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EXECUTIVE SUMMARY

OVERVIEW

This report presents the results of the Florida Recycling Economic Information (REI) Study commissioned by the Florida Department of Environmental Protection (FDEP). This study was conducted by R. W. Beck, Inc. as part of the National Recycling Coalition's U. S. Recycling Economic Information (US REI) Study, and data from the Florida REI study was incorporated into the US REI Study results. The Florida REI study conforms to the methodology developed by the Northeast Recycling Council for gathering economic data on the recycling and reuse industries.[1] This Executive Summary contains the results of the study. The remainder of the report is dedicated to a complete and thorough documentation of the results and the methodology used in producing them.

This study had two primary goals:

1. Document the size of the recycling and reuse industries in Florida; and
2. Contribute REI data to the US REI Study.

To achieve the two goals, the project approach included the following steps:

- A review of existing sources of recycling and reuse data;
- Creation of a database of recycling and reuse businesses and surveying them to gather primary data for categories where little or no existing information was otherwise found;
- Deriving estimates using limited existing information for categories with insufficient existing data or incomplete/unavailable lists of establishments;
- Conducting limited surveys to gather supplemental intermediate input data for economic modeling; and
- Conducting economic modeling to estimate the total economic values.

SUMMARY OF DIRECT RESULTS

Twenty-six recycling and reuse industry categories are used in this study and can be grouped into the following two sectors based on the general types of activities undertaken:

- Recycling; and
- Reuse and Remanufacturing.

[1] Northeast Recycling Council, Recycling Economic Information Study, June 2000.

Direct industry size data was determined for each category by one of three methods:

- Utilizing existing data from a variety of sources including the U.S. Census Bureau, publications of trade associations, and periodicals;
- Surveying establishments and performing a statistical analysis of results; or
- Deriving estimates using limited existing information.

Table ES-1 presents the estimates of direct economic activity, by category and sector, for Florida. As shown in the table, Florida hosts nearly 3,700 recycling and reuse establishments employing approximately 32,000 people generating an annual payroll of $765 million and $4.4 billion in annual revenues.

Over half of the economic activity for the recycling and reuse industries is accounted for by the following four categories:

- Recyclable material wholesalers;
- Paper, paperboard, and deinked market pulp mills;
- Plastics converters; and
- Retail used merchandise sales.

These four categories alone account for approximately 55 percent of all employees and wages and 72 percent of total receipts.

A noticeable distinction exists between the recycling and reuse sectors regarding the size of establishments and average annual payroll. The recycling establishments have an average of 18 employees each, with an average annual payroll per employee of $28,000. Comparatively, the reuse sector is made up of smaller establishments (an average of 5 employees per establishment) with an average annual payroll of $16,000 per employee. Although the reuse and remanufacturing sector comprises 69 percent of total establishments, it makes up only 36 percent of total employees, 25 percent of payroll, and 22 percent of receipts.

These figures are thought to represent the minimum amount of reuse and remanufacturing captured by the methodology, however, because remanufacturing activities are often included with traditional manufacturing industries that were not included in this study. Several years ago Professor Robert T. Lund of Boston University estimated remanufacturing activities on a national level,[2] although state or regional estimates were not attempted. Extrapolating figures from his study down to Florida indicated that reuse and remanufacturing categories might be as much as 50 to 60 percent of total jobs, wages, and receipts for all categories.

[2] Professor Robert T. Lund, The Remanufacturing Industry: Hidden Giant, 1996.

Table ES-1
Summary of Direct Estimates of Economic Activity

Annual Payroll and Estimated Receipts are in $1,000. Throughput is in thousands of tons.
Throughput estimates are not summed due to the potential for triple counting at the collecting, processing, and manufacturing stages.
(D) - Data not disclosed due to a limited number of establishments in this business category and the need to avoid revealing data that could identify a single business. Data for multiple disclosure categories are included in totals.

Business Category	Data Type	Estimates of Total Recycling and Reuse-Related Economic Activity
Recycling Industry Economic Activity		
1. Government Staffed Collection	Establishments	107
	Employment	1,110
	Annual Payroll	27,750
	Estimated Receipts	31,870
	Estimated Throughput	865
2. Private Staffed Collection	Establishments	208
	Employment	2,150
	Annual Payroll	53,750
	Estimated Receipts	61,867
	Estimated Throughput	8,181
3. Compost and Miscellaneous Organics Producers	Establishments	56
	Employment	321
	Annual Payroll	9,515
	Estimated Receipts	36,003
	Estimated Throughput	1,725
4. Materials Recovery Facilities (MRF's)	Establishments	95
	Employment	2,218
	Annual Payroll	32,342
	Estimated Receipts	123,270
	Estimated Throughput	540
5. Recyclable Material Wholesalers	Establishments	408
	Employment	4,164
	Annual Payroll	99,419
	Estimated Receipts	1,106,807
	Estimated Throughput	6,781
6. Glass Container Manufacturing Plants	Establishments	3
	Employment	998
	Annual Payroll	42,750
	Estimated Receipts	94,406
	Estimated Throughput	114
7. Glass Product Producers (other recycled uses)	Establishments	0
	Employment	0
	Annual Payroll	0
	Estimated Receipts	0
	Estimated Throughput	0
8. Nonferrous secondary smelting and refining mills	Establishments	5
	Employment	116
	Annual Payroll	3,886
	Estimated Receipts	54,587
	Estimated Throughput	12
9. Nonferrous product producers	Establishments	7
	Employment	682
	Annual Payroll	17,910
	Estimated Receipts	10,035
	Estimated Throughput	41
10. Nonferrous foundries	Establishments	36
	Employment	416
	Annual Payroll	10,256
	Estimated Receipts	35,790
	Estimated Throughput	3

(continued)

Business Category	Data Type	Estimates of Total Recycling and Reuse-Related Economic Activity
11. Paper and Paperboard Mills/Deinked Market Pulp Producers	Establishments	9
	Employment	3,156
	Annual Payroll	146,069
	Estimated Receipts	1,047,174
	Estimated Throughput	1,140
12. Paper-based Product Manufacturers	Establishments	8
	Employment	244
	Annual Payroll	4,935
	Estimated Receipts	15,077
	Estimated Throughput	51
13. Pavement Mix Producers (asphalt and aggregate)	Establishments	2
	Employment	19
	Annual Payroll	371
	Estimated Receipts	3,544
	Estimated Throughput	63
14. Plastics Reclaimers	Establishments	24
	Employment	402
	Annual Payroll	9,512
	Estimated Receipts	33,864
	Estimated Throughput	63
15. Plastics Converters	Establishments	123
	Employment	2,925
	Annual Payroll	69,219
	Estimated Receipts	541,311
	Estimated Throughput	29
16. Rubber Product Manufacturers	Establishments	8
	Employment	337
	Annual Payroll	15,833
	Estimated Receipts	34,833
	Estimated Throughput	8
17. Steel mills	Establishments	1
	Employment	(D)
	Annual Payroll	(D)
	Estimated Receipts	(D)
	Estimated Throughput	(D)
18. Iron and Steel foundries	Establishments	19
	Employment	477
	Annual Payroll	16,602
	Estimated Receipts	58,966
	Estimated Throughput	43
19. Other Recycling Processors/Manufacturers	Establishments	16
	Employment	516
	Annual Payroll	7,205
	Estimated Receipts	48,433
	Estimated Throughput	101
Recycling Industry Subtotals	**Establishments**	1,135
	Employment	20,251
	Annual Payroll	567,324
	Estimated Receipts	3,337,838
	Estimated Throughput	N/A

(continued)

Business Category	Data Type	Estimates of Total Recycling and Reuse-Related Economic Activity
Reuse and Remanufacturing Industry Economic Activity		
20. Computer and Electronic Appliance Demanufacturers	Establishments	4
	Employment	49
	Annual Payroll	808
	Estimated Receipts	4,038
	Estimated Throughput	N/A
21. Motor Vehicle Parts (used)	Establishments	497
	Employment	2,999
	Annual Payroll	62,383
	Estimated Receipts	307,764
	Estimated Throughput	N/A
22. Retail Used Merchandise Sales	Establishments	1,899
	Employment	7,415
	Annual Payroll	101,616
	Estimated Receipts	530,138
	Estimated Throughput	N/A
23. Tire Retreaders	Establishments	137
	Employment	663
	Annual Payroll	14,063
	Estimated Receipts	74,013
	Estimated Throughput	N/A
24. Wood Reuse	Establishments	4
	Employment	70
	Annual Payroll	1,832
	Estimated Receipts	4,422
	Estimated Throughput	N/A
25. Materials Exchange Services	Establishments	1
	Employment	(D)
	Annual Payroll	(D)
	Estimated Receipts	(D)
	Estimated Throughput	N/A
26. Other Reuse	Establishments	6
	Employment	387
	Annual Payroll	7,008
	Estimated Receipts	35,625
	Estimated Throughput	N/A
Reuse Industry Subtotals	**Establishments**	2,548
	Employment	11,583
	Annual Payroll	187,709
	Estimated Receipts	955,999
	Estimated Throughput	N/A

GRAND TOTALS	**Establishments**	3,683
Recycling and Reuse/Remanufacturing	**Employment**	32,138
	Annual Payroll	765,176
	Estimated Receipts	4,374,479

Another interesting observation can be made by comparing recycling categories that are primarily local establishments performing collection, sorting, and densification activities to those that source material from large distances for downstream processing, conversion, or manufacturing operations. Local collection and processing (baling, grading, densifying, etc.) includes:

- Government staffed residential curbside collection;
- Privately-staffed residential curbside collection;
- Compost and miscellaneous organics products producers;
- Materials recovery facilities; and
- Recyclable material wholesalers.

Establishments in the remaining recycling categories are considered to be downstream processors of recycled materials and tend to utilize recycled materials in manufacturing. When the two groups are compared, "local" collection and processing make up about 49 percent of total recycling employment and 41 percent of receipts whereas non-local downstream processing makes up the remaining 51 percent of employment and 59 percent of receipts. This indicates that public and private investment in local recyclables collection and processing infrastructure pays great dividends in downstream private recycling economic activity. Public policy in the form of state or local laws and regulations that require collection of recyclables or that discourage disposal (e.g. disposal taxes, material specific bans, etc.), directly affects these local public and private sector establishments and indirectly the larger recycling and reuse industry as a whole.

SUMMARY OF INDIRECT AND INDUCED ECONOMIC ACTIVITY

In addition to the twenty-six categories of direct recycling and reuse establishments, the study estimated data for four specific categories of support businesses that provide goods or services to recycling and reuse industry establishments as shown in Table ES-2. The general category Other Indirect Establishments shown in the table includes all other indirect establishments that provide goods or services (such as office supply companies, accounting firms, legal firms, building and landscape maintenance firms, etc.).

Table ES-2
Estimates of Indirect Economic Activity of Select Support Business Categories
(Annual Payroll and Estimated Receipts are in $1,000)

Business Category	Data Type	Value
Recycling and Reuse Equipment Manufacturers [1]	Employment	983
	Annual Payroll	29,075
	Estimated Receipts	217,230
Consulting/Engineering [2]	Employment	165
	Annual Payroll	5,721
	Estimated Receipts	12,764
Brokers [2]	Employment	72
	Annual Payroll	6,231
	Estimated Receipts	9,862
Transporters [2]	Employment	1,873
	Annual Payroll	56,965
	Estimated Receipts	197,088
Other Indirect Establishments [2]	Employment	14,201
	Annual Payroll	447,409
	Estimated Receipts	1,143,337
Support Businesses Totals	**Employment**	17,294
	Annual Payroll	545,401
	Estimated Receipts	1,580,281

Notes:
[1] Data for Recycling and Reuse Equipment Manufacturers are based on a statistical analysis of survey results.
[2] Data come from modeling output and reflect the indirect activity stimulated by the 26 direct categories of recycling and reuse establishments targeted by this study for direct data.

The study also estimated other economic activity produced in Florida's economy attributable to the recycling and reuse industry using economic modeling. Furthermore, state government tax revenues arising from the recycling and reuse industry were also estimated. Table ES-3 shows summarized state government tax revenues for the direct economic activity of the 26 business categories.

Table ES-3
Summary of Recycling & Reuse Industry
Direct Effects on State Government Revenues
(in $ Millions)

Recycling Collection	6.36
Recycling Processing	12.23
Recycling Manufacturing	27.70
Reuse/Remanufacturing	15.77
Total	62.07

CONCLUSIONS

The estimates of direct economic activity presented here reveal that recycling and reuse activities significantly contribute to the economy of Florida. As a reference, comparisons to several other industries and business types can be made. For example, although Florida's recycling and reuse industry employs only one-fifth the number of people as fast food restaurants, the total payroll is more than half that of fast food restaurants. Recycling and reuse in Florida employ five times the number of people employed in convenience stores and has a total payroll ten times larger.

The results of the economic modeling estimate that nearly 1 percent of jobs and total value added in Florida can be attributed to the recycling and reuse industry (including down-stream effects).

As noted previously, investments at the local level in collection and processing of recyclables and public policies that favor recycling and reuse certainly enable large private sector investments in downstream processing and manufacturing.

Results of the follow-on national REI study should be reviewed upon its completion to evaluate the contribution of recycling and reuse to the economy in Florida as compared to the remainder of the U.S. and other individual states of similar make-up in order to gain insight on the influence of public policies on states' recycling and reuse industries. However, further study is necessary to rigorously assess the impact of public policy on recycling economic activity and to document the growth over the baseline in this report.

1 INTRODUCTION

1.1 OVERVIEW

This report presents the results of the Florida Recycling Economic Information (REI) Study commissioned by the Florida Department of Environmental Protection (FDEP). This study was conducted by R. W. Beck, Inc. as part of the National Recycling Coalition's U. S. Recycling Economic Information (US REI) Study. Data from this study has been incorporated into the US REI Study, along with data from other states cooperating in that study.

The goal of the study was to document the size of the recycling and reuse industry by first determining direct economic information for each of twenty-six categories of recycling and reuse establishments. The direct economic values that were measured included:

- Number of establishments;
- Employment;
- Annual payroll;
- Annual receipts; and
- Annual throughput (for applicable categories).

Next, similar information was estimated for four categories of supporting establishments intimately involved in the recycling and reuse industry. Finally, the broader effect of recycling and reuse businesses and their employees on the economy was derived through economic modeling using direct data as inputs. This information included:

- Indirect economic values (inter-industry linkages as measured by purchase of intermediate commodities);
- Induced economic values (personal spending by employees of direct and indirect establishments);
- Multipliers to calculate total economic values (the sum of direct, indirect, and induced) from direct economic values; and
- Tax revenues attributable to the recycling and reuse industry.

1.2 COMPARISON TO SIMILAR STUDIES

The Florida REI study conforms to the methodology for gathering economic data on the recycling and reuse industries developed by the Northeast Recycling Council (NERC) on behalf of the U.S. Environmental Protection Agency (EPA). As a result, the information contained in this report is directly comparable to that of REI studies conducted for:

- The Northeast Recycling Council,[3] including the states of Delaware, Massachusetts, New Jersey, New York, Pennsylvania, and Vermont;
- The National Recycling Coalition,[4] for the nation as a whole and the states of California, Indiana, Illinois, Nebraska, and Ohio; and
- Other states that conform to the specified REI methodology.[5]

At least seven other recycling economic information studies had been performed before NERC developed a standard REI study methodology. Although those existing studies quantified employment and most included other industry size estimates (such as annual sales or value-added), they used varying (and sometimes inconsistent) data collection methodologies and industry definitions. Therefore, care should be taken if attempting to compare the results of this study to previous studies. Table 1-1 lists the types of data collected in this study compared to three previous economic information studies.

Table 1-1

Comparison of Data Presented in Other Recycling Economic Information Studies

Name of Study	Types of Data Presented						
	Recycling Collection	Recycling Processing	Recycling End Use	Reuse	Support Businesses	Multipliers	Tax Revenues
Florida REI Study (2000)	●	●	●	●	●	●	●
Selected Previous Studies							
Assessment of Economic Impacts of Recycling in Iowa		●	●				●
Arizona Recycling Market Development Study		●	●			●	
Value Added to Recyclable Materials in the Northeast - NERC (1994)	●	●	●				

1.3 INTENDED USES FOR THE STUDY

Recycling and reuse businesses, like other businesses, provide a number of economic benefits, including: creating jobs, making investments, and paying taxes. This study and the economic benefit information it contains may be used as a:

- Reference for economic development agencies, entrepreneurs, and financiers to understand and evaluate recycling and reuse businesses;
- Reference for lawmakers to assist them in evaluating legislation that would affect recycling and reuse;

[3] "Recycling Economic Information Study", Northeast Recycling Council, June 2000.

[4] Scheduled for completion by December 2000.

[5] Iowa, Minnesota, Missouri, and Wisconsin all conducted studies in 2000 that made use of at least some of the tools and methodology found in "Recycling Economic Information Study", Northeast Recycling Council, June 2000.

- Tool for recycling advocates to increase understanding of the industry, promote awareness of recycling and reuse, and target resources for growth; and
- Baseline of economic information to document future growth and development of the industry.

1.4 REPORT ORGANIZATION

This report is organized into the following sections:

1. **Introduction**, which provides a brief overview of the development of the REI study, comparison to similar studies, and intended uses of the study;
2. **Data Characterization**, which briefly describes the development of the business categories, types of data, approaches to data development, and the included activities and boundaries of the study;
3. **Study Methodology**, which explains the methodology used in developing estimates for each category and data type;
4. **Study Results**, which presents detailed data tables and related notes for each sponsoring state and the region as a whole;
5. **Indirect and Induced Economic Information**, which presents the multipliers and related results of economic modeling; and
6. **Recommendations for Future Studies**, which provides suggestions for replication of the study.

The following appendices contain additional detail to support and further explain the methodology and results:

A. Description of Recycling and Reuse Business Categories
B. Evaluation of Data Sources
C. Sample of Raw Data from U.S. Census Bureau's *Standard Statistical Establishments List (SSEL)*
D. Survey Materials
E. Statistical Analysis of Survey Results
F. Glossary of Terms

2 DATA CHARACTERIZATION

2.1 STUDY BOUNDARIES

Defining the recycling and reuse industry is complex. For example, one establishment may perform a variety of processing and/or manufacturing activities, only some of which are related to recycling or reuse. So the question arises whether the establishment should be included, and if so, what portion of that establishment's activities should be attributed to recycling/reuse. In the case of product manufacturing, both recycled and non-recycled materials may be used, again raising the question whether the total activity should be included or only a partial amount.

The most challenging issue that recycling economic information studies face is defining the extent of economic information to include when an industry is able to utilize recovered as well as virgin feedstock or makes an intermediate product as well as converts those intermediate products to end-products within the same facility.

Consistent with the methodology developed by NERC on behalf of the EPA, this study includes those activities that are most essential to the continued recycling or reuse of scrap materials and used products. The study boundaries:

- Include all "supply side" activities involved in recovering and preparing scrap materials and used products for resale;
- Include "demand side" activities up to the first point at which the scrap materials or used products have successfully competed directly against their respective primary, or virgin, equivalents;
- Exclude the activities of non-business entities such as individuals, and of advocacy, education and other organizations which do not directly add value to scrap materials and used products, or directly support such activities; and
- Exclude activities involving incineration or use of materials as fuel.

"Recycling and Reuse" as defined in this study includes the following "covered activities":

- Collecting scrap materials or used products for the purposes of intermediate processing, manufacturing, and/or distribution by reuse sales establishments;
- Intermediate processing of scrap materials or used products including sorting, cleaning, consolidating, treating, disassembling, densifying, and/or transferring ownership for use in processing, product manufacturing, and/or for distribution by reuse sales establishments;
- Reclaiming of scrap materials or used products to produce refined raw materials and/or reusable products meeting the specifications of manufacturers, reuse sales establishments or other end-users;

- Manufacturing "first-stage" products containing scrap materials or used products;
- Operating wholesale or retail sales establishments that offer, largely or exclusively, used products prepared for reuse; and
- Intimately supporting the above activities through research, equipment development and sales, consulting, engineering, brokering, and exchange services.

The end-point of recycling is considered to be the "first-stage" manufactured product. "First-stage" refers to the first product produced from recycled materials, such as a roll of paper, sheet of plastic, glass bottle or metal billet. First-stage products are often converted into finished products (e.g., envelopes, plastic bottles, or metal parts), sometimes at the same facility. Only production of first-stage products is intended to be included in this definition. At this stage, the recycled material has successfully competed against virgin material and is often indistinguishable from other first-stage products that are made from those virgin materials. This study attempted to exclude economic activity associated with further conversion within the same facility as these are essentially manufacturing rather than recycling activities.

2.2 BUSINESS CATEGORIES

This report presents recycling and reuse industry data for twenty-six separate business categories. Data is also presented for four categories of support businesses because of their intimate involvement in the industry. The business categories are grouped into three major sectors:

- **Recycling Industry:** includes all collection and processing of recovered materials and manufacturing using recycled materials;
- **Reuse and Remanufacturing Industry**: includes preparation of materials for reuse and remanufacturing of used or broken equipment; and
- **Support Businesses:** businesses that do not directly recycle materials or reuse products, but provide specialized equipment and services necessary to the recycling and reuse industry.

Table 2-1 briefly defines each of the 30 business categories as used in this study.

Table 2-1
Business Category Definitions

Business Category	Definition
Recycling Industry	
1. Government Staffed Residential Curbside Collection	Recyclables collection using government employees
2. Private Staffed Residential Curbside Collection	Private sector collection of recyclables, including contract collection on behalf of municipalities
3. Compost and Miscellaneous Organics Producers	Produce compost, mulch, bark, or bedding from yard and wood waste, biosolids, or other organics, also includes vermiculture
4. Materials Recovery Facilities	Process commingled or recovered materials, usually from curbside/drop-off collection or recyclables separated from solid waste
5. Recyclable Material Wholesalers	Paper stock dealers, scrap metal processors, and other establishments that sort, remove contaminants, and densify recovered materials
6. Glass Container Manufacturing Plants	Produce finished glass containers
7. Glass Product Producers (other recycled uses)	Produce glass products other than containers
8. Nonferrous Secondary Smelting and Refining Mills	Recycling and alloying of nonferrous metals, primary products include billets, ingots, and other basic shapes
9. Nonferrous Product Producers	Produce nonferrous products through extrusion, rolling, or drawing processes
10. Nonferrous Foundries	Produce castings from nonferrous metals
11. Paper and Paperboard Mills/Deinked Market Pulp Producers	Produce paper and paperboard products from recovered paper or market pulp and/or deink recovered paper and sell pulp
12. Paper-based Product Manufacturers	Produce cellulose-based products from recovered paper or paperboard (e.g., cellulose insulation, hydro-seeding, animal bedding)
13. Pavement Mix Producers (asphalt and aggregate)	Produce asphalt paving mix from recycled materials such as crumb rubber, aggregates, or glass
14. Plastics Reclaimers	Transform recovered plastics directly into products (e.g., plastic lumber) or raw materials ready for remanufacture
15. Plastics Converters	Convert a recycled plastic clean flake or pellet into an intermediate or end product
16. Rubber Product Manufacturers	Manufacture products using crumb rubber or cut rubber shapes and stampings as feedstock
17. Steel Mills	Produce iron and steel slabs, billets, bar, plate, and sheet from scrap and/or raw materials

Business Category	Definition
18. Iron and Steel Foundries	Produce cast iron or steel products
19. Other Recycling Processors/Manufacturers	Other processors and manufacturers not elsewhere classified, using ash, sludge, engineering application of tires or other recovered materials
Reuse and Remanufacturing Industry	
20. Computer and Electronic Appliance Demanufacturers	Sort, grade, dismantle and/or rebuild used electronic appliances
21. Motor Vehicle Parts (used)	Clean, sort, inspect, and remanufacture used automobile parts
22. Retail Used Merchandise Sales	Retail thrift stores, antique shops, reuse centers, and other shops dedicated to selling used merchandise
23. Tire Retreaders	Remove old tread from worn tires and add new tread
24. Wood Reuse	Process used wood for reuse (e.g., pallet rebuilders, construction materials)
25. Materials Exchange Services	Facilitate the reuse of products and materials by commercial and industrial establishments
26. Other Reuse	Other reuse or remanufacturing, not elsewhere classified
Support Businesses	
27. Recycling and Reuse Equipment Manufacturers	Produce new primary equipment designed for use by recycling businesses – conveyers, balers, wash systems, sorting systems
28. Consulting/Engineering	Provide technical research, development, and engineering services to recycling and reuse establishments
29. Brokers	Buy and sell recovered materials or reusable products without processing or otherwise adding value
30. Transporters	Transport recovered materials or reusable goods by air, rail, water, or truck

For more detailed definitions, please see Appendix A.

2.3 TYPES OF INFORMATION DEVELOPED

The two types of economic information developed in the study were:

1. **Direct Economic Information:** Information directly derived from the establishments in each business category and necessary to document industry size; and
2. **Total Economic Information**: Information on the economic values that recycling and reuse establishments induce in the greater economy at the state level, including state tax revenue impacts.

In deriving the direct information, five primary data types were developed:

1. **Number of Establishments:** An establishment is a single physical location where business is conducted or where services or industrial operations are performed;
2. **Employment**: Consists of full and part-time employees, including salaried officers and executives of corporations;
3. **Total Annual Payroll**: Includes all forms of compensation, such as salaries, wages, commissions, bonuses, vacation allowances, sick-leave pay, and the value of payments in kind (e.g., free meals and lodgings) paid during the year to all employees;
4. **Total Annual Receipts**: Revenue for goods produced, distributed, or services provided, including revenue earned from premiums, commissions and fees, rents, interest, dividends, and royalties. Excludes all revenue collected for local, state, and federal taxes; and
5. **Total Throughput**: Total tons of recovered materials collected or processed. This data type was not gathered for reuse and support business categories because reuse businesses typically do not track throughput data in a manner comparable to recycling businesses (e.g., they may use the number of units remanufactured rather than tons).

The total economic information, developed through economic modeling, generated four secondary data types:

1. **Indirect Economic Values**: Economic activity accrued by other establishments (suppliers and customers) as a result of the activities of the recycling and reuse businesses;
2. **Induced Economic Values:** Economic activity accrued by retail and other establishments because of personal purchases by recycling and reuse industry and indirect establishment employees;
3. **Multipliers**: The ratio of total values (direct, indirect, and induced) to direct values; and
4. **Tax Revenues:** State revenues derived from taxes, charges and fees, and miscellaneous revenues.

3 STUDY METHODOLOGY

3.1 OVERVIEW

This chapter provides a detailed description of the methodologies used to develop the economic activity estimates shown in Sections 4 and 5. This section includes general descriptions of strategies for data gathering and analysis employed in the study. Notes on the specific methodology for the direct data for each category are shown in Section 4 along with the results of the study.

3.2 APPROACHES TO DIRECT DATA DEVELOPMENT

In developing the direct economic information reported in Section 4, one of three methods was employed for each business category, depending on the availability and adequacy of existing information and business lists:

- **Existing Data:** Obtained through existing sources of information (e.g., U.S. Census Bureau's Economic Census, U.S. Geological Survey's Mineral Commodity Reports, expert opinions by industry and trade associations);
- **Survey Data:** Gathered by surveying the businesses directly and compiling the data into a database of establishments; or
- **Derivation:** Limited existing data was used to derive estimates of economic activity.

The study focused on using existing data, of sufficient quality, and with categories defined consistently with the study, for as many business categories as possible to avoid duplicating efforts if sources of existing information were available. If little or no existing information was available but listings of businesses in a category were available, the next option was to develop a database of businesses and conduct surveys to obtain the desired economic information. When limited existing information was available, but no specific list of establishments could be found for purposes of surveying, estimates were derived based on limited existing data and estimations by industry experts.

Due to the number of different business categories included in this study, the exact methodology used to calculate economic activity for each category was tailored to fit the material flows and processes found in each. Table 3-1 lists the business categories and the approach used for each category.

Table 3-1
Data Development Approach by Category

	Business Category	Approach
	Recycling Industry	
1.	Government Staffed Residential Curbside Collection	Derivation
2.	Private Staffed Residential Curbside Collection	Derivation
3.	Compost and Miscellaneous Organics Producers	Survey
4.	Materials Recovery Facilities	Survey
5.	Recyclable Material Wholesalers	Existing Data
6.	Glass Container Manufacturing Plants	Survey
7.	Glass Product Producers (other recycled uses)	Survey
8.	Nonferrous Secondary Smelting and Refining Mills	Existing Data
9.	Nonferrous Product Producers	Existing Data
10.	Nonferrous Foundries	Existing Data
11.	Paper and Paperboard Mills/Deinked Market Pulp Producers	Existing Data
12.	Paper-based Product Manufacturers	Survey
13.	Pavement Mix Producers (asphalt and aggregate)	Survey
14.	Plastics Reclaimers	Survey
15.	Plastics Converters	Existing Data
16.	Rubber Product Manufacturers	Survey
17.	Steel Mills	Existing Data
18.	Iron and Steel Foundries	Existing Data
19.	Other Recycling Processors/Manufacturers	Survey
	Reuse and Remanufacturing Industry	
20.	Computer and Electronic Appliance Demanufacturers	Survey
21.	Motor Vehicle Parts (used)	Existing Data
22.	Retail Used Merchandise Sales	Existing Data
23.	Tire Retreaders	Existing Data
24.	Wood Reuse	Survey
25.	Materials Exchange Services	Survey
26.	Other Reuse	Survey
	Support Businesses	
27.	Recycling and Reuse Equipment Manufacturers	Survey
28.	Consulting/Engineering	Modeling
29.	Brokers	Modeling
30.	Transporters	Modeling

The breakdown of the number of categories served by each approach is:

- Existing Data – 11;
- Survey Data – 14;
- Derivation Data – 2; and
- Modeling – 3.

Each of the three approaches is described in greater detail in the following subsections. Furthermore, Appendix B – Data Sources – summarizes data sources used for compiling the survey database or otherwise used for producing direct data for this study.

After the direct economic values were developed, total economic values were estimated through economic modeling, using the direct data as inputs. In order to apply the economic model accurately, certain categories required additional information, known as intermediate inputs. To derive the total economic values, the following steps were taken:

- Survey for Intermediate Inputs – A detailed survey of a limited number of establishments was conducted to obtain estimates of the amounts of expenditures on inputs such as raw materials, chemicals, electricity, accounting services and other items necessary to production (usually expressed as a dollar amount per $1,000 in output for a particular type of industry); and
- Conduct Economic Modeling – A process based on an input-output approach developed by the U.S. Bureau of Economic Analysis. Several models have been developed, including RIMS II, Implan, and REMI. The model chosen for this study was the Implan.

3.2.1 EXISTING DATA

The first strategy employed was to utilize existing data from public sources or trade associations. The most common example of this strategy was the use of U.S. Census Bureau reports when a category defined in the study was aligned with a distinct SIC code. Reports from the U.S. Census included an extract created from the Standard Statistical Establishments List (SSEL) and the 1997 Economic Census. Other sources of publicly available data included U. S. Geological Survey reports and reports developed by individual state governments.

3.2.1.1 Relation of SIC and NAICS to Business Categories

The U.S. Department of Commerce, Bureau of the Census compiles and reports a wide range of economic data on U.S. industrial activity. Prior to 1997, the Census Bureau classified businesses according to the SIC system developed by the Executive Office of the President, Office of Management and Budget. The system classified establishments by their primary activity. Beginning in 1997, the SIC system is being phased out and will be replaced by the new *North American Industrial Classification System* (NAICS). The new system harmonizes systems used in Mexico and Canada, in accordance with the North American Free Trade Agreement.

Table A-1, in Appendix A, attempts to classify each business category in the study by SIC and NAICS. The codes were assigned by comparing each business category to the definitions listed in the SIC and NAICS manuals. In many cases, the listed SIC also includes businesses not involved in recycling and reuse.

3.2.1.2 Use of U.S. Department of Commerce, Bureau of Census Statistics

The primary source of U.S. Census data used for this study was an extract of the *Standard Statistical Establishments List* (SSEL) for relevant SIC codes. Because the most recent year available was 1996, the data for this study is referenced by SIC code. The SSEL provides number of establishments, number of employees, payroll, and receipts for each SIC code. It should be noted that certain data are not disclosed when an SIC code has a small of number of associated businesses and showing exact numbers would reveal sensitive information for a particular company.

In order to use the data when disclosure problems were encountered, a method of estimating based on suppression codes was developed. The U.S. Census Bureau uses lettered suppression codes to represent the range of employees for the category. When required, an estimate of number of employees was calculated by taking the midpoint of each suppression code range and adding all the midpoints for all suppression codes for a particular SIC code. For example, an SIC code with three establishments may have one establishment with code "a" (0-4 employees), one establishment with code "c" (10-19 employees) and the third establishment with code "d" (20-99 employees). In this case, the estimate used for this study was 2 for the first establishment, 14.5 for the second, and 59.5 for the third; for an estimated total of 76 employees. When fractions occurred in the total, the total was rounded down.

In cases of disclosure, the U.S. Census Bureau does not give any information for payroll and estimated receipts. In such cases, payroll and receipts were estimated by using an average payroll per employee and average receipts per employee, based on U.S. totals for employees, payroll, and receipts. See Appendix C for a sample of data provided by U.S. Census SSEL.

3.2.1.3 Additional Sources of Existing Data

Although the most commonly used existing data was the U.S. Census SSEL, other sources provided throughput data or partial data for use in derivations. The most common source of throughput data was the 1997 Economic Census, a series of reports on industrial activity prepared by the U.S. Census Bureau. Other major sources of existing information and their contributions include:

- American Forest and Paper Association – State-wide throughput data for paper, paperboard, and deinked market pulp mills;
- American Plastics Council – Database provided employment and throughput data for plastics reclaimers;
- Steel Recycling Institute – Expert opinion on the steel recycling process and percentage of activities to include in the study; and
- U.S. Geological Survey – Expert opinions on the recycling of nonferrous metals and the percentage of activities to include in the study for nonferrous product producers and nonferrous foundries.

3.2.2 SURVEY DATA

When little or no existing data was available for a particular business category, R.W. Beck conducted surveys of those businesses and performed a statistical analysis of the results to develop estimates of economic activity.

3.2.2.1 Recycling Economic Information Study Database

The National Recycling Coalition as part of the US REI study developed a national database of establishments as a tool for surveying businesses in categories with little or no sources of existing data. The database was compiled from various electronic databases, state directories, periodicals, and other sources.

During the survey process, about 160 establishments were confirmed to be in survey categories in the state of Florida. Of the remaining Florida establishments, as many as 110 are likely to be in survey categories. Although the database contains a number of businesses that are not in survey categories, those listings are incidental incorporations from electronic directories. Please refer to Table 3-1 for a listing of the survey categories for which the database was developed.

3.2.2.2 Survey Design

The survey was designed to obtain economic information from businesses in categories with little or no existing information.

Because the results for this Florida REI Study were desired as quickly as possible after project inception, all survey information was gathered by telephone and no survey form was mailed to recycling and reuse industry establishments. Appendix D contains forms used for recording telephone survey information. Those forms have been designed so that they are suitable for mailing if so desired (other studies that mailed the forms achieved a 10-15 percent return rate before telephone follow-up).

The survey cover page confirmed the database records for company name, mailing information, physical location, and contact information. For companies with more than one physical location, one cover page and survey for each physical location were completed.

The survey used responses to the following questions to develop estimates of economic activity:

1. Classify your recycling activities according to the categories defined for the study: (respondents could check more than one activity);
2. Identify the single category that is most representative of the recycling-related operations for this establishment;
3. Give estimations of establishment size including number of employees, total annual payroll, and estimated receipts;
4. Estimate the percentages of labor and receipts based on covered recycling activities; and

5. Estimate the amounts, by type, of recycled materials processed.

Checkboxes with associated ranges (i.e., 0-9 employees, $50,000-$149,999 total payroll) were used for questions regarding number of employees, payroll, receipts, and percentages. Due to the sensitive nature of the survey questions, it was anticipated that asking for responses in ranges rather than exact numbers would increase the response rate. With enough responses, any variation from the exact amount was likely averaged out.

3.2.2.3 Survey Approach

Prior to beginning the project it was estimated and budgeted that approximately 500 establishments would need to be targeted for survey phone calls. Once the survey database was finalized, 564 establishments were listed as being in survey categories or as "unknown." Although the project budget constrained the total number of phone calls that were able to be placed, a statistical formula was used to ensure the correct number of completions was targeted and distributed appropriately by category. The number chosen for follow-up phone calls depended on the number of completed surveys needed in each category in order to obtain statistics accurate to +/- 10 percent at a 95 percent level of confidence.

This entailed randomly numbering all establishments to be surveyed. Phone calls were placed beginning with the first randomly selected business for each category and continued until all businesses in the category were called or an appropriate number of completions needed for statistical confidence was reached.

As was mentioned in the previous section, surveys were completed by telephone. Senior staff then reviewed all survey data for accuracy and completeness. Responses were then entered into the REI Study database. After checking the database for errors, the raw data was compiled and analyzed using a statistical approach.

3.2.2.4 Survey Calculations

Survey data was analyzed in an attempt to identify the recycling characteristics of establishments in Florida. Furthermore, because the Florida REI Study was conducted during the latter phases of the NERC REI Study, survey data from the NERC study was available for use by this study. For a limited number of categories (where survey data from Florida was lacking because categories contained small numbers of establishments and/or few establishments provided data) average per-establishment data from the Northeast was used to supplement the Florida data to provide better statistical accuracy. Survey data on three variables (number of employees, payroll, and receipts) provided the primary information analyzed.

Survey information obtained from 129 firms was used to estimate the number of employees[6] involved in recycling activities, as well as the dollar value of recycling and reuse payroll and receipts. Based on initial estimates and survey participation

[6] Employee responses were adjusted to a full-time equivalent basis. Thus, two employees each working 50% on recycling activities would be counted as one employee.

responses, R. W. Beck estimated the total number of firms engaged in recycling activities for each of fourteen survey business categories in the state. In Florida, nearly 220 firms are believed to be involved in recycling activities in these categories. For a detailed explanation of the statistical analysis of surveys, please refer to Appendix E – Statistical Analysis of Survey Results.

3.2.3 DERIVATION DATA

In the third strategy, derivations were made by using data from a variety of sources, such as trade organizations, industry experts, periodicals and other publications. Data points from various sources were pieced together to develop estimates of economic activity. As an example of this approach, a detailed explanation of the sources and methodology used for both public and private curbside collection of recyclables is given in Section 4.3, note 6. Additionally, direct data for three of the four support business categories was derived as a result of economic modeling.

3.3 INTERMEDIATE INPUT DATA FOR ECONOMIC MODELING

Prior to beginning economic modeling, the 26 direct recycling and reuse business categories were evaluated to identify those categories where recycling establishments were thought to significantly differ from similar non-recycling establishments in the way they operate, their process inputs, and their purchases from other establishments in the economy. Next, existing in-house data from previous studies was examined to identify where recycling and reuse industry-specific data was lacking.

For those categories lacking adequate input data, a detailed survey that asked for much greater detail regarding the cost elements of production was sent to select establishments. Those establishments that were cooperative and expressed interest in the study during the gathering of the direct economic information (employment, payroll, and revenues) were targeted for the additional surveys. Only a handful of establishments were targeted for each business category because the major process inputs and cost elements of the businesses were assumed to be very similar to each other (and quite different from the cost elements of virgin business establishments).

3.4 ECONOMIC MODELING

This study modeled indirect, induced, and total economic values of 26 categories of recycling or reuse establishments using the Implan[7] economic model.

Economic modeling started with the purchase of data files that provided a standard inter-industrial accounting of the economy of Florida. These data files were procured from Minnesota IMPLAN Group, Inc., the data supplier for the Implan model. What followed was an eight-step process to construct a model that would isolate the 26

[7] The modeling system used for this study is called IMPLAN Pro, published by the Minnesota IMPLAN Group, Inc. Data are available and may be purchased from this company for all states and all counties in the U.S. Their data standards are rigorous, their data sets are updated annually, and their methods for compiling and processing the main input-output data sets are widely considered to be a significant enhancement of the basic I-O data that are compiled and solicited by the U.S. Bureau of Economic Analysis. This company has the largest user base of any of the commercial input-output models available in the U.S.

categories of recycling and reuse establishments from other establishments in the state so that their economic values could be separately analyzed and reported.

The eight-step process is described below:

1. U.S. standard industrial classifications were identified that best corresponded to the kind of recycling product, process, or service that each of the 26 recycling and reuse categories produces. This was necessary because there is no specific set of "recycling and reuse" industries in the 537 industries contained in the data files.
2. These industrial types were controlled for in the initial model while the remaining industries were aggregated to the one-digit SIC level. The initial model that was produced, then, had twenty-six specific recycling industry candidates and twelve broad industrial aggregates (e.g., farming, the remainders of manufacturing, wholesale trade, transportation, etc.).
3. The direct values obtained from the study were substituted for the direct values (also called the "social" accounts) in the model. Estimates of returns to proprietors, property income, and indirect tax payments to state and local governments were derived from the averages of the original industrial group. This assumed that the recycling or reuse firms yield roughly the same return on investment to sole proprietors or investors as the corresponding industry that may contain significant non-recycling establishments.
4. The remaining values in the parent category (the original values minus the recycling industry direct values) were then manually placed back into the one-digit industrial sector so that the only direct data in the sector reflected the recycling and reuse industries. This ensured the model's total amount of industrial activity summed to precisely the same value as it had originally, before isolating recycling and reuse business categories.
5. Recycling and reuse establishments differ from non-recycling and reuse establishments in the way they operate, their process inputs, and their purchases from other establishments in the economy. This step attempted to account for these differences with data from two sources: (1) the additional intermediate input data that was collected as described previously; and (2) "in-house" data from other previous county-level studies that were conducted in Iowa, Illinois, Nebraska, and Wisconsin counties that reflected the kinds of recycling industries measured in this study but did not contain virgin-only establishments. Twelve models were built from in-house data from counties to isolate recycling industries (primarily ferrous and nonferrous metals, plastics manufacturing, and paper industries) and their production characteristics. The production inputs in the model were then re-configured so that the industrial linkages to raw commodities, mining, or refiners were reduced and linkages to recycling-related processors were strengthened. These changes resulted in a recalculation of all of the production input values for each recycling and reuse industry category.
6. There are several other components to input-output modeling that were investigated. One modification involved changing regional purchase coefficients in

the model (RPCs). For some materials, recycled commodities may be shipped on average less or greater distances than the virgin alternative, including across state boundaries. In-house data from a previous Recycle Iowa Study (an early economic impact study of recycling) of the general likelihood of a recycled commodity being purchased locally for industrial usage was examined for its bearing on this study. Absent other information about some commodity types, the RPC adjustment for a recycling commodity that was believed to be much more likely purchased locally was estimated by taking the square root of the existing number for that industry. For example, an RPC of .31 in a commodity supply category would be inflated to .56 to increase the likelihood that the input commodity was purchased locally. RPCs were only changed for a small subset of industries[8] and were only done so to maximize the expected linkage between recovered materials collection, processing, and conversion into final demand goods.

There were other account categories that were assessed also in the I-O model. The byproducts category in the model itemizes the commodity production by industry. Each of these categories was scrutinized and assessed as to its reasonableness for each recycling or reuse industry. No other accounts categories were altered in the models (including exports, institutional demands, or household incomes).

7. The resulting model was then re-checked for errors, omissions, and reasonableness and re-estimated in final form. This step included rebalancing the model so that the gross total equaled the original starting values.
8. Once the final state model was constructed, multipliers were generated for each recycling and reuse industry for Total Industrial Output, Personal Income, Value Added, and Jobs. These multipliers were applied to the original direct values to isolate each industry's unique economic contribution.

In order to estimate state revenues associated with the economic data (both direct as well as indirect and induced), data on Florida's government finances were gathered for 1992 through 1997 from the U.S. Census of Governments publications. Data on incomes were obtained from the U.S. Bureau of Economic Analysis Regional Economic Information System. Annual incomes were converted to fiscal values, and the weighted average revenue incidences for state government own-source revenues[9] was compiled for:

- All State Taxes (e.g., personal, corporate, sales, use, excise, etc.)
- Charges and Fees (e.g., direct state charges and fees, including higher education and health)
- Miscellaneous Revenues (e.g., special revenues, gifts, interest earnings, etc.)
- Total Own-Source Revenues (i.e., the sum of the previous three items).

[8] RPCs were increased for the following categories: compost and miscellaneous organics producers, plastics reclaimers, motor vehicle parts (used), and wood reuse.

[9] Own-source means collected through the state revenue system and not received, for example, as a state disbursement of funds collected through the federal revenue system.

The revenue indices that were developed were then applied to the direct and total values of industrial output and personal income to yield state revenue estimates.

3.5 VALIDATION OF STUDY RESULTS

Upon completion of the REI study, various methods of internal and external review were used to ensure that both direct and indirect study results are valid and meaningful. The methods of internal review included:

- Review of completed surveys by senior staff;
- Comparisons to other industries in the region; and
- Estimations of recycling and reuse as a portion of Florida's economy.

External review included a review of the direct economic information for the 26 recycling and reuse categories by the FDEP. Furthermore, a previous review by state government staff and industry trade associations of the Northeast data produced by the NERC REI Study validated that the study methodology fairly and conservatively characterized the level of economic activity for their state or industry.[10]

[10] Trade associations that reviewed the NERC study included the American Forest and Paper Association, the American Plastics Council, the Institute of Scrap Recycling Industries, and the Steel Recycling Institute.

4 STUDY RESULTS

This section presents the detailed results and explanations of estimates for individual data points. The section contains:

- A general description of the format for the data tables;
- A table of results; and
- Numbered notes that correspond to specific data points in the data tables.

Section 4.1 describes the table format and column headings. Section 4.2 presents the detailed data tables while Section 4.3 gives a detailed explanation for each data point in the tables. For an explanation of a specific data point, simply look up the number of the associated note in Section 4.3.

4.1 GENERAL NOTES ON DATA TABLES

This section provides general information regarding the format of the data tables presented in section 4.2. Detailed descriptions of all table column headings and an explanation of the three tiers of data presented are given here.

4.1.1 THREE-TIERED APPROACH TO DATA PRESENTATION

Three facts about recycling and reuse businesses complicate recycling economic information studies and have led to inconsistency in past efforts:

1. Most establishments involved in recycling and reuse are part of industries in which many establishments do not recycle or reuse recovered materials or products at all;
2. Some establishments involved in recycling or reuse are also involved in non-recycling activities not intended to be covered in this study; and
3. Many recycling manufacturers use less than 100 percent recycled feedstock and/or adjust the percentage of recycled feedstock throughout the year.

Past studies have handled each of these challenges differently. In an effort to exclude non-recycling activities, some studies relied on survey respondents to estimate recycling activities. Other studies have targeted all facilities involved in recycling and did not attempt to adjust the statistics to account for non-recycling activities. Various industry and recycling experts have criticized both approaches.

To overcome these challenges, the Florida REI Study is reporting three tiers of statistics. The goals of this approach are:

- To report statistics on recycling and reuse-related businesses as they actually exist in the economy (i.e., as part of industries and establishments that do not always involve recycling); and

- To derive conservative estimates for the amount of economic activity that can "reasonably" be attributed exclusively to recycling. The three tiers of statistics are described below.

4.1.1.1 Tier One - Statistics on All Industry Establishments

Tier One statistics are reported only for certain business categories where data was available from a source that included all establishments in the category, even though some of them may not do any recycling. This information typically comes from U.S. Bureau of Census data by SIC code. For example, data for all paper mills will be shown even though some of those establishments do not utilize recovered paper.

4.1.1.2 Tier Two - Statistics on Establishments Involved in Recycling

Like Tier One, Tier Two statistics are only reported for certain business categories where data was available from a source that aggregated data for recycling and non-recycling establishments. The data covers only those establishments that have some involvement in recycling, and attempts to exclude data on establishments with no recycling activities. Although all of these establishments perform some amount of recycling or reuse activity, they may also perform non-recycling activities not covered in this report. For example, information on all paper mills that utilize recovered paper would be included here, even though some of these establishments may also be involved in non-covered activities like production of wood pulp.

4.1.1.3 Tier Three - Statistics on Covered Recycling Activities

Tier Three statistics are the heart of this study and are reported for all business categories. They are conservative estimates of the portion of economic activity in Tier One or Tier Two that can be reasonably attributed to the recycling activities covered in the study. Most Tier Three estimates are derived from survey results in which respondents themselves are asked to identify what percentage of their facility's activities involves "covered activities."[11] For some important categories, including paper, plastics and metals manufacturers, an algorithm is being used to estimate covered economic activity. The algorithms begin with Tier One and Tier Two data as described above. Then, the percentage of Tier Two activity involving covered recycling activities is being estimated based on available statistics and industry expert opinions. The exact approach used for each category is documented in detail in Section 4.3. Additionally, Tier Three statistics are reported in two columns, depending on whether the establishments in the category are "100 percent dependent on recycling," or simply "undertaking recycling activities." Those establishments that are dependent on recycling have 100 percent of employment and revenues derived from recycling activities, while those that are "undertaking recycling activities" have only a portion of economic activity derived from recycling. This distinction is intended to assist in accurately and conservatively reporting overall results and to further illuminate the actual structure of the recycling industry.

[11] For a complete definition of covered activities, refer to Section 2.1 and note 2 on page 4-9.

4.1.2 DEFINITIONS OF COLUMN HEADINGS IN THE DATA TABLES

For Table 4-2, the lettered column headings are defined as follows:

A. Business Category – for a detailed list of business category definitions, refer to Appendix A.

B. Data Type – the data types presented in Table 4-2 are:

- Establishments – an establishment is a single physical location of a company or government. A single company or government may have multiple establishments (physical locations).
- Employment – total number of employees for all establishments in a category.
- Annual Payroll – total annual payroll for all employees in a category; reported in thousands of dollars.
- Estimated Receipts – total annual estimated receipts for all establishments in a category; reported in thousands of dollars.
- Estimated Throughput – if possible, total tons of materials processed is estimated; reported in thousands of tons.[12]

C. Presents the combined statistics for all establishments in categories without regard to recycling activity.[13]

D. This is a subset of C and reports statistics on only those establishments with some portion of operations in covered recycling activities.[14] Establishments in this column may have all of their operations or only a portion of their operations involved in covered recycling activities. This column excludes any virgin-only establishments that may be shown in Column C.

E. This is a subset of D and focuses on the employment, payroll, and receipts figures in establishments with less than 100 percent of operations involved in recycling or reuse-related activities. The same establishments are considered in columns D and E. The employment, payroll, and receipts figures are adjusted to eliminate employees who are focused on virgin material preparation, and further discounted for other non-covered activities.

F. Presents estimates for establishments with 100 percent of operations dependent on recycling or reuse, which in most cases establishments consume no virgin material.[15] This column presents data that is discounted for non-covered activities.

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[12] Note that subtotals and grand totals for throughput are not shown due to the potential for triple-counting material by adding tons of the same material at three different stages - collection, local processing, and reclamation/manufacturing.

[13] A category may not show data for Column C because: (1) it does not have virgin-only establishments; or (2) virgin-only establishments were excluded from the data collection process.

[14] For a complete definition of covered recycling activities, refer to page 2-1 and note 2 on page 4-9.

[15] All domestic steel mills depend on a minimum level of scrap in their processes. Therefore, all steel mill economic activity is included in this column even though some mills use virgin feedstock.

G. Presents conservative estimates of total recycling or reuse-related economic activity. These estimates were developed by adding Columns E and F.

4.1.3 ABBREVIATIONS USED IN DATA TABLES

Table 4-1 presents a list of abbreviations used in the data tables.

Table 4-1
Abbreviations Used in Tables of Results

Abbreviation	Definition
AF&PA	American Forest and Paper Association
AISE	American Iron and Steel Engineers
APC	American Plastics Council
GPI	Glass Packaging Institute
REI	Recycling Economic Information Study
SPI	Society of the Plastics Industry
SRI	Steel Recycling Institute
U.S. Census SSEL	U.S. Census *Standard Statistical Establishments List*
U.S.G.S.	U.S. Geological Survey

4.2 DATA TABLES

Table 4-2
State of Florida
Summary of Recycling and Reuse Industry Economic Information

Annual Payroll and Estimated Receipts are in $1,000. Throughput is in thousands of tons.
All numbered notes are fully explained in Section 4.3 - Specific Notes on Data Tables
(D) - Data not disclosed due to a limited number of establishments in this business category and the need to avoid revealing data that could identify a single business. Data for multiple disclosure categories are included in totals.

		Tier 1		Tier 2		Tier 3				
		C. Total Statistics on All Industry Establishments (not all perform recycling or reuse-related activities) [1]		**D. Total Statistics on Establishments Undertaking Some Recycling or Reuse Activities** (includes recycling and non-recycling activities) [2],[3]		**E. Statistics on Employees Undertaking Recycling or Reuse Activities** (excluding virgin material preparation and downstream conversion activities) [2],[4]		**F. Statistics on Establishments 100% Recycling or Reuse-Dependent** (No virgin material) [2],[5]		**G. Estimates of Total Recycling-Related Economic Activity** (Sum of columns E and F)
A. Business Category	**B. Data Type**	**Estimates**	**Sources**	**Estimates**	**Sources**	**Estimates**	**Sources**	**Estimates**	**Sources**	
Recycling Industry Economic Activity										
1. Government Staffed Collection	Establishments							107	Derivation; multiple sources	107
	Employment							1,110	Derivation; multiple sources	1,110
	Annual Payroll							27,750	Derivation; multiple sources	27,750
	Estimated Receipts							31,870	Derivation; multiple sources	31,870
	Estimated							865	FL DEP 1997 Data [7]	865
2. Private Staffed Collection	Establishments							208	Derivation; multiple sources	208
	Employment							2,150	Derivation; multiple sources	2,150
	Annual Payroll							53,750	Derivation; multiple sources	53,750
	Estimated Receipts							61,867	Derivation; multiple sources	61,867
	Estimated							8,181	FL DEP 1997 data [9]	8,181
3. Compost and Miscellaneous Organics Producers	Establishments							56	REI Study Database [10]	56
	Employment							321	Survey results extrapolated	321
	Annual Payroll							9,515	based on state average.	9,515
	Estimated Receipts							36,003	(n=31). [11], [12]	36,003
	Estimated							1,725	FL DEP 1997 data [13]	1,725
4. Materials Recovery Facilities (MRFs)	Establishments							95	REI Study Database [10]	95
	Employment							2,218	Survey results extrapolated	2,218
	Annual Payroll							32,342	based on statistical average.	32,342
	Estimated Receipts							123,270	(n=31). [11], [14].	123,270
	Estimated							540	FL DEP 1997 data [15]	540
5. Recyclable Material Wholesalers	Establishments							408	US Census SSEL 1995 SIC	408
	Employment							4,164	code 5093. [16], [17]	4,164
	Annual Payroll							99,419		99,419
	Estimated Receipts							1,106,807		1,106,807
	Estimated							6,781	Derivation [18]	6,781
6. Glass Container Manufacturing Plants	Establishments					3	REI Study Database [10]			3
	Employment					998	Survey results extrapolated			998
	Annual Payroll					42,750	based on statistical average.			42,750
	Estimated Receipts					94,406	(n=2). [11],[19]			94,406
	Estimated					114	1997 Economic Census [20]			114
7. Glass Product Producers (other recycled uses)	Establishments					0	[21]			0
	Employment					0				0
	Annual Payroll					0				0
	Estimated Receipts					0				0
	Estimated Throughput					0				0

		Tier 1		Tier 2		Tier 3				
		C. Total Statistics on All Industry Establishments (not all perform recycling or reuse-related activities) [1]		D. Total Statistics on Establishments Undertaking Some Recycling or Reuse Activities (includes recycling and non-recycling activities) [2],[3]		E. Statistics on Employees Undertaking Recycling or Reuse Activities (excluding virgin material preparation and downstream conversion activities) [2],[4]		F. Statistics on Establishments 100% Recycling or Reuse-Dependent (No virgin material) [2],[5]		G. Estimates of Total Recycling-Related Economic Activity (Sum of columns E and F)
A. Business Category	B. Data Type	Estimates	Sources	Estimates	Sources	Estimates	Sources	Estimates	Sources	
8. Nonferrous secondary smelting and refining mills	Establishments			5	US Census SSEL 1995; SIC			5	From Column D [24]	5
	Employment			122	code 3341. [16], [22]			116	Column D adjusted for	116
	Annual Payroll			4,090				3,886	non-covered activities [24]	3,886
	Estimated Receipts			57,460				54,587		54,587
	Estimated Throughput			12	1992 Economic Census [23]			12	From Column D [24]	12
9. Nonferrous product producers	Establishments	14	U.S. Census SSEL, 1996; SIC	7	Column C adjusted for	7	From column D [28]			7
	Employment	1,516	codes 3351-3356. [16], [25]	758	non-recycling establishments [26]	682	Column D adjusted for			682
	Annual Payroll	39,800		19,900		17,910	non-covered activities [28]			17,910
	Estimated Receipts	22,301		11,151		10,035				10,035
	Estimated Throughput			41	1997 Economic Census [27]	41	From column D [28]			41
10. Nonferrous foundries	Establishments			36	US Census SSEL 1995; SIC	36	From column D [31]			36
	Employment			462	codes 3363-3369. [16], [29]	416	Column D adjusted for			416
	Annual Payroll			11,396		10,256	non-covered activities [31]			10,256
	Estimated Receipts			39,767		35,790				35,790
	Estimated Throughput			3	1997 Economic Census [30]	3	From column D [31]			3
11. Paper and Paperboard Mills/Deinked Market Pulp Producers	Establishments	15	US Census SSEL 1995; SIC	9	Derived from column C with	5	From Column D [35]	4	Derived from Column D with	9
	Employment	6,474	codes 2611, 2621, and 2631.	3,884	data from AF&PA Paper	1,495	Derived from Column D with	1,661	data from AF&PA [36]	3,156
	Annual Payroll	299,628	[16],[32]	179,777	Matcher. [33]	69,214	data from AF&PA and adjustment	76,855		146,069
	Estimated Receipts	2,148,050		1,288,830		496,200	for non-covered activities [35]	550,975		1,047,174
	Estimated Throughput			1,140	AF&PA [34]	439	Derived from Column D [35]	701	Column D - Column E [36]	1,140
12. Paper-based Product Manufacturers	Establishments							8	REI Study Database[10]	8
	Employment							244	Survey results extrapolated	244
	Annual Payroll							4,935	based on NERC regional average.	4,935
	Estimated Receipts							15,077	(n=5). [11],[37]	15,077
	Estimated Throughput							51	R.W. Beck estimate [38]	51
13. Pavement Mix Producers (asphalt and aggregate)	Establishments					2	REI Study Database[10]			2
	Employment					19	Survey results extrapolated			19
	Annual Payroll					371	based on statistical average.			371
	Estimated Receipts					3,544	(n=2). [11],[39]			3,544
	Estimated Throughput					63	R.W. Beck estimate [40]			63
14. Plastics Reclaimers	Establishments							24	APC Database [41]	24
	Employment							402		402
	Annual Payroll							9,512	U.S. Census 1997 [41]	9,512
	Estimated Receipts							33,864	Plastics News [41]	33,864
	Estimated Throughput							63	APC Database [41]	63
15. Plastics Converters	Establishments	755	Probe Economics [42]	123	Derivation; from SPI data [43]	123	From Column D [45]			123
	Employment	22,454	Probe Economics [42]	3,657	Derivation; from SPI data [43]	2,925	Column D adjusted for			2,925
	Annual Payroll	531,284	Probe Economics [42]	86,523	Derivation; from SPI data [43]	69,219	non-covered activities [45]			69,219

continued

		Tier 1		Tier 2		Tier 3				
		C. Total Statistics on All Industry Establishments (not all perform recycling or reuse-related activities) [1]		**D. Total Statistics on Establishments Undertaking Some Recycling or Reuse Activities** (includes recycling and non-recycling activities) [2],[3]		**E. Statistics on Employees Undertaking Recycling or Reuse Activities** (excluding virgin material preparation and downstream conversion activities) [2],[4]		**F. Statistics on Establishments 100% Recycling or Reuse-Dependent** (No virgin material) [2],[5]		**G. Estimates of Total Recycling-Related Economic Activity** (Sum of columns E and F)
A. Business Category	**B. Data Type**	**Estimates**	**Sources**	**Estimates**	**Sources**	**Estimates**	**Sources**	**Estimates**	**Sources**	
	Estimated Receipts	4,154,800	Probe Economics [42]	676,639	Derivation; from SPI data [43]	541,311				541,311
	Estimated Throughput			29	APC Database [44]	29	From Column D [45]			29
16. Rubber Product Manufacturers	Establishments					8	REI Study Database[10]			8
	Employment					337	Survey results extrapolated			337
	Annual Payroll					15,833	based on statistical average.			15,833
	Estimated Receipts					34,833	(n=6). [11],[46]			34,833
	Estimated Throughput					8	Estimated from FL DEP data [47]			8
17. Steel mills	Establishments			1	AISE Directory [48]			1	From Column D [49]	1
	Employment			(D)				(D)		(D)
	Annual Payroll			(D)				(D)		(D)
	Estimated Receipts			(D)				(D)		(D)
	Estimated Throughput			(D)				(D)		(D)
18. Iron and Steel foundries	Establishments			19	US Census SSEL 1995; SIC	19	From Column D [52]			19
	Employment			502	codes 3321-3325. [16], [50]	477	(Column D-Column F) adjusted for			477
	Annual Payroll			17,476		16,602	non-covered activities [52]			16,602
	Estimated Receipts			62,069		58,966				58,966
	Estimated Throughput			43	1997 Economic Census [51]	43	From Column D [52]			43
19. Other Recycling Processors/Manufacturers	Establishments					16	REI Study Database [10]			16
	Employment					516	Survey results extrapolated			516
	Annual Payroll					7,205	based on statistical average.			7,205
	Estimated Receipts					48,433	(n=8). [11],[53]			48,433
	Estimated Throughput					101	R.W. Beck estimate [54]			101
Recycling Industry Subtotals	**Establishments**					219		916		1,135
	Employment					7,865		12,385		20,251
	Annual Payroll					249,361		317,963		567,324
	Estimated Receipts					1,323,519		2,014,319		3,337,838

		Tier 1		Tier 2		Tier 3				
		C. Total Statistics on All Industry Establishments (not all perform recycling or reuse-related activities) [1]		**D. Total Statistics on Establishments Undertaking Some Recycling or Reuse Activities** (includes recycling and non-recycling activities) [2],[3]		**E. Statistics on Employees Undertaking Recycling or Reuse Activities** (excluding virgin material preparation and downstream conversion activities) [2],[4]		**F. Statistics on Establishments 100% Recycling or Reuse-Dependent** (No virgin material) [2],[5]		**G. Estimates of Total Recycling-Related Economic Activity** (Sum of columns E and F)
A. Business Category	**B. Data Type**	**Estimates**	**Sources**	**Estimates**	**Sources**	**Estimates**	**Sources**	**Estimates**	**Sources**	
Reuse and Remanufacturing Industry Economic Activity										
20. Computer and Electronic Appliance Demanufacturers	Establishments					4	REI Study Database [10]			4
	Employment					49	Survey results extrapolated			49
	Annual Payroll					808	based on state average.			808
	Estimated Receipts					4,038	(n=4). [11],[55]			4,038
	Estimated					N/A				N/A
21. Motor Vehicle Parts (used)	Establishments							497	US Census SSEL, 1995	497
	Employment							2,999	SIC code 5015; [16],[56]	2,999
	Annual Payroll							62,383		62,383
	Estimated Receipts							307,764		307,764
	Estimated							N/A		N/A
22. Retail Used Merchandise Sales	Establishments							1,899	US Census SSEL, 1995	1,899
	Employment							7,415	SIC code 5932; [16],[57]	7,415
	Annual Payroll							101,616		101,616
	Estimated Receipts							530,138		530,138
	Estimated							N/A		N/A
23. Tire Retreaders	Establishments							137	US Census SSEL, 1995	137
	Employment							663	SIC code 7534; [16],[58]	663
	Annual Payroll							14,063		14,063
	Estimated Receipts							74,013		74,013
	Estimated							N/A		N/A
24. Wood Reuse	Establishments					4	REI Study Database[10]			4
	Employment					70	Survey results extrapolated			70
	Annual Payroll					1,832	based on statistical average.			1,832
	Estimated Receipts					4,422	(n=3). [11],[59]			4,422
	Estimated					N/A				N/A
25. Materials Exchange Services	Establishments							1	REI Study Database[10]	1
	Employment							(D)	Survey results extrapolated	(D)
	Annual Payroll							(D)	based on statistical average.	(D)
	Estimated Receipts							(D)	(n=1). [11],[60]	(D)
	Estimated							N/A		N/A
26. Other Reuse	Establishments					6	REI Study Database [10]			6
	Employment					387	Survey results extrapolated			387
	Annual Payroll					7,008	based on statistical average.			7,008
	Estimated Receipts					35,625	n=(3). [11],[61]			35,625
	Estimated					N/A				N/A
Reuse Industry Subtotals	**Establishments**					14		2,534		2,548
	Employment					506		11,077		11,583
	Annual Payroll					9,647		178,062		187,709
	Estimated Receipts					44,084		911,915		955,999

		Tier 1		Tier 2		Tier 3				
		C. Total Statistics on All Industry Establishments (not all perform recycling or reuse-related activities) [1]		**D. Total Statistics on Establishments Undertaking Some Recycling or Reuse Activities** (includes recycling and non-recycling activities) [2],[3]		**E. Statistics on Employees Undertaking Recycling or Reuse Activities** (excluding virgin material preparation and downstream conversion activities) [2],[4]		**F. Statistics on Establishments 100% Recycling or Reuse-Dependent** (No virgin material) [2],[5]		**G. Estimates of Total Recycling-Related Economic Activity** (Sum of columns E and F)
A. Business Category	**B. Data Type**	**Estimates**	**Sources**	**Estimates**	**Sources**	**Estimates**	**Sources**	**Estimates**	**Sources**	
GRAND TOTALS	**Establishments**					233		3,450		3,683
Recycling and Reuse/Remanufacturing	**Employment**					8,371		23,462		32,138
	Annual Payroll					259,008		496,025		765,176
	Estimated Receipts					1,367,603		2,926,234		4,374,479

4.3 SPECIFIC NOTES ON DATA TABLES

The purpose of this section is to provide detailed descriptions of the numbered notes presented in Table 4-2.

[1] Statistics for Column C include data for all establishments in industries with recycling or reuse-related activities. Although the industry overall performs recycling or reuse-related activities, it may include some establishments with no recycling or reuse-related activities.

[2] Covered activities is defined as all activities that support:
- Transforming pre-consumer scrap materials or post-consumer products into a recycled material;
- Transforming recycled materials into a first intermediate product (e.g. sheet, fiber, roll);
- Transforming recycled materials directly into a finished product;
- Preparing used products for reuse; and
- Manufacturing equipment for the recycling or reuse industries.

Covered activities *do not* include converting a first intermediate product to finished or semi-finished products or preparing materials for fuel use.

[3] Statistics are for establishments with some amount of covered recycling activities. Establishments may perform both non-recycling and recycling activities.

[4] These estimates include activities where virgin and recycled feedstock materials are co-processed. The estimates do not include virgin-only feedstock material preparation activities and further conversion of intermediate products to finished or semi-finished goods.

[5] Statistics on establishments where 100 percent of labor and receipts are dependent on recycling or reuse-related activities. The estimates do not include virgin-only feedstock material preparation activities and further conversion of intermediate products to finished or semi-finished goods.

[6] The data for Category 1, Government Staffed Residential Curbside Collection, was derived through an algorithm based on data points from a variety of sources. The following tables summarize calculations and data sources used in making estimates of economic activity for this category.

Table 4-3
Summary of Calculations

Data Type	Calculation
Establishments	1) K*D
Recycling Collection Employees	2) ((A/(B*C*F))*D*E)*(1+G)*(1+H)
Yard Waste Collection Employees	3) ((A/(B*L*F))*D*M*N*O)*(1+G)*(1+H)
Total Curbside Recycling and Yard Waste Collection Employees	4) Calculation 2+ Calculation 3
Annual Payroll	5) Calculation 4*I
Receipts	6) (A/B)*D*J*12 months/year

Table 4-4
Summary of Data Sources Used for
Government Staffed Residential Curbside Collection

Data Label	Data Type	Value	Reference
A	Population with curbside collection	11,070,000	BioCycle (4/99)
B	Persons per household	2.48	U. S. Census Bureau
C	Homes collected per truck per day	900	R. W. Beck Estimate
D	Percent of homes collected by government staffed collection	34%	R. W. Beck Privatization Study
E	Average crew per truck	1.5	R. W. Beck Estimate
F	Collection days per cycle	5	Assumes once per week collection
G	Additional percent supervisory	10%	R. W. Beck Estimate
H	Additional percent absenteeism, recycling coordinator, etc.	5%	R. W. Beck Estimate
I	Average payroll per employee	$25,000	1997 U. S. Economic Census
J	Recycling collection cost per household per month	$1.75	R. W. Beck Estimate
K	Number of curbside programs	315	BioCycle (4/99)
Additional Data for Yard Waste Collection			
L	Homes collected per truck per day	1000	R. W. Beck Estimate
M	Average crew per truck	2	R. W. Beck Estimate
N	Percent of households with yard waste collection	75%	Estimated from BioCycle (5/98)
O	Percent of year collection takes place	100%	R. W. Beck Estimate

[7] Estimated throughput is equal to total tons of residential recyclables plus yard waste from the FDEP's 1999 Solid Waste Management in Florida annual report times the percentage of homes collected by government staffed curbside collection.

[8] Calculations and values for Private Staffed Residential Curbside Collection are the same as those presented in Note 6, with the exception of Data Label D. For Category 2, Data Label D is "Percent of Homes Collected by Private Sector" and has a value of 66 percent.

[9] Throughput is equal to total state recycling collection minus throughput from government staffed curbside collection.

[10] Number of establishments for all survey categories is based on the REI study database.

[11] In general, data for all survey categories is based on a statistical analysis of survey results. See Section 3.2.2 for a detailed description of survey design and calculations. The number of completed surveys on which results are based is given as "n."

[12] Number of employees, payroll, and receipts for Compost Producers are based on a statistical analysis of survey results. Statistics are extrapolated based on 31 completed surveys for the state.

[13] Throughput is equal to tons of yard waste recycled as reported by FDEP.

[14] Number of employees, payroll, and receipts for Materials Recovery Facilities (MRFs) are based on a statistical analysis of survey results. Statistics are based on a total of 31 completed surveys for the state.

[15] Throughput is equal to the total tons of "minimum five" materials plus yard waste reported by FDEP multiplied by 66 percent (assumes that two-thirds of material collected goes to MRFs).

[16] Data derived from the 1995 U.S. Census Bureau's Standard Statistical Establishments List. See Section 3.2.1.2 for a detailed description of the use of census bureau statistics.

[17] Data are taken directly from U.S. Census SSEL for SIC code 5093 – Recyclable Material Wholesalers. This category includes a number of different types of businesses including scrap metal and plastics dealers, C&D processors, beneficiation facilities, crumb rubber producers and textile processors. No adjustments were made to Census data since the category is defined as 100 percent recycling-related.

[18] Throughput for Recyclable Material Wholesalers is derived as follows: Government Staffed Throughput + Private Staffed Throughput – Compost/Organics Throughput – Materials Recovery Facilities Throughput.

[19] Number of employees, payroll, and receipts for Glass Container Manufacturing Plants are based on a statistical analysis of survey results (2 completed surveys out of a total of 3 establishments).

[20] Throughput is estimated based on 1997 Economic Census reports showing a national average of 114 tons of cullet per employee. Throughput is equal to 114 tons x number of employees.

[21] No FL establishments in the REI database.

[22] Data for Nonferrous Smelting and Refining Mills is taken from SIC code 3341, Secondary Smelting and Refining. Estimates assume that a sizeable percentage of nonferrous scrap is recovered in secondary nonferrous mills.

[23] Throughput for nonferrous smelting and refining is estimated based on national scrap consumption for smelting and refining mills from the 1992 Economic Census, adjusted upward based on employment increases for this category. Data from the 1997 Economic Census were not used because they conform to the new NAICS system, which includes data for making nonferrous metal powder, paste, and flake from purchased nonferrous metals. Allocations to the state level are on a state-employment basis.

[24] Employment, payroll, and receipts are derived from Column D with an adjustment for the percent of covered activities (95 percent). Number of establishments and throughput are from Column D with no adjustment.

[25] Data for Nonferrous Product Producers is taken from U.S. Census SSEL for SIC codes 3351-3355 with no adjustments.

[26] Data are derived by multiplying Column C figures by 50 percent, the percentage of establishments assumed to be utilizing scrap or recycled materials, based on comments from U.S.G.S. nonferrous metals specialists.

[27] Throughput for Nonferrous Product Producers is estimated based on scrap purchases reported in the 1997 Economic Census. Total tons of scrap for the U.S. is calculated as: Total Scrap Cost (by SIC) / ($0.45/lb) / (2000 lbs./ton). Tons of scrap on the state-level is estimated as: Total tons of scrap x State Employees/U.S. Employees.

[28] Estimates of employees, payroll, and receipts are derived from Column D with an adjustment for the percent of covered activities (90 percent). Number of establishments and throughput are from Column D with no adjustments.

[29] Data for Nonferrous Foundries is taken from U.S. Census SSEL for SIC codes 3363, 3365, 3366, and 3369, with no adjustments.

[30] Throughput for Nonferrous Foundries is estimated based on scrap purchases reported in the 1997 Economic Census. Total tons of scrap for the U.S. is calculated as: Total Scrap Cost (by SIC) / ($0.45/lb) / (2000 lbs./ton). Tons of scrap on the state-level is estimated as: Total tons of scrap x State Employees/U.S. Employees.

[31] Estimates of employees, payroll, and receipts are derived from Column D with an adjustment for the percent of covered activities (90 percent). Number of establishments and throughput are from Column D with no adjustments.

[32] Data for Paper, Paperboard, and Deinked Market Pulp Producers is taken directly from the U.S. Census SSEL for SIC codes 2611, 2621, and 2631, with no adjustments.

[33] Establishments, employees, payroll, and revenue figures are derived from Column C by multiplying each data point by the percentage of pulp, paper, and paperboard mills in the state utilizing recovered paper (as found in *Paper Matcher*).

[34] Throughput is taken from the AF&PA Annual Statistical Summary Recovered Paper Utilization (April, 1999). Throughput numbers used are for 1995 to coincide with the data from U.S. Census SSEL. For FL, AF&PA reported recovered paper consumption combined with GA. Therefore, throughput is apportioned based on FL employees as a percent of total FL and GA employees.

[35] Data in column E is derived from Column D based on data from AF&PA Paper Matcher. Number of establishments from Column D is multiplied by 55 percent (national percentage of mills utilizing recovered paper but which do not entirely depend on recovered paper). Employees, payroll, and receipts from Column D are multiplied by 55 percent and again by 70 percent (average percent of employees involved in covered recycling–related activities in mills that are not entirely dependent on recycling).

[36] Data in column F is derived from Column D based on data from AF&PA Paper Matcher. Number of establishments, employees, payroll, and receipts from Column D are multiplied by 45 percent (national percentage of mills utilizing recovered paper which are entirely dependent on recovered paper) and again by

95 percent (adjustment for non-covered activities). Throughput is equal to Column D – Column E.

[37] Number of employees, payroll, receipts, and throughput for Paper-Based Product Producers are derived based on results from the NERC states because only one FL establishment responded for this category.

[38] Throughput is estimated on a tons per employee basis derived from a limited number of survey responses for the NERC states and FL.

[39] Number of employees, payroll, and receipts for Pavement Mix Producers are based on a statistical analysis of survey results.

[40] Throughput for Pavement Mix Producers is estimated based on NERC web site data for asphalt/concrete and a limited number of survey responses for the NERC states and FL.

[41] For Plastics Reclaimers, establishments, employees, and throughput are based on the American Plastics Council Handler & Reclaimer database developed by R.W. Beck. Payroll is calculated by multiplying employment figures by the average wage for Florida plastics industry employees ($23,661 — *Contribution of Plastics to the U.S. Economy*, prepared for the Society of the Plastics Industry by Probe Economics). Estimated receipts is calculated by multiplying pounds of recycled resins produced times an average of recycled resin prices from Plastics News.

[42] Establishments, employees, payroll, and receipts in column C for Plastics Converters are obtained from *Contribution of Plastics to the U.S. Economy*, prepared for the Society of the Plastics Industry by Probe Economics, and multiplied by 84 percent (national employment percentage of the "industry" that converts products instead of selling resins, making molds, selling machinery, and wholesaling products).

[43] Number of establishments, employees, payroll, and estimated receipts in Column D are derived by multiplying column C figures by the industry-wide recycled-content percentage (5.7 percent) divided by the average recycled content of products that contain recycled materials (35 percent).

[44] Throughput is estimated based on data from the APC Handler & Reclaimer database developed by R. W. Beck.

[45] Number of establishments and throughput are directly from Column D. Employees, payroll, and receipts are derived from Column D by multiplying by the estimated percent of employees at recycling-related establishments that are involved in covered recycling-related activities (80 percent).

[46] Number of employees, payroll, and receipts for Rubber Product Manufacturers are based on a statistical analysis of survey results.

[47] Throughput for Rubber Product Manufacturers is estimated based on data provided by the FDEP 1999 Solid Waste Management in Florida report.

[48] Based on data from the AISE 1998 Directory of Iron and Steel Plants, only one steel mill is located in FL. Employment, payroll, receipts, and throughput are not shown due to disclosure issues. Data for disclosure issues is not shown in industry Subtotals, but is included in Grand Totals.

[49] Establishments in column F are based on the number of electric arc furnaces (EAF) (Steel Manufacturer's Association Member Directory, 1998). EAF's

consume virtually 100 percent scrap. Number of employees, payroll, receipts, and throughput are not shown for Column F due to disclosure issues.

[50] Steel Recycling Institute states that all foundries as a matter of practice utilize a significant percentage of scrap in the making of new iron products.

[51] Throughput for Iron and Steel Foundries is estimated as the state's percentage of total national foundry employees multiplied by national scrap consumption by foundries (1997 Economic Census).

[52] In Column E, establishments and throughput are taken directly from Column D. Employees, payroll, and receipts from Column D are multiplied by 95 percent, the estimated percent of foundry employees involved in covered recycling-related activities.

[53] Number of employees, payroll, and receipts for Other Recycling Processors/Manufacturers are based on a statistical analysis of survey results.

[54] Throughput is estimated as 195 tons per employee based on a limited number of survey responses for the NERC region and Florida.

[55] Number of employees, payroll, and receipts for Computer and Electronic Appliance Demanufacturers are based on a statistical analysis of survey results.

[56] Estimates for Motor Vehicle Parts are taken directly from U.S. Census SSEL for SIC code 5015 with no adjustments.

[57] Estimates for Retail Used Merchandise Sales are taken directly from U.S. Census SSEL for SIC code 5932 with no adjustments.

[58] Estimates for Tire Retreaders are taken directly from U.S. Census SSEL for SIC code 7534 with no adjustments.

[59] Number of employees, payroll, and receipts for Wood Reuse are based on a statistical analysis of survey results.

[60] Number of employees, payroll, and receipts for Materials Exchange Services are not shown due to disclosure issues. Data for disclosure issues is not shown in industry Subtotals, but is included in Grand Totals.

[61] Number of employees, payroll, and receipts for Other Reuse are based on a statistical analysis of survey results.

4.4 ANALYSIS OF RESULTS

Table 4-5 presents an analysis of three data types related to the results presented in Table 4-2. The three analyses performed for each category and sector (recycling, reuse, or support businesses) were:

- The number of establishments, employees, payroll, and receipts as a percentage of the total for all categories;
- Number of employees per establishment; and
- Average annual payroll per employee.

Table 4-5
Analysis of Economic Activity for the Recycling and Reuse Industry

Annual Payroll and Estimated Receipts are in $1,000. Throughput is in thousands of tons.
(D) - Data not disclosed due to a limited number of establishments in this business category and the need to avoid revealing data that could identify a single business. Data for multiple disclosure categories are included in totals.

Business Category	Data Type	Estimates of Recycling and Reuse-Related Economic Activity	Percent of Total for All Categories	Employees per Establishment	Annual Payroll per Employee	Estimated Receipts per Employee
Recycling Industry Economic Activity						
1. Government Staffed Residential Curbside Collection	Establishments	107	2.9%			
	Employment	1,110	3.5%	10		
	Annual Payroll	27,750	3.6%		25	
	Estimated Receipts	31,870	0.7%			29
2. Private Staffed Residential Curbside Collection	Establishments	208	5.6%			
	Employment	2,150	6.7%	10		
	Annual Payroll	53,750	7.0%		25	
	Estimated Receipts	61,867	1.4%			29
3. Compost and Miscellaneous Organics Producers	Establishments	56	1.5%			
	Employment	321	1.0%	6		
	Annual Payroll	9,515	1.2%		30	
	Estimated Receipts	36,003	0.8%			112
4. Materials Recovery Facilities (MRFs)	Establishments	95	2.6%			
	Employment	2,218	6.9%	23		
	Annual Payroll	32,342	4.2%		15	
	Estimated Receipts	123,270	2.8%			56
5. Recyclable Material Wholesalers	Establishments	408	11.1%			
	Employment	4,164	13.0%	10		
	Annual Payroll	99,419	13.0%		24	
	Estimated Receipts	1,106,807	25.3%			266
6. Glass Container Manufacturing Plants	Establishments	3	0.1%			
	Employment	998	3.1%	333		
	Annual Payroll	42,750	5.6%		43	
	Estimated Receipts	94,406	2.2%			95
7. Glass Product Producers (other recycled uses)	Establishments	0	0.0%			
	Employment	0	0.0%	N/A		
	Annual Payroll	0	0.0%		N/A	
	Estimated Receipts	0	0.0%			N/A
8. Nonferrous Secondary Smelting and Refining Mills	Establishments	5	0.1%			
	Employment	116	0.4%	23		
	Annual Payroll	3,886	0.5%		34	
	Estimated Receipts	54,587	1.2%			471
9. Nonferrous Product Producers	Establishments	7	0.2%			
	Employment	682	2.1%	97		
	Annual Payroll	17,910	2.3%		26	
	Estimated Receipts	10,035	0.2%			15
10. Nonferrous Foundries	Establishments	36	1.0%			
	Employment	416	1.3%	12		
	Annual Payroll	10,256	1.3%		25	
	Estimated Receipts	35,790	0.8%			86
11. Paper and Paperboard Mills/Deinked Market Pulp	Establishments	9	0.2%			
	Employment	3,156	9.8%	351		
	Annual Payroll	146,069	19.1%		46	
	Estimated Receipts	1,047,174	23.9%			332
12. Paper-based Product Manufacturers	Establishments	8	0.2%			
	Employment	244	0.8%	31		
	Annual Payroll	4,935	0.6%		20	
	Estimated Receipts	15,077	0.3%			62
13. Pavement Mix Producers (asphalt and aggregate)	Establishments	2	0.1%			
	Employment	19	0.1%	10		
	Annual Payroll	371	<0.1%		20	
	Estimated Receipts	3,544	0.1%			187
14. Plastics Reclaimers	Establishments	24	0.7%			
	Employment	402	1.3%	17		
	Annual Payroll	9,512	1.2%		24	
	Estimated Receipts	33,864	0.8%			84
15. Plastics Converters	Establishments	123	3.3%			
	Employment	2,925	9.1%	24		
	Annual Payroll	69,219	9.0%		24	
	Estimated Receipts	541,311	12.4%			185
16. Rubber Product Manufacturers	Establishments	8	0.2%			
	Employment	337	1.0%	42		
	Annual Payroll	15,833	2.1%		47	
	Estimated Receipts	34,833	0.8%			103

Business Category	Data Type	Estimates of Recycling and Reuse-Related Economic Activity	Percent of Total for All Categories	Employees per Establishment	Annual Payroll per Employee	Estimated Receipts per Employee
17. Steel Mills	Establishments	1	<0.1%			
	Employment	(D)	(D)	(D)		
	Annual Payroll	(D)	(D)		(D)	
	Estimated Receipts	(D)	(D)			(D)
18. Iron and Steel Foundries	Establishments	19	0.5%			
	Employment	477	1.5%	25		
	Annual Payroll	16,602	2.2%		35	
	Estimated Receipts	58,966	1.3%			124
19. Other Recycling Processors/Manufacturers	Establishments	16	0.4%			
	Employment	516	1.6%	32		
	Annual Payroll	7,205	0.9%		14	
	Estimated Receipts	48,433	1.1%			94
Recycling Subtotals	**Establishments**	1,135	30.8%			
	Employment	20,251	63.0%	18		
	Annual Payroll	567,324	74.1%		28	
	Estimated Receipts	3,337,838	76.3%			165
Reuse and Remanufacturing Industry Economic Activity						
20. Computer and Electronic Appliance	Establishments	4	0.1%			
	Employment	49	0.2%	12		
	Annual Payroll	808	0.1%		16	
	Estimated Receipts	4,038	0.1%			82
21. Motor Vehicle Parts (used)	Establishments	497	13.5%			
	Employment	2,999	9.3%	6		
	Annual Payroll	62,383	8.2%		21	
	Estimated Receipts	307,764	7.0%			103
22. Retail Used Merchandise Sales	Establishments	1,899	51.6%			
	Employment	7,415	23.1%	4		
	Annual Payroll	101,616	13.3%		14	
	Estimated Receipts	530,138	12.1%			71
23. Tire Retreaders	Establishments	137	3.7%			
	Employment	663	2.1%	5		
	Annual Payroll	14,063	1.8%		21	
	Estimated Receipts	74,013	1.7%			112
24. Wood Reuse	Establishments	4	0.1%			
	Employment	70	0.2%	18		
	Annual Payroll	1,832	0.2%		26	
	Estimated Receipts	4,422	0.1%			63
25. Materials Exchange Services	Establishments	1	<0.1%			
	Employment	(D)	(D)	(D)		
	Annual Payroll	(D)	(D)		(D)	
	Estimated Receipts	(D)	(D)			(D)
26. Other Reuse	Establishments	6	0.2%			
	Employment	387	1.2%	65		
	Annual Payroll	7,008	0.9%		18	
	Estimated Receipts	35,625	0.8%			92
Reuse and Remanufacturing Subtotals	**Establishments**	2,548	69.2%			
	Employment	11,583	36.0%	5		
	Annual Payroll	187,709	24.5%		16	
	Estimated Receipts	955,999	21.9%			83
GRAND TOTALS	**Establishments**	3,683	100.0%			
Recycling, Reuse and Remanufacturing	**Employment**	32,138	100.0%	9		
	Annual Payroll	765,176	100.0%		24	
	Estimated Receipts	4,374,479	100.0%			136

Over half of the economic activity for the recycling and reuse industry is accounted for by the following four categories:

- Recyclable material wholesalers;
- Paper, paperboard, and deinked market pulp mills;
- Plastics converters; and

- Retail used merchandise sales.

These four categories alone account for 55 percent of all employees and wages and 74 percent of total receipts.

A noticeable distinction exists between the recycling and reuse sectors regarding the size of establishments and average annual payroll. The recycling establishments have an average of 18 employees each, with an average annual payroll per employee of $28,000. Comparatively, the reuse sector is made up of smaller establishments (an average of 5 employees per establishment) with an average annual payroll of $16,000 per employee. Although the reuse and remanufacturing sector comprises 69 percent of total establishments, it makes up only 36 percent of total employees, 25 percent of payroll, and 22 percent of receipts.

The methodology used to capture reuse and remanufacturing activity for this report provides a conservative estimate for these sectors. This is because remanufacturing activities are often included with traditional manufacturing industries that were not included in this study. A report entitled *The Remanufacturing Industry: Hidden Giant* by Professor Robert T. Lund of Boston University estimated remanufacturing activities on a national level, although state or regional-level estimates were not attempted. Extrapolating the figures from that report down to Florida indicated that reuse and remanufacturing categories may be as much as 50 to 60 percent of total jobs, wages, and receipts for all categories.Another interesting observation can be made by comparing recycling categories that are primarily "local" establishments performing collection, sorting, and densification activities to those that source material from large distances for downstream processing, conversion, or manufacturing operations. Local collection and processing (baling, grading, densifying, etc.) includes:

- Government staffed residential curbside collection;
- Privately-staffed residential curbside collection;
- Compost and miscellaneous organics products producers;
- Materials recovery facilities; and
- Recyclable material wholesalers.

Establishments in the remaining recycling categories are considered to be downstream processors of recycled materials and tend to utilize recycled materials in manufacturing. When the two groups are compared, "local" collection and processing make up 49 percent of total recycling employment and 41 percent of receipts whereas non-local downstream processing makes up the remaining 51 percent of employment and 59 percent of receipts. This indicates that public and private investment in local recyclables collection and processing infrastructure pays great dividends in downstream private recycling economic activity. Public policy in the form of state or local laws and regulations that require collection of recyclables or that discourage disposal (e.g. disposal taxes, material specific bans, etc.), directly affects these local public and private sector establishments and indirectly the larger recycling and reuse industry as a whole.

4.5 ACCURACY AND COMPLETENESS OF RESULTS

The results of this study for the categories identified are thought to be realistic and generally conservative. The results for categories which used existing U.S. Census data are believed to be the most accurate, followed by data for survey categories, while the derivations are likely to be the least accurate because of the limited amount of available data for estimations. Census data, although updated yearly, lags in publication by three years so that data is not as current as data for survey categories. Survey data is current; however, confidence intervals for total employment, payroll, and receipts for certain categories are quite large because of the small number of establishments in those categories.

The study did encounter a number of limitations that impacted the ability to accurately capture all recycling and reuse activity. The limitations of the study include:

- Survey data asked for intervals rather than discrete numbers;
- Certain business categories that could be considered part of the recycling and reuse industry were excluded for logistical reasons. Examples include equipment remanufacturers (only national-level data was available) and collectors of commercial and industrial recyclables (very difficult to quantify).
- Many companies in non-traditional recycling categories, such as fluorescent lamps and carpets, were not easily identifiable and may not be included under any of the categories.
- Some derivations, such as that for plastics converters, are based on the best of several less-than-desirable options available; it is very difficult to assess the accuracy of those results.

Although the study was not able to capture every possible type of recycling and reuse activity, it is reasonably accurate for the categories shown and conservatively estimates the total amount of recycling and reuse activity taking place.

5 INDIRECT AND INDUCED ECONOMIC INFORMATION

5.1 OVERVIEW

This study modeled the economic values of twenty-six recycling or reuse categories. Further calculations were made to estimate selected state government revenues that would be associated with the levels of economic activity that were identified through the modeling process. This section provides an overview of the process of input-output modeling, its strengths, its limitations, and its adaptation to this study. This section also defines the terms used and what the model output data represents. The following section provides the results in tabular form.

5.1.1 INPUT-OUTPUT MODELING PROCESS AND LIMITATIONS

Economic values or economic effects studies are usually conducted with input-output (I-O) econometric models of a regional economy. Input-output modeling allows researchers to investigate the interdependencies that industries, institutions, and households have with each other in a region of study. I-O models, therefore, relate the products made within a region and the products consumed by industries and households in that same region.

At a basic level, any industry's or institution's output (usually its gross sales) requires employees, materials, utilities, capital investments, financing, maintenance, equipment, and service inputs. The probability that a firm purchases its inputs locally (meaning within the region being modeled) is estimated in the I-O model. Estimates of an industry's inputs mix and whether those inputs are purchased within the region being modeled are based on national and regional industrial surveys.

Primary survey information to update the national or regional statistics is needed to improve the quality of the model output, particularly where the industry segment under study may differ from national or regional averages. As was discussed previously in the Study Methodology section, this study performed limited surveys to obtain additional intermediate input data. Furthermore, it made use of in-house data from previous county-level and state-level modeling projects to further improve the quality of the model that was produced.

There are important limitations to these models that must be acknowledged. First and foremost, absent highly detailed and costly local industry surveys, which was not done for this study, national and regional averages for major industrial input categories (the production functions) and the likelihood of a local purchase of inputs for the industries that were studied (regional purchasing coefficients) were still heavily relied on. Industries that fall within general industrial categories normally have very similar industrial input characteristics. A plastics firm that produces finished goods from recycled stock will be configured very similarly to a plastics firm that produces goods primarily from virgin inputs. Except for the source of their commodity input into production and the physical configuration of their processing machinery, their overall remaining operational

characteristics -- transportation, utilities, services, maintenance, financial inputs, etc. -- are likely to be very similar. Consequently, in most instances, production characteristics of existing firms in the state of study provided a very good first pass at identifying intra-regional linkages and supply chains of goods and services required for production. Although the I-O model has information on up to 537 industries, there is no specific set of "recycling and reuse" industries. Consequently, the models that were produced were significantly modified to accept recycling and reuse industries distinctly. Furthermore, the use of in-house data and additional surveys for select recycling and reuse industries enhanced the quality of the model output for this study.

Other limits in these types of models include:

- Difficulties in capturing economies of scale, particularly for industries with relatively small numbers of establishments, where establishment-to-establishment variation may be significant (the current input values or production functions are, therefore, initially constant);
- An inability to identify input substitutes – especially in new technologies or in instances where input modes have changed;
- Dated data on industrial performance and purchases, particularly for industries that are newly-emerging or rapidly changing;
- In-state and out-of-state purchases of commodities within a study area are fixed (regional purchasing coefficients must be adjusted if it is suspected that the regional averages are not right); and
- An implicit assumption that input commodity supply is infinite and perfectly elastic.

I-O models, therefore, are just that -- models -- that simulate industrial inter-dependencies in the current economy under study. I-O models are not necessarily good models for forecasting because they model the existing economy, and do not forecast the net impact of replacing a virgin-commodity establishment with a recycled-commodity establishment, for example. Furthermore, the results for one region reflect the economy of that particular region and generally are not transferable to other regions. I-O models, therefore, have limits. Nevertheless, I-O models are comparably much less expensive to produce than more involved models, and do an excellent job of estimating the role a particular industry has (such as the recycling industry) on a specific economy.

The generic term “economic impact” is frequently used to describe a set of economic activities in a region. This term often suffers from serious misapplication. There are several kinds of economic activities that may occur within a particular region. For example:

- Firms may produce goods or provide services for export outside the region. They attract outside funds into the region that supports employment, industrial purchases, and household spending.

- Firms may substitute locally produced commodity inputs for those that previously were purchased from outside the region. In this case funds are retained in the region and flow to local suppliers to an industry.
- Firms may produce goods and services for local consumption (either by industries or by households). Although they may help to retain funds in the region, they may not cause significant additional economic activity.

I-O models identify the overall size and contribution of an industry -- its *economic effect* or *economic value* -- to the area mix of economic activity along with interdependencies that exist between it and other firms or service suppliers. In other words, the strength of linkages that exist among industries and the overall value (output, incomes, and jobs) of their production. The impact of an industry hasn't yet been determined.

In the case of firms that produce finished goods for export outside a region, there is a measurable *economic impact* – were it not for the external demand for the locally-produced product, the economic activity would not be in the local economy.

A much harder measure of potential economic impact falls into the category of import substitution. If a region is able to develop indigenous industries that produce a good that substitutes for a good that is imported, then that industry is *retaining* dollars in the state that used to be exported. An industry that produces a good using recycled feedstock that is supplied locally will create a product that substitutes local inputs for non-local inputs. Recycling industries often fit into the import substitution category, particularly in states without virgin feedstock production infrastructures. By utilizing recycled content, they are purchasing locally and, therefore, stimulating indigenous economic activity.

This study generally reserves the use of the term *economic impact* only for industries that have verifiable levels of exports -- where the output that they are producing is a genuine and real increase in industrial output for the region of study -- or for true import substitutes. To claim economic impacts over and above those just mentioned would involve much more extensive industrial measures for each category of establishments that was assessed in this study, and over a period of time.

This study does, however, isolate *total economic values* -- estimates, by category, of the value of economic inter-relationships that exist in Florida for the industries. These values are the intrinsic worth of a set of industrial activities to Florida. They represent a slice of the economic pie from a particular point of view.

In summary, economic models are and only can be estimates of inter-industrial linkages and regional values. They are based on an amalgam of federal, county, and state data, academic procedures, along with some survey-derived direct data, all compiled with due diligence for accuracy and reasonableness. Consequently, although an inter-industrial accounting framework is implied, all estimates are simulations of economic values based on the data employed and the assumptions implicit in the modeling.

5.1.2 KINDS OF ECONOMIC INFORMATION PRODUCED BY I-O MODELS

Input-output models produce many kinds of data for analysis and decision making. The more useful results for industrial leaders, planners, and policy makers are estimates of (1) total industrial output, (2) personal income, (3) value added, and (4) jobs. These are the categories of economic activity that are reported in detail in the data tables that follow this section. These terms are defined below:

- *Total industrial output* for most private industries is simply gross sales. For public or quasi-public institutions this normally includes all public outlays, along with the value of government sales and other subsidies received, to isolate the current economic value of their output to the citizens or the area served.
- *Personal income* includes the wages and salaries of employees and proprietors, normal profits to sole proprietors, and an estimate of the cash value of all benefits (e.g., social insurance, retirement, and medical benefits).
- *Value added* is a measure of gross regional product. It includes all personal income (employment compensation, incomes to sole proprietors) plus property incomes (dividends, interests, and rents), and indirect tax payments (primarily excise and sales taxes paid by individuals to businesses).
- *Jobs* is the number of positions in the economy, not the number of employed persons. This distinction is important because the relationship between job growth and labor force growth is very different in different industries. Some industries rely heavily on semi-skilled and part-time labor. Other industries generally only produce full-time, skilled jobs. It is always important, when possible, to quantitatively assess whether the jobs that are stimulated are part-time or full-time or higher-paying versus lower-paying.

Economic data is further reported as direct, indirect, induced, and total economic effects.

- *Direct effects* refer to the operational characteristics of the firms or institutions that are studied. This study measured the apparent value of twenty-six categories of recycling and reuse establishments. The direct output of these entities is, therefore, their reported gross sales. The direct jobs are the jobs that are associated with those establishments. The direct personal income contains their reported payments to all employees, plus an additional estimate of benefit values and of returns to sole proprietors. The estimate of benefit values and returns to sole proprietors were based on industrial averages in industries that are similar to the recycling and reuse industries included in this study.
- *Indirect effects* measure the value of additional economic demands that the direct firms or institutions place on supplying industries in the region. When firms produce goods or conduct business or when public entities provide public goods or services, they must make many purchases. Some of these are from suppliers in the area. Some are not. Public utilities, communications

systems, fuel, wholesale goods and services, manufactured goods, financial and legal services, raw and processed commodities, and a variety of professional services are necessary to produce the direct values described above.

- *Induced effects* accrue when workers in the direct and indirect industries spend their earnings on goods and services in the region. Induced effects can also be called household effects, and the terms are often used inter-changeably. When workers in direct and indirect industries purchase goods and services for household consumption, they, in turn, stimulate another layer of the economy. Most induced activity accrues to retail, services, and finance, insurance, and housing spending. Because employment is stimulated in these industries as well, *their* demands for inputs increase, yielding an additional round or additional rounds of indirect purchases and additional rounds of induced activity. The I-O models solve for these iterative rounds of transactions until all of the possible inter-industrial transactions have been accumulated.
- *Total economic effects* are the sum of direct, indirect, and induced effects. They are all of the transactions attributable, either directly or indirectly, to the activities of establishments in the business categories included in this study.

The term *multiplier* or *multiplier effect* is frequently used when referring to economic effects or economic impacts. There are different kinds of multipliers -- this study reports two types. The Type I multiplier identifies the value of direct and indirect transactions -- e.g., the output of a business category and all other output that it purchases from its suppliers in the region – relative to the value of only the direct transactions. The Type II multiplier identifies the value of <u>all</u> economic transactions (direct, indirect, and induced) that are stimulated in the economy by an industry under study, including the personal spending of employees throughout the supply chain whose economic activity is apportioned to the industry, relative to the value of only the direct transactions.

5.2 RESULTS

Table 5-1 shows estimates of economic activity accruing to establishments in business categories that provide goods or services to recycling and reuse industry establishments. The category Other Indirect Establishments shown in the table includes all other indirect establishments that provide goods or services (such as office supply companies, accounting firms, legal firms, building and landscape maintenance firms, etc.).

As Table 5-1 shows, the indirect economic activity accruing to Recycling and Reuse Equipment Manufacturers and Transporters composes a very significant portion of the total indirect effects, typically representing approximately 15-25 percent depending on the data type that is considered. It is important to note that the data for Recycling and Reuse Equipment Manufacturers is based on a statistical analysis of survey data and therefore represents complete data for those types of establishments located in a state. Totals for the other categories represent indirect activity relating to only the 26 categories of recycling and reuse industry establishments investigated for this study.

Table 5-1
Estimates of Indirect Economic Activity of Select Support Business Categories
(Annual Payroll and Estimated Receipts are in $1,000)

Business Category	Data Type	Value
Recycling and Reuse Equipment Manufacturers [1]	Employment	983
	Annual Payroll	29,075
	Estimated Receipts	217,230
Consulting/Engineering [2]	Employment	165
	Annual Payroll	5,721
	Estimated Receipts	12,764
Brokers [2]	Employment	72
	Annual Payroll	6,231
	Estimated Receipts	9,862
Transporters [2]	Employment	1,873
	Annual Payroll	56,965
	Estimated Receipts	197,088
Other Indirect Establishments [2]	Employment	14,201
	Annual Payroll	447,409
	Estimated Receipts	1,143,337
Support Businesses Totals	**Employment**	17,294
	Annual Payroll	545,401
	Estimated Receipts	1,580,281

Notes:
[1] Data for Recycling and Reuse Equipment Manufacturers are based on a statistical analysis of survey results.
[2] Data come from modeling output and reflect the indirect activity stimulated by the 26 direct categories of recycling and reuse establishments targeted by this study for direct data.

Listed below in Table 5-2 are the titles of data tables that follow and a description of the information they contain.

Table 5-2
Guide to Data Tables

Number	Title	Information Contained
Table 5-3	Recycling and Reuse Industry Economic Values and Multipliers	Shows direct, indirect, and induced economic values and multipliers for the 26 categories of recycling and reuse establishments
Table 5-4	Recycling and Reuse Industrial Multipliers Compared to Multipliers for Other Industries	Shows multipliers for the recycling and reuse industry as compared to multipliers for other major industrial sectors
Table 5-5	Summary of Recycling & Reuse Industry Effects on Own-Source State Government Revenues	Shows state taxes, charges and fees, miscellaneous revenues, and total state revenues associated with direct and total economic values for the 26 categories of recycling and reuse establishments

Table 5-3
Recycling and Reuse Industry Economic Values and Multipliers

	Jobs (Actual)				Jobs Multiplier		Personal Income (in $ Millions)				Income Multiplier		Industrial Output (in $ Millions)				Output Multiplier		Value Added (in $ Millions)				Value Added Multiplier	
	Direct	Indirect	Induced	Total	Type I	Type II	Direct	Indirect	Induced	Total	Type I	Type II	Direct	Indirect	Induced	Total	Type I	Type II	Direct	Indirect	Induced	Total	Type I	Type II
Recycling Collection																								
1. Government Staffed Residential Curbside Collection	1,110	59	265	1,433	1.05	1.29	28	2	7	37	1.06	1.32	32	5	18	55	1.15	1.73	34	3	12	48	1.08	1.43
2. Private Staffed Residential Curbside Collection	2,150	191	406	2,747	1.09	1.28	57	6	11	73	1.10	1.29	62	15	28	105	1.24	1.70	63	9	18	89	1.14	1.43
Subtotal	3,260	250	671	4,180	1.08	1.28	85	8	18	110	1.09	1.30	94	20	47	160	1.21	1.71	96	11	30	137	1.12	1.43
Recycling Processing																								
3. Compost and Miscellaneous Organics Producers	321	118	207	647	1.37	2.02	13	4	5	22	1.28	1.70	36	9	14	59	1.25	1.65	19	5	9	33	1.29	1.78
4. Materials Recovery Facilities (MRFs)	2,218	491	608	3,316	1.22	1.50	37	15	16	68	1.40	1.83	123	38	42	203	1.31	1.65	71	22	27	120	1.32	1.70
5. Recyclable Material Wholesalers	4,164	3,796	7,183	15,144	1.91	3.64	113	111	188	412	1.98	3.64	1,107	277	498	1,882	1.25	1.70	228	172	317	717	1.75	3.14
Subtotal	6,703	4,405	7,998	19,107	1.66	2.85	163	129	210	502	1.79	3.08	1,266	324	554	2,144	1.26	1.69	318	199	353	870	1.63	2.74
Recycling Manufacturing																								
6. Glass Container Manufacturing Plants	998	199	640	1,837	1.20	1.84	43	7	17	67	1.15	1.54	94	18	44	157	1.19	1.66	52	11	28	92	1.21	1.75
7. Glass Product Producers (other recycled uses)	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
8. Nonferrous secondary smelting and refining mills	116	180	130	426	2.55	3.68	4	6	3	13	2.46	3.25	55	15	9	79	1.28	1.45	6	10	6	21	2.66	3.65
9. Nonferrous product producers	682	0	126	808	1.00	1.18	18	0	3	21	1.00	1.18	10	0	9	19	1.00	1.87	18	0	6	24	1.00	1.30
10. Nonferrous foundries	416	185	210	811	1.45	1.95	10	6	6	22	1.58	2.13	36	16	15	67	1.46	1.87	11	10	9	30	1.91	2.76
11. Paper and Paperboard Mills/Deinked Market Pulp Producers	3,156	3,833	3,571	10,560	2.21	3.35	154	126	94	374	1.82	2.43	1,047	346	251	1,644	1.33	1.57	266	200	157	623	1.75	2.34
12. Paper-based Product Manufacturers	244	29	76	349	1.12	1.43	5	1	2	8	1.18	1.57	15	3	5	23	1.18	1.53	6	2	3	11	1.24	1.75
13. Pavement Mix Producers (asphalt and aggregate)	19	20	13	52	2.05	2.75	0	1	0	1	2.60	3.49	4	2	1	6	1.49	1.75	1	1	1	3	1.69	2.14
14. Plastics Reclaimers	402	135	118	656	1.34	1.63	10	5	3	17	1.47	1.80	34	13	8	55	1.38	1.63	12	7	5	25	1.58	2.00
15. Plastics Converters	2,925	2,685	2,149	7,759	1.92	2.65	71	87	54	212	2.22	2.98	541	227	152	920	1.42	1.70	114	139	95	347	2.22	3.06
16. Rubber Product Manufacturers	337	94	245	676	1.28	2.01	16	3	7	26	1.22	1.63	35	9	17	61	1.25	1.74	18	5	11	34	1.30	1.90
17. Steel mills	(D)	(D)	(D)	(D)	2.21	3.17	(D)	(D)	(D)	(D)	2.16	2.93	(D)	(D)	(D)	(D)	1.43	1.68	(D)	(D)	(D)	(D)	2.45	3.36
18. Iron and Steel foundries	477	261	331	1,069	1.55	2.24	17	9	9	35	1.51	2.01	59	22	23	104	1.37	1.76	21	13	15	48	1.65	2.36
19. Other Recycling Processors/Manufacturers	516	106	397	1,019	1.21	1.98	9	3	10	23	1.35	2.50	48	8	28	84	1.17	1.74	22	5	17	45	1.22	2.01
Subtotal	10,588	8,090	8,295	26,973	1.76	2.55	369	265	217	851	1.72	2.30	2,058	713	582	3,354	1.35	1.63	562	423	365	1,350	1.75	2.40
Reuse/Remanufacturing																								
20. Computer and Electronic Appliance Demanufacturers	49	14	17	80	1.29	1.63	1	0	0	2	1.58	2.11	4	1	1	7	1.33	1.62	1	1	1	3	1.67	2.33
21. Motor Vehicle Parts (used)	2,999	1,428	1,477	5,904	1.48	1.97	66	49	40	156	1.74	2.35	308	135	102	545	1.44	1.77	78	79	65	222	2.01	2.85
22. Retail Used Merchandise Sales	7,415	1,564	3,674	12,653	1.21	1.71	115	48	95	258	1.42	2.25	530	122	254	907	1.23	1.71	247	76	162	485	1.31	1.96
23. Tire Retreaders	663	367	359	1,389	1.55	2.10	17	12	10	38	1.71	2.29	74	31	25	130	1.42	1.76	32	19	16	67	1.59	2.08
24. Wood Reuse	70	20	33	123	1.29	1.76	2	1	1	3	1.32	1.77	4	2	2	8	1.39	1.91	2	1	1	5	1.35	1.97
25. Materials Exchange Services	(D)	(D)	(D)	(D)	1.22	1.51	(D)	(D)	(D)	(D)	1.10	1.21	(D)	(D)	(D)	(D)	1.23	1.46	(D)	(D)	(D)	(D)	1.11	1.21
26. Other Reuse	387	172	192	751	1.44	1.94	10	5	5	20	1.55	2.07	36	15	14	64	1.42	1.80	13	9	8	31	1.65	2.28
Subtotal	11,587	3,566	5,753	20,906	1.31	1.80	210	115	151	477	1.55	2.27	956	307	398	1,661	1.32	1.74	375	184	254	812	1.49	2.17
Total All Groups	32,138	16,311	22,717	71,167	1.51	2.21	827	516	596	1,939	1.62	2.34	4,374	1,363	1,581	7,319	1.31	1.67	1,352	817	1,001	3,170	1.60	2.35

(D) - Data not disclosed due to a limited number of establishments in this business category and the need to avoid revealing data that could identify a single business. Data for multiple disclosure categories are included in totals.

Table 5-4
Recycling and Reuse Industrial Multipliers Compared to Multipliers for Other Industries

	Output		Jobs		Personal Income		Value Added	
	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
Recycling and Reuse	*1.31*	*1.67*	*1.51*	*2.21*	*1.62*	*2.34*	*1.60*	*2.35*
Agriculture	1.26	1.64	1.15	1.40	1.24	1.66	1.26	1.69
Mining	1.28	1.50	1.57	2.23	1.54	2.05	1.27	1.53
Construction	1.30	1.71	1.32	1.84	1.29	1.73	1.43	2.10
Manufacturing	1.33	1.65	1.64	2.43	1.49	1.99	1.53	2.12
Transportation, Communications, & Utilities	1.33	1.70	1.57	2.31	1.43	1.92	1.34	1.76
Wholesale Trade	1.25	1.70	1.35	2.02	1.26	1.68	1.22	1.63
Trade	1.23	1.71	1.11	1.38	1.20	1.60	1.20	1.63
Financial, Insurance, & Real Estate	1.24	1.47	1.47	2.09	1.43	1.91	1.20	1.40
Services	1.34	1.91	1.24	1.69	1.26	1.69	1.34	1.94
Government	1.06	1.76	1.03	1.55	1.03	1.37	1.03	1.52

Table 5-5
Summary of Recycling & Reuse Industry Effects on Own-Source State Government Revenues

	Direct Effects (in $ Millions)				Total Effects (in $ Millions)			
	All State Taxes	Charges & Fees	Miscellaneous Revenues	Total Revenues	All State Taxes	Charges & Fees	Miscellaneous Revenues	Total Revenues
Recycling Collection								
1. Government Staffed Residential Curbside Collection	1.68	0.15	0.25	2.08	2.22	0.20	0.33	2.75
2. Private Staffed Residential Curbside Collection	3.46	0.31	0.52	4.28	4.45	0.40	0.66	5.51
Subtotal	5.14	0.46	0.77	6.36	6.67	0.59	1.00	8.26
Recycling Processing								
3. Compost and Miscellaneous Organics Producers	0.77	0.07	0.12	0.96	1.32	0.12	0.20	1.63
4. Materials Recovery Facilities (MRFs)	2.24	0.20	0.33	2.78	4.11	0.37	0.61	5.09
5. Recyclable Material Wholesalers	6.86	0.61	1.02	8.50	24.97	2.22	3.73	30.92
Subtotal	9.88	0.88	1.47	12.23	30.40	2.70	4.54	37.64
Recycling Manufacturing								
6. Glass Container Manufacturing Plants	2.63	0.23	0.39	3.26	4.06	0.36	0.61	5.03
7. Glass Product Producers (other recycled uses)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8. Nonferrous secondary smelting and refining mills	0.25	0.02	0.04	0.31	0.81	0.07	0.12	1.01
9. Nonferrous product producers	1.09	0.10	0.16	1.35	1.29	0.11	0.19	1.60
10. Nonferrous foundries	0.63	0.06	0.09	0.78	1.35	0.12	0.20	1.67
11. Paper and Paperboard Mills/Deinked Market Pulp Producers	9.34	0.83	1.39	11.56	22.66	2.01	3.38	28.06
12. Paper-based Product Manufacturers	0.30	0.03	0.05	0.38	0.48	0.04	0.07	0.59
13. Pavement Mix Producers (asphalt and aggregate)	0.02	0.00	0.00	0.03	0.08	0.01	0.01	0.10
14. Plastics Reclaimers	0.58	0.05	0.09	0.72	1.05	0.09	0.16	1.30
15. Plastics Converters	4.31	0.38	0.64	5.34	12.84	1.14	1.92	15.90
16. Rubber Product Manufacturers	0.97	0.09	0.14	1.20	1.58	0.14	0.24	1.96
17. Steel mills	0.63	0.06	0.09	0.78	1.85	0.16	0.28	2.29
18. Iron and Steel foundries	1.06	0.09	0.16	1.31	2.13	0.19	0.32	2.64
19. Other Recycling Processors/Manufacturers	0.55	0.05	0.08	0.68	1.37	0.12	0.20	1.70
Subtotal	22.37	1.99	3.34	27.70	51.55	4.58	7.69	63.83
Reuse/Remanufacturing								
20. Computer and Electronic Appliance Demanufacturers	0.05	0.00	0.01	0.06	0.11	0.01	0.02	0.13
21. Motor Vehicle Parts (used)	4.02	0.36	0.60	4.97	9.42	0.84	1.41	11.67
22. Retail Used Merchandise Sales	6.95	0.62	1.04	8.60	15.62	1.39	2.33	19.34
23. Tire Retreaders	1.00	0.09	0.15	1.24	2.31	0.20	0.34	2.85
24. Wood Reuse	0.12	0.01	0.02	0.15	0.21	0.02	0.03	0.26
25. Materials Exchange Services	0.02	0.00	0.00	0.02	0.02	0.00	0.00	0.03
26. Other Reuse	0.59	0.05	0.09	0.73	1.21	0.11	0.18	1.50
Subtotal	12.74	1.13	1.90	15.77	28.90	2.57	4.31	35.78
Total All Groups	50.13	4.45	7.48	62.07	117.53	10.44	17.53	145.50

5.3 INTERPRETATION OF RESULTS

This section is intended to aid readers in interpreting the results of the tables in the previous section.

Economic values are most accurate at the business category level. Summing totals by groups of recycling or reuse activity for the state as a whole (as has been done in the tables) results in some degree of duplicated accounting of economic activity. This is true for any set of industrial assessments in any input-output modeling scenario -- it is not a problem with recycling, per se, nor with this study, but arises simply because of the many business categories that are included in this study.

For example, direct sales by a raw commodity processor represent an input purchase by an industry producing a finished good for sale. A large portion of the raw commodity processor's direct sales is already reflected in the finished good industry's input purchases. In this case, then, aggregation biases the economic values in the subtotals and totals upwards. As a general rule, the higher the Type I multiplier (which is a measure of how strongly a firm depends on supplier inputs), the higher the probability of aggregation bias in reporting subtotals and totals. This is an inherent *Catch 22* in input-output modeling: to eliminate aggregation bias of this sort, the industries must be lumped together in the construction of the model so that inter-industrial transactions are properly accounted and the resulting multipliers are properly dampened. Doing so, however, eliminates the industrial detail that is desired.

Nevertheless, subtotals and totals have been produced so that relative comparisons can be made. Users of these findings, however, must be cautious to avoid claims about the recycling and reuse industry that may be unwarranted given that there is some degree of inflation in the subtotals or totals. Based on other modeling experience, it is believed that aggregation bias may have inflated the subtotals and totals by up to 15 percent, and possible higher. It is important to note that this bias is associated with any total that is derived from indirect and induced information, including total economic activity, subtotal/total multipliers, and total government tax revenues. Alternatively, **totals derived only from direct information and government tax revenues derived from direct economic activity do not include bias**.

Multipliers reveal potential changes in the regional economy attributable to a change in direct activity in a particular industry in that same economy. Multipliers can be instructive for anticipating economic growth, in the case of a new or expanding firm, and economic decline, in the case of a plant closing. Economic multipliers are often misunderstood and therefore improperly used. Developers, planners, and decision-makers frequently use national level multipliers that are produced by the U.S. Bureau of Economic Analysis (BEA) as points of comparison. These multipliers are called RIMS II (Regional Input-Output Multiplier System), and they are widely used by development groups to support economic investment or public spending. Multipliers are available for over 500 industries in the categories of earnings, employment, and industrial output. Many users, however, mistakenly apply these statistics because they:

- Fail to account for regional production and cost of living differences (detailed multipliers are available at the state and county level, but project promoters often rely on national averages due to costs);
- Use the wrong multiplier to describe a phenomenon (multipliers for different categories of economic activity can vary substantially); or
- Seek to promote industries with the largest multipliers possible without consideration of either the appropriateness of the application or of the actual scope of local production.

The reader can be assured that this study produced Type I and Type II multipliers that are specific Florida and are not directly derivative of national averages.

Before making any comparisons among multipliers, it is important to understand what influences them. Firms with strong linkages to area supplying firms or that pay relatively high earnings may yield comparatively higher multipliers. Firms that are otherwise not linked strongly to local suppliers or that pay lower than average wages will usually produce lower multipliers. More urbanized areas and states with larger and more diversified economies have, on the average, much higher multipliers than less populated, more rural states for the same types of businesses.

Given the above guides to interpreting the data, there are several general conclusions that can be drawn:

- Florida recyclable material wholesalers, non-ferrous smelting and refining mills, paper and paperboard mills, pavement mix producers, and steel mills tended to have the higher multipliers than establishments in other business categories.
- Larger and more populous states tend to produce industries with higher multipliers than other states.
- Investments in local recycling collection and processing and policies that encourage recycling and reuse yield significant total state government revenues from taxes, charges, fees, and miscellaneous revenues. For example, 58 percent of total recycling industry tax revenues arise from recycling manufacturing establishments and their indirect and induced economic activity.

6 RECOMMENDATIONS FOR FUTURE STUDIES

This section summarizes the recommendations for replicating the study in future years. Recommendations are:

- Carefully review changes in definitions from the SIC classification system to the NAICS system when utilizing U.S. Census data. Whereas this study utilized data based on the SIC system, future studies will need to utilize data based on NAICS. Although definitions for most categories remain unchanged, a few categories are worth noting. For example, the SIC system classifies materials recovery facilities (MRFs) under SIC 4953, Refuse Systems, which includes landfills and other waste handling facilities. The new NAICS system code, 56292, is specifically for MRFs. Therefore, the data for MRFs may be gathered by examining Census data rather than through surveys. An example of a category for which it may be more difficult to utilize existing data is nonferrous secondary smelting and refining mills. The NAICS definition for this category includes a few miscellaneous activities, such as alloying of zinc paste, that were not included in the SIC definition and should not be included in estimates of recycling-related activities.
- Narrow the definition of compost and organics producers and find listings of facilities through sources other than the Downing and Associates list[16]. Although the Downing and Associates list was thorough and complete, the definition of compost and organics was very broad, resulting in a large number of listings that were municipal mulching operations or only a small portion of a larger facility, such as a MRF or transfer station. *BioCycle* regularly publishes lists of various types of composting programs. Although it typically publishes only the program name, city, and state, it may be possible to make special arrangements to gain more detailed contact information.
- Make every attempt before mailing surveys to correctly classify establishments. Due to the diverse nature of the sources used to compile the database and the lack of classification for some electronic lists, a large number of establishments were misclassified, resulting in additional efforts during the surveying process and a smaller number of establishments in some categories than was initially expected.
- Redesign the survey form to allow one establishment to be classified in more than one category and allow the employment, payroll, and receipts amounts to be divided among the selected categories.
- Conduct more and better research on the industrial characteristics of recycling and reuse firms to improve the explanatory power of I-O models. This research should focus on the following areas:

[16] Please refer to Appendix B for a listing and evaluation of all sources used.

- Input-output tables (use, make, total requirements) for critical recycling and reuse industries so that inter-industrial transactions are better understood. Furthermore, constructing similar tables for non-recycling industries will better allow comparisons between recycling and non-recycling businesses.
- Tracking the throughput of major recycling commodities at state levels to the production of a final industrial or household good. For many industries there is not good information on the propensity of recyclables being purchased, processed, and manufactured into a consumer good within a state or region.
- A comparison of critical costs associated with the flow of recycled products into goods for final use.

Finally, follow-up study that would be useful and interesting should be considered, including:

- Additional research to better document intermediate input statistics for recycling businesses and to enable comparisons between recycling and non-recycling businesses in the same industry;
- Estimating the amount of economic activity that can be attributed to public policy since the Solid Waste Management Act of 1988; and
- Determining the amount of growth over today's baseline (as measured through this report) that could be realized by additional levels of recycling and reuse.