery facility owned, operated or used by the department shall accept for final disposal from March 1 to July 31 and September 1 to November 30 of each year truckloads primarily composed of yard waste, except that composted yard waste may be used as part of the final vegetative cover for a department landfill.

f. All city agencies responsible for the maintenance of public lands shall to the maximum extent practicable and feasible give preference to the use of compost materials derived from the city's solid waste in all land maintenance activities.

§ 16-309 Christmas trees.

Within eighteen months of the effective date of this chapter, the commissioner shall designate areas and within these designated areas establish and implement a collection system for Christmas trees during the first three weeks of January of each year and provide for the composting or recycling of the Christmas trees the department collects or receives for disposal.

§ 16-310 Batteries and tires.

If within eighteen months of the effective date of this chapter, no state or federal legislation has been enacted requiring the collection of or imposing deposits on dry cell batteries or tires, the commissioner shall establish and implement citywide deposit or reclamation programs, that

provide separate collection systems or convenient drop-off locations for dry cell batteries and tires to ensure that they are not incinerated or disposed of in an unlined landfill. The commissioner may establish a reasonable battery deposit charge and a reasonable tire deposit charge pursuant to this section.

§ 16-311 Recycling centers.

a. The commissioner shall, within eighteen months of the effective date of this chapter, develop and establish or support the development and establishment of not less than ten recycling centers. Such recycling centers shall be strategically sited and of sufficient size and number to provide for the recycling of all recyclable materials required to be recycled by the department and its contractors pursuant to section 16-305 of this chapter. The commissioner may utilize and include among the required number of recycling centers, recycling centers in existence before the effective date of this chapter, and where necessary the commissioner may provide for the expansion of such existing centers. The commissioner shall evaluate the feasibility of utilizing existing recycling centers in determining the need to establish city owned or operated centers. Notwithstanding the requirement for not less than ten recycling centers, the commissioner may utilize less than ten recycling centers if the recycling centers have the combined capacity to process all the material required to be recycled pursuant to section 16-305 of this chapter.

b. The commissioner shall establish or ensure that there exists at least one buy-back center in each borough. For economic development purposes, these buy-back centers shall be sited so that they are accessible to all residents, including residents of low income neighborhoods. The commissioner may include these buy-back centers among the recycling centers required under this section. The commissioner shall not include material from commercial generators which is processed for recycling at these and all other buy-back centers in the solid waste required to be reduced or recycled pursuant to section 16-305.

c. Recycling centers may be owned, operated, or funded by the city, any agency of the city, any person, or a public-private joint venture.

d. The commissioner may provide financial or other assistance to recycling centers in existence before and after the effective date of this chapter, upon a determination that such assistance will further the purposes of this chapter.

e. To the extent feasible, the commissioner shall ensure that all recycling centers established after the effective date of this chapter shall be sited to encourage the use of existing rail or shipping facilities, upon a determination that such siting will further the purposes of this chapter.

§ 16-312 Processing recyclable materials.

The commissioner shall establish procedures and standards for processing recyclable materials in city owned or operated recycling centers, city owned or operated transfer stations or any city owned or operated facility that renders recyclable materials suitable for reuse or marketing and sale. The commissioner shall review the procedures and standards at least annually and make any

changes necessary to conform to the requirements of the marketplace.

§ 16-313 Marketing recyclable materials.

a. The department shall establish procedures, standards and strategies to market the department-collected recyclable materials designated pursuant to section 16-305 of this chapter, including but not limited to maintaining a list of prospective buyers, establishing contact with prospective buyers, entering into contracts with buyers, and reviewing and making any necessary changes in collecting or processing the materials to improve their marketability.

b. Within eighteen months of the effective date of this chapter, the commissioner in conjunction with the office for economic development shall submit to the mayor, the council, the board of estimate, each citizens' board created under section 16-317 of this chapter and the citywide board created under section 16-319 of this chapter a study of existing markets for processing and purchasing recyclable materials, and the potential and the steps necessary to expand these markets. Such study shall also include a proposal developed in conjunction with the department of finance to use, where feasible, the city's tax and finance authority to stimulate recycling and the demand for recycled materials.

§ 16-314 Recycling program revisions.

a. The commissioner shall annually review the recycling program and all rules and regulations promulated therefor, and shall make the necessary revisions to improve the efficiency of collecting, processing, marketing and selling the materials recycled pursuant to this chapter. These revisions may include designating additional recyclable materials. The commissioner shall not delete designated materials without designating additional materials so that the total quantity, by weight, of all designated recyclable materials collected, processed, marketed and sold does not decrease.

b. By the end of the fifth year following the enactment date of this chapter, the commissioner shall designate two additional recyclable materials contained in residential or commercial solid waste and provide for the recycling of these materials in accordance with the provisions of this chapter.

§ 16-315 Notice, education and research programs.

a. In addition to the notice requirements of section one thousand forty-three of chaper forty-five of the charter, within thirty days of the effective date of any regulations promulgated pursuant to this chapter, and as frequently thereafter as the commissioner deems necessary, the department shall notify all community boards and persons occupying residential, commercial and industrial premises affected by the regulations, of the requirements of the regulations, by placing advertisements in newspapers of citywide, borough-wide and community circulation, posting notices in public places where such notices are customarily placed, and, in the commissioner's discretion, employing any other means of notification deemed necessary and appropriate.

b. Within twelve months of the effective date of this chapter, the department shall develop and implement an educational program, in conjunction with the board of education, private schools, labor organizations, businesses, neighborhood organizations, community boards, and other interested and affected parties, and using flyers, print and electronic advertising, public events, promotional activities, public service announcements, and such other techniques as the commissioner determines to be useful, to assure the greatest possible level of compliance with the provisions of this chapter. The educational program shall encourage waste reduction, the reuse of materials, the purchase of recyclable products, and participation in city and private recycling activities.

c. The department shall perform such research and development activities, in cooperation with other city agencies, and public and private institutions, as the commissioner determines to be helpful in implementing the city's recycling program. Such research shall include, but not be limited to, investigation into the use of cooperative marketing programs, material recovery facilities, recycling as an economic development tool, export promotion, tax credits and exemptions for market promotion.

Subchapter 3
Recycling Plan

§ 16-316 Recycling plan.

a. The commissioner shall, within twelve months of the effective date of this chapter, prepare and submit to the mayor, the council and the citywide board created under section 16-319 of this chapter a preliminary citywide recycling plan. The commissioner shall, within eighteen months of the effective date of this chapter, prepare and submit to the mayor, the council and the citywide board a citywide recycling plan and each year thereafter the commissioner shall submit to such parties an updated plan. The preliminary plan, the plan and each updated plan shall include, but need not be limited to:

1. a waste composition analysis that identifies the quantity and composition of the city's solid waste by recycling district;

2. annual recycling and reduction goals equal to or exceeding the mandatory minimum levels of sections 16-304 and 16-305, including the quantity and composition of recyclable materials to be collected, processed, marketed and sold by recycling district;

3. a five-year strategy for collecting, processing, marketing and selling the designated recyclable materials, and disposing of residual, non-recyclable solid waste, taking into account persons engaged in the business of recycling or persons otherwise providing recycling services before the effective date of this chapter. Such strategy may be based upon the results of the waste composition analysis performed pursuant to paragraph one of this subdivision or information obtained in the course of past collection of solid waste by the department, and may include recommendations with respect to increasing the number of materials designated for recycling pursuant to sections 16-305, 16-306 or 16-307 of this chapter;

4. comprehensive and up-to-date lists of large-scale generators of recyclable materials within the city and potential purchasers of recyclable waste material both within the city and in other locations;

5. a comprehensive analysis of all appropriate department properties and facilities to determine their feasibility as recycling centers;

6. proposed methods and programs to achieve a reduction in the city's solid waste stream, including but not limited to identifying materials the use of which should be regulated or limited based upon their incompatibility with recycling;

7. recommended revisions and an evaluation of the feasibility and effectiveness of such revisions to the building code of the city of New York, chapter one of title twenty-seven of this code, prepared in conjunction with the department of buildings, requiring newly constructed buildings and buildings undergoing specified alterations to contain storage space, devices or mechanisms that facilitate source separation and storage of the recyclable materials designated pursuant to sections 16-305 and 16-306 and that enable the department efficiently to collect, process, market and sell the designated materials; in preparing such recommendations, the commissioner and the commissioner of buildings shall evaluate the feasibility and effectiveness of requiring separate chutes to facilitate source separation in multi-family dwellings, storage areas that conform to fire and safety code regulations, and specialized storage containers;

8. to the extent feasible, proposals developed in consultation with the metropolitan transportaion authority, the port authority of New York and New Jersey, the department of transportation, and the department of ports, international trade and commerce, to separate, collect and recycle recyclable materials, including but not limited to newspaper, that are discarded at transportation facilities, including subway, bus, railroad and ferry stations;

9. proposals developed in consultation with the board of education, the department of correction, health and hospitals corporation and other appropriate entities to separate, collect and recycle materials that are discarded at schools, jails, hospitals and other similar institutions throughout the city:

10. recommended product labeling requirements that would facilitate source separation and recycling of recyclable materials;

11. a proposal for an incentive program, including cash incentives, to encourage recycling participation;

12. an analysis of whether providing a reduced tipping fee for the disposal of residue that results from recycling activity in the private sector will enhance or increase private sector recycling;

13. an evaluation of economic development benefits of alternative recycling methods and strategies;

14. a comparison of the economic costs of recycling to the economic costs of other disposal

and waste management strategies, including but not limited to resource recovery incineration and export; such comparison shall include but not be limited to expense, capital and external costs;

15. a review of all regulations pertaining to solid waste collection and disposal to determine their compatibility with the provisions and goals of this chapter;

16. a report on and evaluation of any pending federal and state legislation on recycling, waste reduction or any other solid waste management issues;

17. a detailed report on the recycling activities of the department during the preceding year;

18. specific and detailed objectives for the activities and programs conducted and assisted under this chapter;

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19. the commissioner's conclusions as to the effectiveness of such activities and programs in achieving these objectives and the purposes of this chapter;

20. a summary of outstanding recycling problems confronting the department in the order of priority;

21. recommendations with respect to legislation the commissioner deems necessary or desirable to assist in solving these recycling problems;

22. the commissioner's plans for recycling and reduction activities and programs during the next year; and

23. all other information required to be submitted to the council pursuant to any other provision of this chapter.

b. Within four years of the effective date of this chapter, the commissioner shall prepare and submit to the mayor, the council, each citizens' board and the citywide board, a detailed and comprehensive plan to achieve for New York city the New York State goal of forty percent recycling and eight to ten percent waste reduction by 1997.

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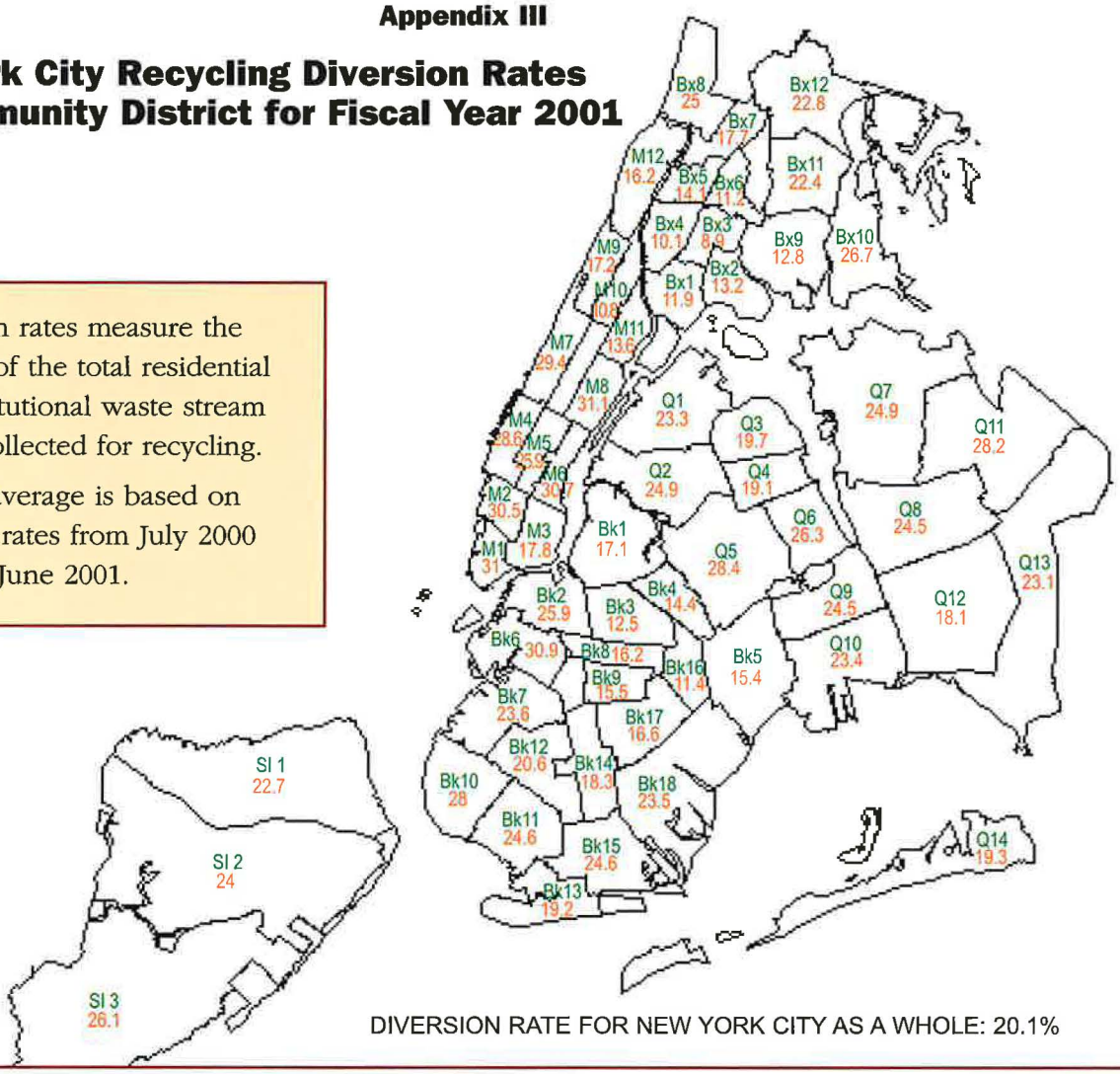
Appendix III

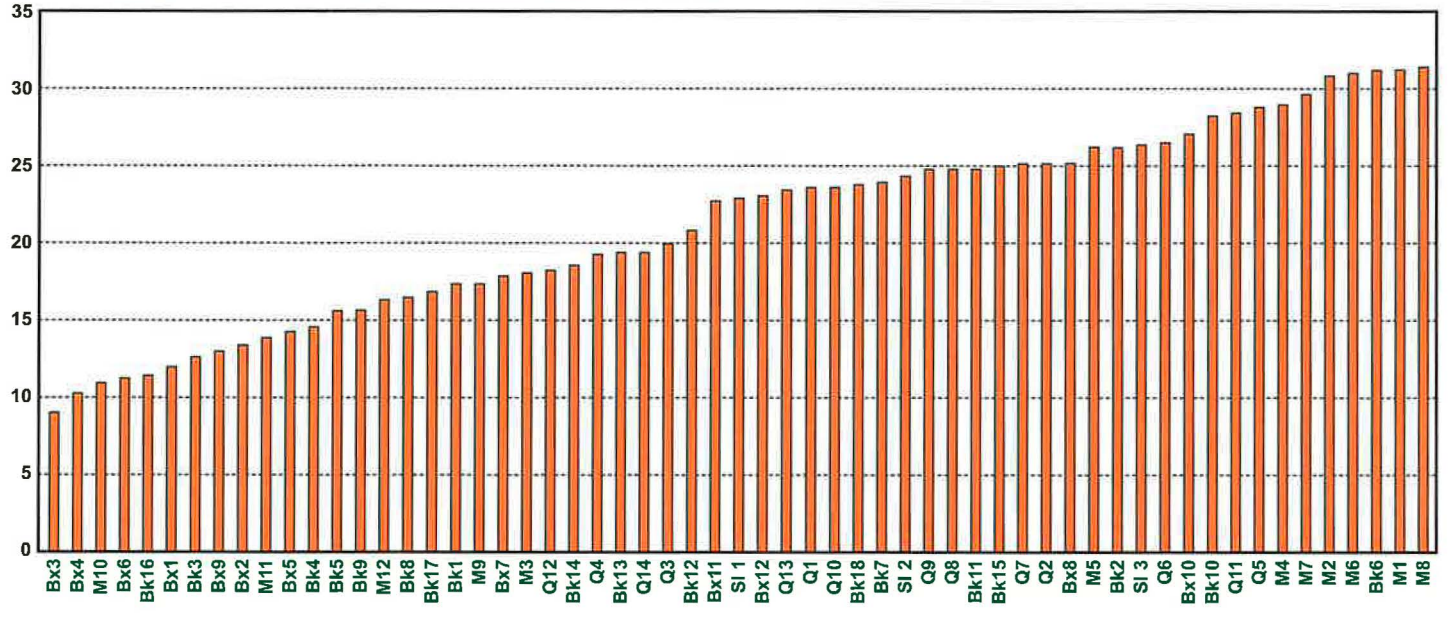
New York City Recycling Diversion Rates by Community District for Fiscal Year 2001

Diversion rates measure the percent of the total residential and institutional waste stream that is collected for recycling.

Annual average is based on monthly rates from July 2000 through June 2001.



DIVERSION RATE FOR NEW YORK CITY AS A WHOLE: 20.1%



DIVERSION RATES BY DISTRICT (in %)

Appendix IV

Source Data

Source:	Waste News, February 18, 2001									DOS Calculations			
	Total recycling tons reported	Paper	Metal	Plastic	Glass	Yard	Other	Includes commercial?	Reported diversion rate	Implied base	Base without Yard & Other	Working adjusted diversion rate	Diversion without yard waste
Austin	47,180	22,105	1,105	809	3,458	16,686	3,017		28.5%	165,544	145,841	18.8%	20.5%
Baltimore	119,665	19,156	10,825	N/A	44	6,369	83,271	y	35.3%	338,994	249,354	8.8%	33.8%
Boston	42,000	15,000	24,000	(MGP combined)		3,000	N/A		14.0%	300,000	297,000	13.0%	13.1%
Charlotte	70,739	26,888	(paper & MGP combined)			32,231	11,620		24.0%	294,746	250,895	9.1%	14.7%
Chicago	2,287,708	545,499	117,168	2,197	22,741	176,472	1,423,631	y	47.9%	4,776,008	3,175,905	21.7%	45.9%
Cleveland	6,000	information not provided					N/A		2.0%	300,000	300,000	2.0%	0.0%
Columbus	34,211	8,581	1,944	1,038	2,189	20,316	143		9.7%	352,691	332,232	4.1%	4.2%
Dallas	8,387	6,506	269	229	897	486	N/A		19.0%	44,142	43,656	18.1%	18.1%
Denver	17,511	12,909	511	339	3,227	270	255		7.5%	233,480	232,955	7.3%	7.4%
Detroit	42,649	162	35,578	32	10	6,826	41		7.2%	592,347	585,480	6.1%	6.1%
El Paso	13,850	3,556	347	180	N/A	9,333	434	y	4.0%	346,250	336,483	1.2%	1.3%
Fort Worth	19,511	13,635	1,405	1,405	3,066	N/A	N/A		7.2%	270,986	270,986	7.2%	7.2%
Houston	66,000	15,000	2,450	1,350	350	30,500	16,350		16.0%	412,500	365,650	5.2%	9.3%
Indianapolis	29,452	9,452	(paper & MGP combined)			6,000	14,000	y	24.0%	122,717	102,717	9.2%	20.1%
Jacksonville	563,696	148,096	221,436	5,028	17,453	132,918	38,765	y	39.0%	1,445,374	1,273,691	30.8%	32.8%
Los Angeles	691,870	137,499	8,112	2,900	19,224	454,803	69,332		40.9%	1,691,614	1,167,479	14.4%	19.2%
Memphis	78,808	6,039	705	1,107	2,214	68,743	N/A		19.9%	396,020	327,277	3.1%	3.1%
Milwaukee	58,128	23,418	1,501	1,490	4,727	23,119	3,873		28.0%	207,600	180,608	17.2%	19.0%
Nashville	73,305	information not provided							8.0%			8.0%	8.0%
New York	749,000	423,000	305,000	(MGP combined)		21,000	N/A		19.7%	3,802,030	3,781,030	19.2%	19.3%
Oklahoma City	10,000	7,400	600	1,000	1,000	N/A	N/A		23.6%	42,373	42,373	23.6%	23.6%
Philadelphia*	44,794	32,314	12,480	(MGP combined)		N/A	N/A	y	32.5%	137,828	137,828	6.2%	6.3%
Phoenix	106,970	92,422	5,241	4,493	4,814	N/A	N/A		18.0%	594,278	594,278	18.0%	18.0%
Portland**	not reported in *Waste News*, see Appendix V							y	53.6%			35.7%	39.9%
San Antonio	45,408	17,953	945	1,877	2,672	N/A	21,961		26.3%	172,654	150,693	15.6%	26.3%
San Diego	62,953	23,400	604	860	2,424	35,665	N/A		46.0%	136,854	101,189	27.0%	27.0%
San Francisco	568,138	144,317	18,638	2,659	22,954	12,148	367,422	y	42.0%	1,352,710	973,140	19.4%	41.5%
San Jose	214,260	62,919	N/A	N/A	9,813	123,277	18,251	y	47.0%	455,872	314,344	23.1%	27.4%
Seattle	102,500	46,800	2,300	700	13,000	39,700	N/A	y	52.0%	197,115	157,415	39.9%	39.9%
Washington	21,706	15,045	473	672	3,673	N/A	1,843		17.0%	127,682	125,839	15.8%	17.0%

Notes: *Philadelphia's reported residential rate is used as its adjusted rate.
**Portland's tonnages are from its own report, see Appendix V.

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Appendix IV *(continued)*

Source Data

Source:	2000 Census	DOS Calculation	1990 Census										
	Population 2000	Pounds yard waste per capita	Total household units	1, detached	1, attached	2	3 or 4	5 to 9	10 to 19	20 to 49	50 or more	mobile home or trailer	other
Austin	552,434	60	216,940	45.7%	6.1%	5.2%	4.6%	6.0%	10.5%	9.6%	9.7%	1.4%	1.1%
Baltimore	645,593	20	303,707	11.3%	52.9%	7.0%	7.3%	6.3%	5.5%	1.7%	7.0%	0.0%	1.0%
Boston	555,447	11	250,864	11.0%	4.6%	14.4%	25.9%	12.0%	10.6%	9.4%	11.0%	0.1%	1.1%
Charlotte	504,637	128	170,407	55.1%	4.7%	4.1%	6.2%	11.8%	10.0%	4.6%	1.7%	1.0%	0.8%
Chicago	2,802,079	126	1,133,040	23.3%	2.8%	18.8%	14.0%	11.0%	6.7%	7.1%	15.1%	0.1%	1.1%
Cleveland	495,817	0	224,312	41.5%	8.2%	19.8%	7.9%	5.6%	5.1%	3.0%	6.1%	0.5%	2.3%
Columbus	670,234	61	278,103	45.3%	8.1%	5.2%	10.3%	11.9%	9.3%	5.0%	3.3%	0.7%	0.8%
Dallas	1,075,894	1	465,580	44.1%	3.8%	2.2%	4.9%	10.2%	11.8%	9.1%	11.8%	1.0%	1.2%
Denver	499,055	1	239,637	47.4%	6.6%	3.5%	4.1%	5.1%	9.1%	11.5%	11.5%	0.3%	0.9%
Detroit	970,196	14	410,028	59.3%	6.6%	12.1%	3.3%	2.4%	3.8%	4.6%	6.2%	0.1%	1.7%
El Paso	615,032	30	168,626	60.1%	5.7%	2.5%	4.2%	6.7%	6.1%	4.1%	6.1%	3.2%	1.2%
Fort Worth	491,801	0	194,429	60.8%	3.2%	4.5%	4.6%	7.1%	8.3%	5.5%	3.7%	1.4%	1.1%
Houston	1,786,691	34	726,403	45.8%	5.1%	2.2%	4.0%	6.6%	10.8%	6.7%	16.6%	0.9%	1.4%
Indianapolis	741,304	16	319,959	55.2%	7.9%	2.9%	5.7%	9.7%	9.3%	4.2%	2.7%	1.6%	0.8%
Jacksonville	693,630	383	267,149	58.0%	4.5%	2.9%	5.1%	6.5%	6.4%	3.3%	4.4%	8.0%	0.9%
Los Angeles	3,597,556	253	1,299,964	39.2%	5.9%	3.2%	6.4%	9.6%	11.2%	13.5%	9.2%	0.6%	1.2%
Memphis	603,507	228	248,574	58.2%	4.9%	4.3%	5.6%	10.1%	7.9%	3.4%	3.7%	0.8%	1.0%
Milwaukee	578,364	80	254,205	37.0%	4.6%	25.7%	8.1%	5.8%	4.5%	6.7%	5.6%	0.2%	1.9%
Nashville	510,274	0	219,522	48.7%	6.5%	7.7%	4.1%	6.7%	11.5%	7.1%	5.2%	1.7%	0.9%
New York	8,000,000	5	2,992,170	8.4%	5.9%	12.8%	8.7%	6.8%	6.7%	17.2%	31.8%	0.0%	1.7%
Oklahoma City	472,221	0	212,391	62.6%	4.2%	2.7%	4.4%	8.2%	6.3%	3.3%	4.0%	3.1%	1.1%
Philadelphia	1,436,287	0	674,900	5.4%	62.1%	8.4%	6.5%	3.8%	2.7%	2.9%	7.4%	0.0%	0.9%
Phoenix	1,198,064	0	422,037	55.2%	5.4%	1.8%	4.5%	4.5%	7.0%	6.1%	9.8%	4.7%	1.1%
Portland	503,891	196	198,320	62.4%	1.9%	4.5%	4.8%	4.9%	7.6%	6.4%	5.9%	0.8%	0.7%
San Antonio	1,114,130	0	365,401	59.7%	3.3%	3.1%	5.6%	8.3%	7.3%	4.4%	5.5%	1.7%	1.2%
San Diego	1,220,666	58	431,723	46.6%	8.9%	3.1%	5.9%	10.3%	9.2%	7.0%	6.5%	1.3%	1.1%
San Francisco	745,774	33	328,472	16.7%	15.1%	11.7%	12.6%	11.1%	11.2%	9.7%	9.9%	0.0%	2.0%
San Jose	861,284	286	259,331	57.7%	9.6%	2.0%	6.0%	4.7%	5.6%	4.7%	4.1%	4.6%	1.0%
Seattle	536,978	148	249,033	51.5%	1.5%	4.3%	4.8%	6.8%	9.9%	12.2%	7.6%	0.3%	1.1%
Washington	523,124	0	278,490	12.4%	25.7%	3.1%	7.8%	7.4%	13.4%	7.3%	22.1%	0.0%	0.9%

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Appendix IV *(continued)*

Source Data

Source: *1990 Census*

	Population 1990	Land Area (square mile), 1990	Density (people/ square mile)	Rank of population density	percent of housing units built							
					1989–March 1990	1985–1988	1980–1984	1970–1979	1960–1969	1950–1959	1940–1949	1939 or earlier
Austin	465,577	218	2,138	24	0.7%	10.7%	22.1%	28.8%	16.4%	10.6%	5.6%	5.0%
Baltimore	736,014	81	9,109	7	0.5%	1.6%	3.1%	7.6%	9.8%	17.5%	18.6%	41.2%
Boston	574,283	48	11,865	4	1.3%	3.1%	3.1%	8.5%	9.3%	7.4%	9.6%	57.6%
Charlotte	396,003	174	2,272	23	1.5%	11.8%	13.6%	22.1%	21.3%	15.6%	8.3%	5.9%
Chicago	2,783,726	227	12,252	3	0.6%	1.6%	2.7%	7.2%	13.1%	16.2%	13.9%	44.6%
Cleveland	505,616	77	6,566	10	0.3%	0.8%	1.7%	5.9%	8.7%	13.8%	16.2%	52.6%
Columbus	632,958	191	3,316	16	2.2%	9.8%	7.8%	20.0%	18.6%	14.6%	9.5%	17.5%
Dallas	1,006,831	342	2,941	19	0.6%	9.4%	14.8%	21.3%	19.8%	18.2%	9.1%	6.8%
Denver	467,610	153	3,050	17	0.4%	3.6%	7.1%	16.5%	15.6%	20.2%	11.0%	25.7%
Detroit	1,027,974	139	7,411	9	0.2%	0.5%	1.8%	4.8%	7.6%	22.3%	27.0%	35.8%
El Paso	515,342	245	2,100	25	1.5%	9.6%	12.8%	26.4%	18.7%	17.6%	6.0%	7.4%
Fort Worth	447,619	281	1,592	27	0.8%	11.5%	14.8%	14.8%	14.6%	20.5%	12.2%	10.9%
Houston	1,630,672	540	3,020	18	0.7%	2.6%	13.8%	31.0%	21.3%	16.7%	7.9%	6.0%
Indianapolis	731,321	362	2,022	26	1.5%	7.9%	7.2%	17.3%	20.2%	15.7%	10.0%	20.2%
Jacksonville	635,230	759	837	29	2.3%	14.7%	10.9%	20.3%	18.7%	17.4%	8.8%	6.9%
Los Angeles	3,485,398	469	7,427	8	2.3%	7.0%	6.2%	13.8%	17.8%	20.8%	14.7%	17.4%
Memphis	610,337	256	2,384	21	0.8%	3.4%	4.0%	19.8%	25.4%	23.6%	12.0%	11.0%
Milwaukee	628,088	96	6,536	11	0.5%	1.0%	2.3%	10.0%	13.6%	21.8%	12.3%	38.4%
Nashville	488,518	473	1,032	28	2.3%	14.0%	9.8%	21.7%	18.9%	16.3%	7.7%	9.3%
New York	7,322,564	309	23,705	1	0.7%	2.7%	2.9%	8.1%	15.0%	15.3%	14.4%	40.9%
Oklahoma City	444,730	608	731	30	0.7%	6.6%	16.1%	21.2%	18.5%	15.9%	10.5%	10.5%
Philadelphia	1,585,577	135	11,736	5	0.4%	1.5%	2.1%	6.1%	10.6%	14.1%	13.6%	51.6%
Phoenix	983,403	420	2,342	22	1.7%	13.5%	16.1%	28.3%	16.4%	15.8%	5.3%	2.9%
Portland	437,398	125	3,508	14	0.8%	2.2%	3.6%	11.0%	11.7%	16.1%	15.2%	39.4%
San Antonio	935,927	333	2,811	20	0.6%	8.4%	16.5%	22.2%	17.7%	16.6%	9.4%	8.6%
San Diego	1,110,549	324	3,428	15	2.5%	13.4%	10.5%	24.3%	17.0%	16.1%	7.5%	8.6%
San Francisco	723,959	47	15,502	2	0.7%	2.6%	3.0%	6.6%	9.0%	9.7%	13.3%	55.1%
San Jose	782,225	171	4,566	13	1.5%	7.9%	8.7%	32.1%	27.0%	13.3%	4.1%	5.5%
Seattle	516,259	84	6,153	12	1.9%	5.5%	4.5%	9.0%	13.2%	14.9%	14.8%	36.2%
Washington	606,900	61	9,884	6	0.6%	1.7%	3.2%	8.4%	14.9%	15.5%	18.1%	37.7%

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Appendix V

Supplementary Data for Portland, Oregon reported in City of Portland, Office of Sustainable Development, Solid Waste and Recycling Division, *Management Report for 2000 Activities* August 2001

Residential Data	*Tons per year*
curbside yard	19,900
self-hauled yard	12,000
home composting	17,500
yard total	**49,400**
curbside recycling	48,200
self-hauled recyclables	15,000
recycling total	**63,200**
bottle bill	12,100
"other" total	**12,100**
residential refuse	**113,600**
Diversion overall:	52.3%
Diversion without yard:	39.9%
Diversion without yard or "other":	35.7%


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