JUNE 22, 2005

Georgia Department of Community Affairs

(Funded through the Solid Waste Trust Fund)

FINAL REPORT

GEORGIA STATEWIDE WASTE CHARACTERIZATION STUDY

Final Report

Georgia Statewide Waste Characterization Study

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June 22, 2005

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Georgia Department of Community Affairs
GEORGIA STATEWIDE
WASTE CHARACTERIZATION STUDY

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INTRODUCTION

Introduction

The 1990 Georgia Comprehensive Solid Waste Management Act codified improved methods of solid waste management in the State. A section of the Solid Waste Management Act set forth a 25 percent statewide per capita municipal solid waste disposal reduction goal by July 1996. Although the State's per capita municipal solid waste disposal rate climbed from 5.56 pounds per person per day in 1993 to 7.14 pounds per person per day in 2003, many of Georgia's municipalities have made great strides in reducing the waste stream by promoting waste reduction, reuse, and recycling. Despite increased recycling and waste reduction program efforts in the 90's, Georgia has seen an annual increase, in aggregate and per capita, in the amount of waste sent to landfills in the past decade.

Information provided by the Georgia Department of Community Affairs ("DCA") indicates that, as of 2003, the state had 25.6 years of remaining permitted municipal solid waste disposal capacity.[1]

Waste composition data plays a critical role in solid waste system planning and design. Data generated from waste composition studies are used in several ways, including determining the quantity of material available for recovery, measuring the effectiveness of existing recycling programs, and right-sizing solid waste and recycling facilities.

Due to the importance of waste composition data in solid waste system planning and design, the Georgia DCA urges counties to use locally-developed waste composition data in preparing their respective solid waste master plans that are filed periodically with the State. Due to the cost and level of resources associated with conducting these studies, many counties opt to use alternative sources of data to estimate the composition of their waste stream. Alternative data—such as national waste generation estimates, or studies based on other states or regions of the country—may not accurately represent the local waste stream characteristics in Georgia.

DCA recognized the need to provide more accurate waste characterization data that would add to the validity of municipal solid waste management plans and make it easier for local governments to plan for and anticipate the full costs of their waste management programs. From a solid waste planning perspective, the State would benefit greatly from more comprehensive solid waste disposal data. DCA retained the

[1] 2004 Solid Waste Management Annual Report, Georgia Department of Community Affairs Office of Environmental Management. Annual Reports can be found online at the Georgia Department of Community Affairs' website at http://www.dca.state.ga.us/development/research/programs/swar.asp.

consulting firm of R.W. Beck, Inc. to perform a multi-phase, statewide municipal solid waste ("MSW") characterization study ("the Project") to better understand the composition of solid waste being disposed in Georgia.

Project Objectives

The purpose of the Project was to prepare information that can be used by cities and counties across Georgia to estimate the composition of their disposed municipal solid waste streams based on the results of a set of representative waste composition studies performed across the state. Waste generated outside the state of Georgia was excluded from the Study.

Specific objectives of the Study were to:

- Determine the composition of Georgia's overall waste stream;
- Determine the waste composition by Georgia Regional Development Center ("RDC");
- Compare the composition of waste for each of the material categories determined by DCA for each RDC and the State as a whole;
- Provide local governments with locally-developed waste composition data needed to prepare solid waste master plans; and
- Prepare a web-based, interactive computer model for Georgia's local governments' use in estimating the composition of their disposed waste stream.

These objectives were met by this Study and the data herein can be used by solid waste planners in each of the State's 159 counties and 528 municipalities. The study also provides a baseline, which has not previously been established, from which the State can redefine the reduction goals set forth in the 1990 Solid Waste Management Act. It should be noted that the statewide aggregate waste stream composition data that was developed in this study has a higher level of statistical confidence than RDC-level or generating sector composition profiles. Local estimates that are produced from this study's data, while not as precise as the statewide estimates, are however a vast improvement over current methods of estimating local waste composition.

Solid waste planners can use the results of this Study to better anticipate the amount of municipal solid waste disposed in their community/region, document anticipated tonnages, and plan for the design or retrofit of facilities needed to process the solid waste stream. Each of these outcomes is beneficial as the State seeks to emphasize the importance of the role of solid waste management planning and how it relates to determining the quantity of material available for recovery through municipal programs, measuring the effectiveness of existing recycling programs, and determining future needs for solid waste and recycling facility siting.

Report Organization

This report is organized into four sections plus appendices:

Section 1 – Introduction. This section introduces the purpose and scope of the Project.

Section 2 – Background. This section summarizes Georgia's key demographic and solid waste system data that were considered in developing a comprehensive sampling plan. Additionally, this section includes an evaluation of the county-level waste disposal data currently compiled by the Georgia Department of Natural Resources Environmental Protection Division, which forms the basis of the aggregate results in subsequent sections.

Section 3 – Methodology. This section describes the sampling plan, field data collection procedures and sorting procedures used in the 2003-2004 Study.

Section 4 – Statewide MSW Composition. This section of the report presents the results for the State as a whole (i.e., all regions aggregated). Composition results are broken down by material type, material group, and generating sector.

Appendices A through M – Composition by Regional Development Center. Appendices A through M of the report highlight waste composition by individual material category and by material group for each of the thirteen RDCs included in the study. These 13 RDCs contribute more than 90 percent of the MSW in the state.

Appendix N – Solid Waste Material Definitions. This appendix presents the material definitions used in this study.

Appendix O – Solid Waste Characterization Study Data Collection Form. Field data for the study were collected via a customized field data recording form. A sample of this form is included in this appendix.

Acknowledgements

This study could not have been successfully completed without assistance from many organizations and individuals. We would specifically like to thank the following organizations and individuals for the assistance they provided throughout the project.

Host Facilities	
Augusta, Richmond County Landfill (Mark Johnson, Assistant Director)	
City of LaGrange Landfill (David Brown, Director of Public Services)	
Columbus, Pine Grove Landfill (Ralph Jackson, Manager)	
DeKalb County Georgia - North Transfer Station (Billy Malone, Director of Sanitation, DeKalb County Georgia)	
DeKalb County-Seminole Rd (Billy Malone, Director of Sanitation, DeKalb County Georgia)	
EPI Transfer Station, Columbus (Jimmy Hunt, General Manager)	
EPI Transfer Station, Thomaston (Jimmy Hunt, General Manager)	
Houston County Landfill (Terry Dietch, Manager)	
Pecan Row Landfill (Ulysses Collins, Site Manager)	
Oak Grove Landfill (Republic Waste) (Mark Allen, General Manager)	
Rome, Walker Mountain Landfill (Mike Gattis, Director)	
Superior Landfill (Travis Dawn, Site Manager)	
Wayne County-Broadhurst Environmental (Republic Waste) (John Simmons, General Manager)	
Other Individuals	
Mike Cordesman, President and COO, Republic Waste, Inc.	Bogdon Mykhalus, Director, Pine Bluff Landfill (Waste Management)
Ross King, Assistant Director, Association County Commissioners of Georgia	Wes Mahaney, General Manager, Taylor County Landfill (Allied Services)
Tommy Stalnaker, Director of Operations, Houston County Public Works	Teresa Smith, Director, Richmond County Public Works
Rufus Riggs, Director of Public Services, Columbus, Georgia	

Section 2
BACKGROUND

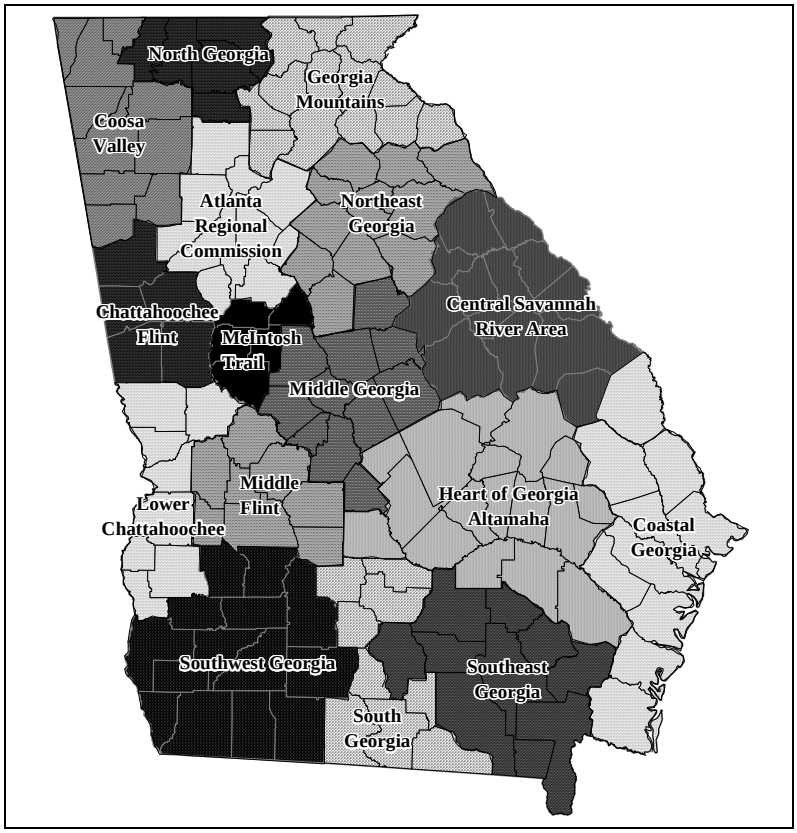
Introduction

This section provides background information about the demographics and disposed solid waste quantities in Georgia. Demographics and MSW quantities are important in developing a solid waste composition study.

Demographic Overview

Georgia is the largest state east of the Mississippi River (24th overall), spanning a land area of 57,906 square miles. Georgia is ranked as one of the most populous states in the United States and is home to 8.6 million people who live in 3.4 million housing units and have a mean annual household income of $ 42,433.

Figure 2-1 Georgia Regional Development Centers



Georgia is comprised of 159 counties that are grouped into 16 Regional Development Centers ("RDCs") based on geographical location. Figure 2-1 illustrates the geographic breakdown of the State's sixteen RDCs.

The objective of this project was to develop baseline data of Georgia's aggregate waste composition and differentiate that data according to the sixteen RDCs. The county make-up of each of the RDCs is detailed below.

Atlanta Regional Commission Regional Development Center. The Atlanta Regional Commission Regional Development Center includes Cherokee, Clayton, Cobb, DeKalb, Douglas, Fayette, Fulton, Gwinnett, Henry, and Rockdale counties.

Central Savannah River Area Regional Development Center. The Central Savannah River Regional Development Center includes Burke, Columbia, Glascock, Hancock, Jefferson, Jenkins, Lincoln, McDuffie, Richmond, Taliaferro, Warren, Washington, and Wilkes counties.

Chattahoochee Flint Regional Development Center. The Chattahoochee Flint Regional Development Center includes Carroll, Coweta, Heard, Merriwether, and Troup counties.

Coastal Georgia Regional Development Center. The Coastal Georgia Regional Development Center includes Bryan, Bulloch, Camden, Chatham, Effingham, Glynn, Liberty, Long, McIntosh, and Screven counties.

Coosa Valley Regional Development Center. The Coosa Valley Regional Development Center includes Bartow, Catosa, Chattooga, Dade, Floyd, Gordon, Haralson, Paulding, Polk, and Walker counties.

Georgia Mountains Regional Development Center. The Georgia Mountains Regional Development Center includes Banks, Dawson, Forsyth, Franklin, Habersham, Hall, Hart, Lumpkin, Raburn, Stephens, Towns, Union, and White counties.

Heart of Georgia – Altamaha Regional Development Center. The Heart of Georgia – Atlamaha Regional Development Center includes Appling, Bleckley, Candler, Dodge, Emanuel, Evans, Jeff Davis, Johnson, Laurens, Montgomery, Tattnal, Telfair, Toombs, Treutlen, Wayne, Wheeler, and Wilcox counties.

Lower Chattahoochee Regional Development Center The Lower Chattahoochee Regional Development Center includes Chattahoochee, Clay, Harris, Muscogee, Quitman, Randolph, Stewart, and Talbot counties.

McIntosh Trail Regional Development Center. The McIntosh Trail Regional Development Center includes Butts, Lamar, Pike, Spalding, and Upson counties.

Middle Flint Regional Development Center. The Middle Flint Regional Development Center includes Crisp, Dooly, Macon, Marion, Schley, Sumter, Taylor, and Webster counties.

Middle Georgia Regional Development Center. The Middle Georgia Regional Development Center includes Baldwin, Bibb, Crawford, Houston, Jones, Monroe, Peach, Pulaski, Putnam, Twiggs, and Wilkinson counties.

North Georgia Regional Development Center. The North Georgia Regional Development Center includes Fannin, Gilmer, Murray, Pickens, and Whitfield counties.

Northeast Georgia Regional Development Center. The Northeast Georgia Regional Development Center includes Barrow, Clarke, Elbert, Greene, Jackson, Jasper, Madison, Morgan, Newton, Oconee, Oglethorpe, and Walton counties.

South Georgia Regional Development Center. The South Georgia Regional Development Center includes Ben Hill, Brooks, Cook, Echols, Irwin, Lanier, Lowndes, Tift, and Turner counties.

Southeast Georgia Regional Development Center. The Southeast Georgia Regional Development Center includes Atkinson, Bacon, Berrien, Brantley, Charlton, Clinch, Coffee, Pierce, and Ware counties.

Southwest Georgia Regional Development Center. The Southwest Georgia Regional Development Center includes Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth counties.

Table 2-1 Demographics of Georgia's Regional Development Centers

Regional Development Center	Population	Households	Number of Commercial Establishments	Employment
Atlanta Regional Commission	3,429,379	1,328,889	101,571	1,760,405
Central Savannah River Area	426,482	171,616	8,502	234,796
Chattahoochee Flint	294,076	97,221	5,432	194,458
Coastal Georgia	574,283	206,717	13,089	407,086
Coosa Valley	556,207	188,544	8,965	390,407
Georgia Mountains	513,054	166,827	11,121	351,782
Heart of Georgia-Altamaha	279,589	98,923	5,583	299,901
Lower Chattahoochee	255,792	90,421	5,085	191,213
McIntosh Trail	141,773	49,163	2,471	82,240
Middle Flint	103,089	37,400	1,923	77,577
Middle Georgia	635,199	152,270	8,811	314,644
North Georgia	204,391	69,071	4,395	142,983
Northeast Georgia	483,435	161,335	9,715	339,203
South Georgia	214,520	76,219	4,924	159,810
Southeast Georgia	158,287	56,888	3,190	89,464
Southwest Georgia	258,147	129,164	6,678	16,444
State Totals	**8,627,703**	**3,080,668**	**192,490**	**5,302,414**

Population Source: U.S. Census 2003
Households Source: U.S. Census 2000
Employment Source: U.S. Census 2000
Number of Commercial Establishments: U.S. Census 2001

Table 2-1 presents demographics, by RDC, of the population, distribution of the number of households, the number of commercial establishments, and employment respectively. According to the latest Census Bureau data, the State contained over 192,000 businesses with 5.3 million employees.

Waste Disposal Overview

Regional Development Center and Statewide Waste Disposal

Information from Quarterly Disposal Reports from the State's Landfills

The purpose of the field sampling and sorting that was performed for this project was to definitively characterize the composition of disposed[1] municipal solid waste ("MSW")[2]. Accordingly, R.W. Beck evaluated other sources of disposal data to be factored into the overall analysis of the aggregate State-wide waste stream. Most of the solid waste generated in Georgia is collected and disposed in-State.

The Georgia Department of Natural Resources Environmental Protection Division ("GA DNR/EPD") compiles quarterly disposal reports from the State's landfills regarding the quantity of MSW that is disposed from each county.

Table 2-2 Waste Disposed by Regional Development Center

REGIONAL DEVELOPMENT CENTER	TONS OF MSW REPORTED	PERCENT OF STATE TOTAL
Atlanta Regional Commission	4,751,258	47%
Central Savannah River Area	308,022	3%
Chattahoochee Flint	274,089	3%
Coastal Georgia	682,326	7%
Coosa Valley	424,200	4%
Georgia Mountains	606,349	6%
Heart of Georgia-Altamaha	202,699	2%
Lower Chattahoochee	222,257	2%
McIntosh Trail	241,129	2%
Middle Flint	127,956	1%

[1] The terms "disposed" and "disposal," as used throughout the report, are intended to mean landfilled waste.

[2] Georgia's definition of MSW is "any solid waste derived from households, including garbage, trash, and sanitary waste in septic tanks and solid waste from single-family and multifamily residences, hotels and motels, bunkhouses, campgrounds, picnic grounds, and day use recreation areas. The term includes yard trimmings and commercial solid waste but does not include solid waste from mining, agricultural or silviculture operations, or industrial processes or operations." However, sludge/biosolids are excluded from this study.

REGIONAL DEVELOPMENT CENTER	TONS OF MSW REPORTED	PERCENT OF STATE TOTAL
Middle Georgia	608,562	6%
North Georgia	282,378	3%
Northeast Georgia	465,460	5%
South Georgia	226,382	2%
Southeast Georgia	249,467	3%
Southwest Georgia	364,806	4%
STATE TOTAL	10,037,540	100%

Use of this database provides valuable information about the MSW landfills throughout the state and the tonnage of MSW that each facility processes from any given RDC. Table 2-2 shows estimated MSW tonnage disposed by RDC from data reported by EPD.

As part of this report, R.W. Beck did not attempted to validate EPD's reported figures for RDC waste disposal.

Information from Survey of Georgia Landfills

Although the EPD landfill tonnage database is updated on a quarterly basis, the tonnage data may not be exactly accurate and may include tonnage of non-MSW waste going to MSW landfills, therefore varying the aggregate tonnage results. Prior to this study, R.W. Beck conducted a survey, for DCA, of 63 Georgia landfills to determine what amount of non-MSW waste was being disposed in Georgia's MSW landfills. DCA had reason to believe that a significant number of landfills were accepting a potentially large fraction of non-MSW waste such as agricultural waste, biosolids, manufacturing and construction and demolition waste. Such non-MSW waste contributes significantly to the State's MSW waste stream for reporting purposes and for measuring the State's progress in achieving the 25 percent waste reduction goal. For purposes of the survey, four categories of waste were defined:

- Municipal Solid Waste (MSW)
- Construction/Demolition
- Industrial Waste
- Sludge/Biosolids

Table 2-3 Waste Composition at Georgia MSW Landfills

Type of Waste	Weighted Average %	Maximum %	Minimum %	Median %	% of Surveyed Facilities Receiving Waste Type
MSW	66.6%	100.0%	30.0%	69.2%	100.0%
Construction & Demolition	12.3%	50.0%	0.0%	9.5%	88.1%
Industrial Waste	14.0%	53.3%	0.0%	10.5%	76.2%
Sludge/Biosolids	7.1%	22.0%	0.0%	2.0%	71.4%

Survey results showed that some landfills actually tracked materials by type and were able to derive accurate data based on scale records. Most landfills did not track incoming waste by the categories in the survey. These survey respondents estimated the proportion of each material type based on local knowledge of their customers, with some scale records for backup. The survey relied on educated estimates from landfill operators and therefore contributes some uncertainty to the survey results. Although it is not possible to accurately verify the industrial portion of the State's waste stream according to these results, the survey reflects that approximately two-thirds of waste going into Georgia's municipal landfills is actually MSW. Table 2-3 summarizes the results of the industrial waste survey (non-MSW survey).

Table 2-4 Adjusted Waste Disposed by Regional Development Center

Regional Development Center	Tons of MSW Reported	Adjusted Tons of MSW
Atlanta Regional Commission	4,751,258	3,164,338
Central Savannah River Area	308,033	205,143
Chattahoochee Flint	274,089	182,543
Coastal Georgia	682,326	454,429
Coosa Valley	424,200	282,651
Georgia Mountains	606,349	403,828
Heart of Georgia-Altamaha	202,699	134,997
Lower Chattahoochee	222,257	148,023
McIntosh Trail	241,129	160,592
Middle Flint	127,956	85,218
Middle Georgia	608,562	405,302
North Georgia	282,378	188,064

Regional Development Center	Tons of MSW Reported	Adjusted Tons of MSW
Northeast Georgia	465,460	309,996
South Georgia	226,382	150,770
Southeast Georgia	249,467	166,145
Southwest Georgia	364,806	242,961
STATE TOTAL	10,037,540	6,685,000

Table 2-4 shows the adjusted annual disposal tonnages statewide and by RDC after applying the weighted average percentage of MSW actually being disposed at MSW landfills throughout the state.

Waste Disposal by Season

The MSW stream begins as materials discarded at households and businesses. These discarded materials vary greatly depending on household demographics or the nature of a business. This variation can be seen in the composition of each truck and each load delivered to a landfill. Solid waste also varies by season due to:

- Tourism or seasonal residence use;
- Holiday discards;
- Variation in food and beverage consumption under different weather conditions; and
- Growing season impacts on yard waste.

Waste Disposal by Generating Sectors

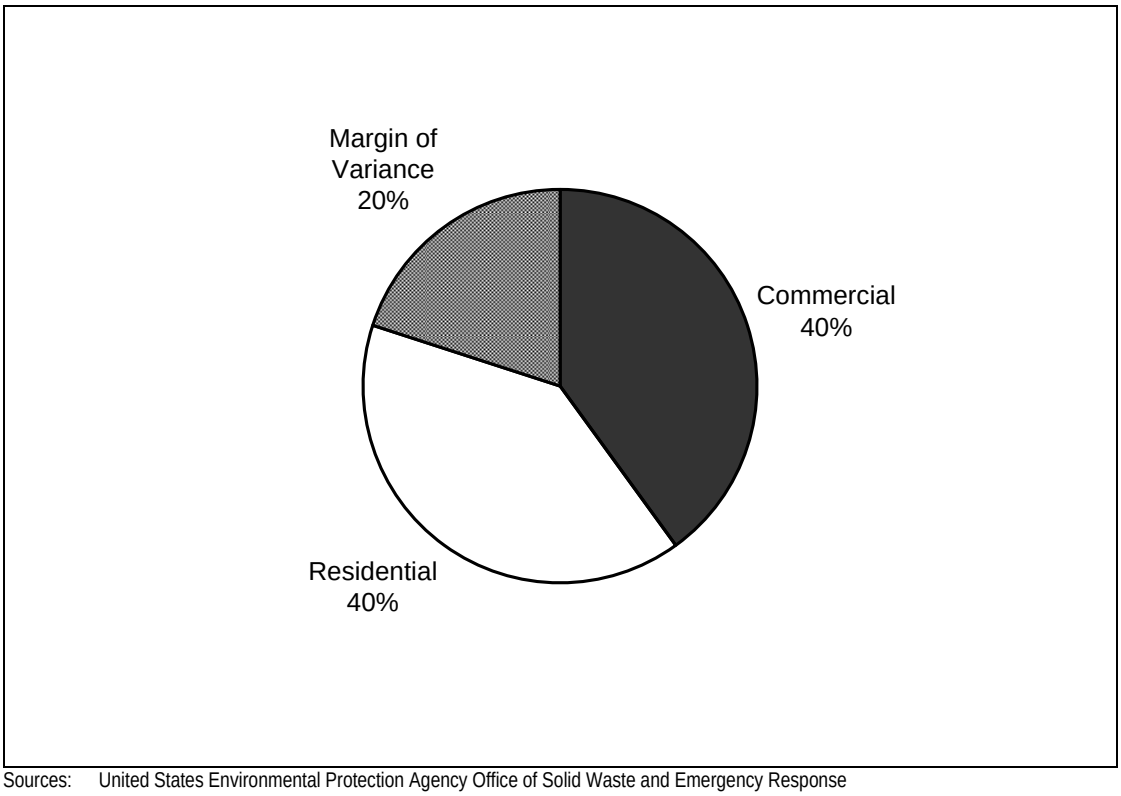
Georgia's State-level reporting system currently does not attempt to segregate the waste stream into different generating sectors. Rather, waste quantities are reported in the aggregate. Due to budget constraints, it was determined that only the aggregate statewide composition of the waste stream would be developed to a high degree of statistical precision.

This Study does, however, present informative data on the composition of the several distinct generating sectors that make up the entire waste stream. This was done for the following generating sectors:

- **Residential waste**: Waste generated in detached single-family residences that are typically served via routed collection by a hauler using specialized waste collection trucks or multi-family waste generated by multi-unit apartments and condominiums, and often collected via dumpster or cart service by a hauler using specialized waste collection trucks.
- **Commercial waste**: The commercial sector is highly variable, and includes waste from all non-residential sources including institutions, businesses, and industrial facilities (excluding specially classified industrial waste) often collected by a hauler using specialized waste collection trucks.

- **Self-haul waste**: Many areas, especially rural areas where curbside collection is not widespread, residents and even some businesses (e.g. contractors) commonly self-haul their waste for disposal, using cars, trucks, vans, and other non-packer trucks. This waste could be classified as residential, commercial, or mixed.
- **Transfer trailer waste**: Waste that is from distant locations is often reloaded into transfer trailers for more efficient long-hauling to a disposal site. These samples often contain a mixture of waste from the sources described above.
- **Convenience center/greenbox waste**: In rural areas where no routed collection service exists, there may be a network of convenience centers and/or greenboxes where single family residents, as well as some multi-family residents and businesses, drop off their waste. This waste, also, could be classified as residential, commercial or mixed.

Figure 2-2 Typical National Waste Production by Generating Sector



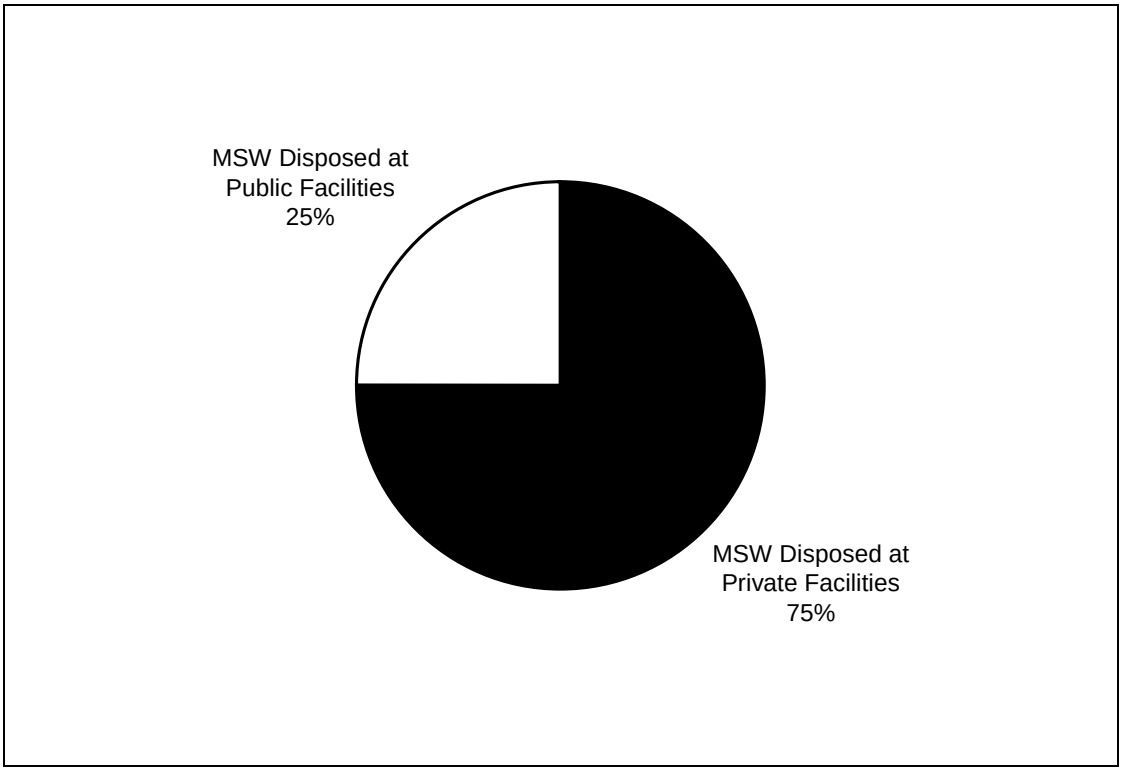
Sources: United States Environmental Protection Agency Office of Solid Waste and Emergency Response
Solid Waste Composition Studies from Minnesota, Wisconsin, California, Wake County North Carolina, and Denton Texas

Nationwide, waste sampling has shown the amount of commercial waste generated compared to the amount of residential waste generated typically falls within a ratio between 60 percent to 40 percent and 40 percent to 60 percent.

Waste Disposal by Landfill Type

The EPD landfill database also contains information regarding the type, or "dominion," of the landfills throughout Georgia. Dominion information shows that 75 percent of MSW is disposed at private facilities. The other 25 percent is disposed at public facilities.

Figure 2-3 MSW Disposal by Landfill Type



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Section 3
METHODOLOGY

Introduction

The overall purpose of this waste characterization study was to estimate the composition of the State's aggregate waste stream. This was done by taking samples of waste from across the Project area and sorting or characterizing the waste into various material groups and categories. Before a study can be performed, the study team will first know how the waste stream is to be characterized. In other words, the waste stream typically has materials made of paper, plastic, glass, etc. The Project team will determine to what finer level of detail the waste will be categorized.

An essential part of a waste composition study is the development of a sampling plan—the where, when, and how to take samples. The sampling plan for this project was developed so as to be within DCA's available budget; encompass data collection from the greatest number of the RDCs; achieve seasonal representation; and capture a statistically meaningful number of samples at each study site. Elements of the sampling plan include:

- Distribution of samples across RDCs;
- Seasonal distribution of samples;
- Generating sectors to be targeted;
- Host facility identification; and
- Project schedule.

Material Definitions

R. W. Beck worked with the Georgia Department of Community Affairs ("DCA") to define a list of disposed MSW material types that are of greatest interest to the State's solid waste and recycling planners. Seven major material groups were subdivided into 39 individual materials categories for the purposes of the study.

Table 3-1 Targeted Materials in Disposed MSW

Paper	**Metals**
Newspaper	Steel Cans
Corrugated Cardboard	Aluminum Cans
Office	Other Ferrous Metals
Magazine/Glossy	Other Nonferrous Metals
Paperboard	**Glass**
Mixed (Other Recyclable)	Clear
Other Paper (Non-recyclable)	Green
Plastic	Amber
#1 PET Bottles	Other
#2 HDPE Bottles	**Organics**
#3 - #7 Bottles	Yard Waste
Expanded Polystyrene	Wood (non-C&D)
Film Plastic	Food Waste
Other Rigid Plastic	Textiles
Inorganics	Diapers
Televisions	Fines
Computers	Other Organics
Other Electronics	**Construction & Demolition Debris**
Tires	Drywall
Household Hazardous Waste	Wood
Other Inorganics	Inerts
	Carpet
	Other C&D

The final list of material categories that were analyzed in the study are listed above in Table 3-1. Detailed definitions are contained in Appendix N.

Sampling Plan

As mentioned previously, the overall purpose of this waste characterization study was to estimate the composition of the State's aggregate waste stream to a high degree of precision. In order to accurately characterize waste by using a sampling technique, the Project team's objective was for the sampled waste to very closely represent the overall waste stream in the study region, (i.e., each RDC and the state of Georgia as a whole.)

At times, circumstances outside the control of the Project team impacted the team's ability to perfectly meet the waste composition study sampling plan. Sampling plans are devised with backup plans and other built-in quality control mechanisms. It is quite common for sampling plans to be adjusted during the study period.

A detailed sampling plan was included with the scope of work for this study. The original plan called for 600 samples to be obtained, from eight MSW disposal facilities, representing 13 of the State's 16 RDCs. The original schedule intended there to be four sampling seasons from spring 2003 through winter 2004.

The original plan was subsequently refined over the Project period. As a result, a total of 569 samples were sorted from 13 MSW recovery facilities, representing 13 of the State's 16 RDCs. Actual sampling took place from fall 2003 through summer 2004. The sections below describe significant elements of the sampling plan, as well as a summary of the sample breakdown.

Methodology for Sample Distribution over RDCs

Using EPD's landfill tonnage reports for the State-wide analysis, R.W. Beck apportioned the State's disposed waste stream by RDC. First, a list of landfills, by RDC, was compiled. Then the MSW tonnage data provided to EPD by each landfill was complied. Each landfill in an RDC was ranked and landfills that reported taking in the most waste in an RDC were selected to host a waste sort. The landfills reporting the most waste were targeted because the higher the percentage of the RDC waste processed at these facilities relates to the likelihood of obtaining samples that most represent waste for the RDC.

To ensure statistical accuracy, any chosen facility had to receive no less than 25,000 tons per year from the RDC being examined.

Many landfills received MSW from more than one RDC. When applicable, the Project team targeted such facilities to provide a wider ranging study that minimizes logistical complications and provides a greater value for the DCA.

Methodology for Sample Distribution by Season

Waste composition has been shown to vary by season. Certain components of the MSW stream—such as yard waste, construction and demolition debris, and selected packaging materials—are known to occur in the waste stream more frequently in certain seasons. To assure that the study results accurately captured variability associated with seasonal changes in the waste stream, field data collection was performed during four seasons across a nine-month timeframe.

Seasonal sampling distribution also provides a built-in quality control mechanism, allowing for adjustments in the sampling plan over time, when needed, to keep on course with Project objectives.

Methodology for Sample Distribution by Generating Sector

Nationwide waste sampling has shown that the MSW stream split between residential and commercial waste most often ranges between 60:40 and 40:60 residential to commercial waste. Refuse trucks are specialized and normally only collect waste from one type of generating sector. However, there are instances when waste from a variety of generators may be delivered in one truck, (e.g., waste in transfer trailers delivered

from transfer stations where various truckloads of waste are combined and compacted and waste from convenience centers or greenboxes in rural areas.)

For purposes of the Georgia statewide study, the Project protocol called for a 50:50 distribution of residential and commercial waste samples from each studied RDC and statewide, because a Georgia-specific split was not known. This methodology allows for a ten percent margin of variance one way or another to still fall within the nationwide average. The allowance for this variance was necessary, as determining the exact proportion of each generator of combined waste loads was deemed unlikely and cost prohibitive.

Methodology for Sample Distribution by Landfill Type

Knowing that 75 percent of Georgia's MSW stream is processed through private disposal facilities, the Project team decided to originally target only private waste disposal sites as host facilities for sampling operations.

In the event that a targeted private facility was unable or unwilling to participate, public facilities in each of the State's RDCs were identified as backup sites.

Again, the ultimate goal was to have a sample stream that closely represented the MSW stream of the study region – 75 percent of the samples from private facilities and 25 percent from public facilities.

Pre-Study Sampling Plan

In order to complete RDC geographic distribution for the original project budget, eight private landfills were initially selected for the sort. Two years passed from the time the Project scope was written and the time sorting was to begin. Originally, the seasonal distribution was scheduled over the four season period from spring 2003 through winter 2004. However, Solid Waste Trust Fund budget uncertainties and timing constraints between the scope submittal and Project initiation made it necessary to adjust the Project timetable.

Table 3-2 Original Seasonal Sampling Plan – Number of Samples

		Fall			Winter				Spring				Summer			
		Superior Landfill - Chatham County	Allied Services - Taylor County	Republic Wayne County Landfill	WMI-Live Oak - DeKalb County	Republic Waste - Oak Grove - Barrow County	Pine Bluff - Cherokee County	Rome Walker Road - Floyd County	Superior Landfill - Chatham County	Allied Services - Taylor County	Pecan Row Landfill - Lowndes County	Republic Wayne County Landfill	WMI-Live Oak - DeKalb County	Republic Waste - Oak Grove - Barrow County	Pine Bluff - Cherokee County	Total
REGIONAL DEVELOPMENT CENTER	Atlanta Regional Commission				20	20	20						20	20	20	120
	Central Savannah River Area	20							20							40
	Chattahoochee Flint				20								20			40
	Coastal Georgia	20							20							40
	Coosa Valley							40								40
	Georgia Mountains					20								20		40
	Heart of Georgia-Altamaha			20								20				40
	Lower Chattahoochee		20							20						40
	McIntosh Trail															0
	Middle Flint															0
	Middle Georgia		20							20						40
	North Georgia						20								20	40
	Northeast Georgia					20								20		40
	South Georgia										40					40
	Southeast Georgia			20								20				40
	Southwest Georgia															0
	Total	40	40	40	40	60	40	40	40	40	40	40	40	60	40	600

The updated pre-study plan projected a sampling timeline beginning in the fall of 2003 and ending in the summer of 2004. Table 3-2 summarizes the intended four season sort periods and landfill facilities before sorting began.

Table 3-3 Backup Locations for Sampling

RDC	Backup Landfill Facility
Atlanta Regional Commission	DeKalb County Landfill
Central Savannah River Area	Richmond County Landfill
Chattahoochee Flint	LaGrange Landfill
Coastal Georgia	Camden County Landfill
Coosa Valley	Bartow County Landfill
Georgia Mountains	Hall County Landfill
Heart of Georgia-Altamaha	Laurens County Landfill
Lower Chattahoochee	Columbus, Pine Grove Landfill
Middle Georgia	Houston County Landfill
North Georgia	Whitfield County Landfill
Northeast Georgia	Clarke County Landfill
South Georgia	Tifton-Omega/Eldorado Road Landfill
Southeast Georgia	Atkinson County Landfill

Thirteen public facilities were identified – one for each targeted RDC – in the event logistical problems arose for the originally targeted host sites. Table 3-3 lists the backup sampling locations that were identified by the Project team.

Post-Study Sampling Plan

Subsequent to the fall sort, R.W. Beck notified DCA of obstacles preventing sampling at some private and backup public facilities. Some entities denied sorting staff access to their facilities, despite prior notification via written letters and telephone correspondence from R.W. Beck and representatives of the DCA. Another obstacle to completing the seasonal sort as originally planned included the state enforced closure of the Live Oak landfill. In addition, logistical issues became apparent at some facilities. One example was a landfill that received most of its MSW via transfer trailers. The facility was constructed in such a way that the truck loads were removed using an apparatus to literally lift the semi trailers and dump their loads – one on top of another – in a giant pit. There would be no way for the Project team to select one sample independent from others.

The issue involving gaining access to host facility sites warrants further discussion. In agreement with the DCA, the project team went through extraordinary efforts to obtain access to private facilities, in an attempt to remain true to the regionally representative sampling methodology. The most common objection raised related to safety concerns. One agreement for access required documentation of safety training of all on-site Project members, a request for extending R. W. Beck insurance to cover the private party, and legal waivers. Though R. W. Beck has an extensive safety plan and sort training protocol, time was required for negotiations and to gather and produce all required documentation. In another instance, facility managers were hesitant to host

sorting operations because of space limitations due to new cell construction. The Project team was able to work with the facility and state permitting authorities to obtain a special amendment to the facility's permit to allow for additional space to be used for a sample staging and sorting area. The site access delays caused the second seasonal sort to begin three months behind schedule. Instead of starting in November 2003, the Winter sort started February 9, 2004.

Table 3-4 Revised Actual Seasonal Sampling Plan – Number of Samples

		Fall			Winter			Spring				Summer					
		Pecan Row Landfill (Private)	LaGrange Landfill (Public)	DeKalb County Landfill (Public)	Superior Landfill (Private)	Republic Waste - Oak Grove Landfill (Private)	Wayne County Landfill (Private)	Rome Walker Mtn RD Landfill (Public)	Richmond County Landfill (Public)	Republic Waste - Oak Grove Landfill (Private)	Columbus, Pine Grove Landfill (Public)	Columbus Transfer Station (Private)	Wayne County Landfill (Private)	Houston County Landfill (Public)	Atlanta North Transfer Station (Public)	Thomaston Transfer Station (Private)	Total
REGIONAL DEVELOPMENT CENTER	Atlanta Regional Commission			40		20				20					20		100
	Central Savannah River Area				9				41								50
	Chattahoochee Flint		40														40
	Coastal Georgia				31												31
	Coosa Valley							40									40
	Georgia Mountains					20				20							40
	Heart of Georgia-Altamaha						18						23				41
	Lower Chattahoochee										20	20					40
	McIntosh Trail															30	30
	Middle Flint																0
	Middle Georgia													37			37
	North Georgia																0
	Northeast Georgia					20				20							40
	South Georgia	40															40
	Southeast Georgia						14						25				39
	Southwest Georgia																0
	Total	40	40	40	40	60	32	40	41	60	20	20	48	37	20	30	568

Due to the above-mentioned unforeseen obstacles, the sampling plan was revised. Facilities were replaced and the sort period lost some months in the timeline. Subsequently, the number of samples to obtain was reduced but remained sufficient to

satisfy the need for statistical validity. Table 3-4 represents the sampling plan that actually took place for all four season sorts, including the sort seasons and the number of samples included in each sort.

In total, four seasonal sampling and sorting events were performed:

- Fall: End of September through mid-October 2003
- Winter: Early February through end of February 2004
- Spring: End of April through mid-May 2004
- Summer: End of August through mid September 2004

The fall and winter events featured approximately 2 ½ weeks (18 days) of field sorting, while the spring and summer events featured approximately 4 weeks (26 days) of field sorting. Field data collection was initiated in the fall of 2003 and concluded in the summer of 2004.

Table 3-5 Host Facility Summary

Sort Season	Sort Location	Sort Dates
Fall	Pecan Row Landfill (Private)	September 29 - October 2, 2003
Fall	LaGrange Landfill (Public)	October 7 - October 10, 2003
Fall	DeKalb County Landfill (Public)	October 13 - October 16, 2003
Winter	Republic Waste - Oak Grove Landfill (Private)	February 9 - February 14, 2004
Winter	Wayne County Landfill (Private)	February 16 - February 20, 2004
Winter	Superior Landfill (Private)	February 23 - February 26, 2004
Spring	Richmond County Landfill (Public)	April 26 - April 29, 2004
Spring	Republic Waste - Oak Grove Landfill (Private)	May 3 - May 7, 2004
Spring	Rome Walker Mtn RD Landfill (Public)	May 10 - May 13, 2004
Spring	Columbus, Pine Grove Landfill (Public)	May 17 - May 18, 2004
Spring	Columbus Transfer Station (Private)	May 19 - May 20, 2004
Summer	Wayne County Landfill (Private)	August 30 - September 4, 2004
Summer	Houston County Landfill (Public)	September 13 - September 15, 2004
Summer	Atlanta North Transfer Station (Public)	September 17 - September 18, 2004
Summer	Thomaston Transfer Station (Private)	September 21 - September 23, 2004

Table 3-5 summarizes the facilities and dates on which sampling and sorting actually took place over the four seasons.

These 13 facilities were targeted because of the extended wastesheds from which they receive waste. Sampling waste from these 13 facilities generated composition data for 13 of the 16 RDCs.

Sorting specifics are described below:

- **Pecan Row (1 sort event)** Located in the South Georgia RDC, 40 samples were targeted at this facility during one season of sorting.

- **LaGrange Landfill (1 sort event)** A total of 40 samples were targeted at this facility in one season. This facility is located in the Chattahoochee Flint RDC.
- **DeKalb County Landfill (1 sort event)** Located in the Atlanta Regional Commission RDC, 40 samples were targeted at this facility during a one season sort.
- **Superior Landfill (2 sort events)** Located in the Central Savannah River Area, this facility receives waste from both its home RDC as well as from the Coastal Georgia RDC, offering the opportunity to collect data from two demographic areas. A total of 40 samples were collected over one season of sorting.
- **Republic Waste-Oak Grove Landfill (6 sort events)**—Located in the Northeast Georgia RDC, this facility receives significant quantities from the Atlanta Regional Commission, Northeast Georgia, and the Georgia Mountains RDCs, offering the opportunity to capture data from up to three demographic areas. A total of 120 samples were targeted at this facility, spread over two seasonal sorts.
- **Wayne County Landfill (Broadhurst Environmental) (4 sort events)**—Samples from the Heart of Georgia-Altamaha and Southeast Georgia were obtained at this facility, located in the Heart of Georgia-Altamaha RDC. A total of 80 samples were targeted over two seasons of sorting at this facility.
- **Rome Walker Mountain Landfill (1 sort event)**—A total of 40 samples were targeted from this facility, which is located in the Coosa Valley RDC.
- **Richmond County Landfill (1 sort event)** Located in the Central Savannah River Area RDC, 41 samples were taken at this facility during a one season sort.
- **Columbus, Pine Grove Landfill (1 sort event)** Located in the Lower Chattahoochee RDC, 20 samples were targeted at this facility during a one season sort.
- **Columbus Transfer Station (1 sort event)** Also located in the Lower Chattahoochee RDC, 20 samples were targeted at this facility during a one season sort.
- **Houston County Landfill (1 sort event)** Located in the Middle Georgia RDC, 37 samples were taken at this facility during a one season sort.
- **Atlanta North Transfer Station (1 sort event)** Located in the Atlanta Regional Commission RDC, this facility offered the opportunity to capture an additional Atlanta Regional Commission data point. 20 samples were targeted at this facility during one season of sorting.
- **Thomaston Transfer Station (1 sort event)** Located in the McIntosh Trail RDC, 30 samples were targeted at this facility during one season of sorting.

Figure 3-1 Location of Host Facilities

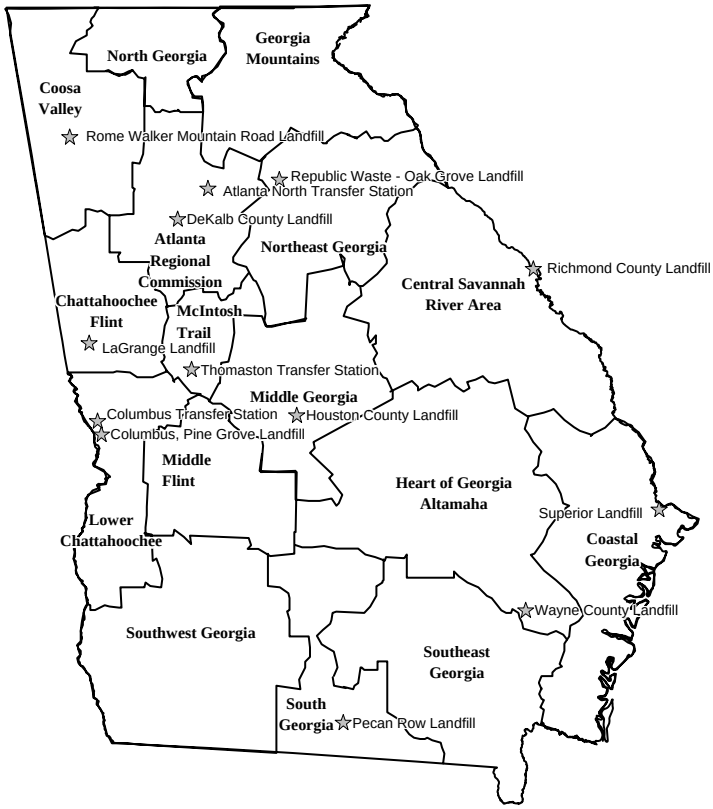

Figure 3-1 presents a map of Georgia showing the location of each of the host facilities within each RDC. As shown, these facilities were distributed across various regions of the State, and allowed the project team to obtain a wide variety of sample material from many different local waste management systems.

Sampling and Sorting

Once access was obtained to host facilities, an appropriate sampling plan was devised, and field data was collected. Field data collection included three primary tasks:

(1) Identifying and taking samples from targeted truckloads originating in each of the generating sectors identified in the sampling plan;

(2) Sorting each sample into the target material categories; and

(3) Recording the weight of sorted materials in each category.

These steps are described below.

Sampling and Sorting Team Positions and Responsibilities

Each sampling and sorting team was made up of five to seven people – a Field Supervisor, a Crew Chief, and a crew of about five sorters. The Field Supervisor was responsible for working with the facility staff and setting up the sort field site. Additionally, the Field

Supervisor kept track of the schedules, sampling plans, and general sort logistics. The Crew Chief was responsible for management of the sort crew.

Sampling

Proper sampling requires that the origin and contents of each sampled truckload be verified prior to taking samples. Each day of the field data collection (at the appropriate disposal facility), the Field Supervisors were provided with a list of the trucks and the number and type of loads to be targeted for that day's sampling and sorting. Truckloads were selected using a stratified random sampling methodology to select incoming vehicles for sampling. This means that trucks were selected at random but in proportion to the number of loads from each specific hauler delivering waste to the facility.

When targeted trucks entered the facility, the Field Supervisor conducted a brief interview with the driver to verify certain information about the contents of the truckload. Questions included:

- Is the load residential, commercial, or mixed?
- Where did the material originate (specific geographic origin)?
- Were any out-of-the-ordinary items picked up on route?
- Is the driver the regular route driver or a substitute? (This question helped gauge route familiarity.)
- Is this a special load? (This question served to verify that material was picked up from the targeted generating sector.)

The hauling company name and truck number was recorded so that the origin of the load could be verified at a later time. Drivers of self-hauled loads were asked to identify the generator class (residential, commercial, industrial, etc.). The type and size of the vehicle used for self-hauling waste and other relevant information was also noted.

At each host facility, a designated area was established to conduct the sorting. Trucks that were selected for sampling were directed to tip their loads in a location designated by facility personnel, ideally adjacent to both the normal tipping area and the sort area. The Field Supervisor worked with a facility-designated loader operator to randomly select a 200- to 250-pound sample to be staged next to the sorting area. The loader operator was directed by the Field Supervisor to place the sample on a plastic tarp, so that smaller particles, or "fines", could be captured. The remaining (unsampled) waste was then processed at the facility in the normal manner.

Industry literature specifies a minimum sample size of 200 pounds, which is consistent with R. W. Beck's past sorting experience. However, in any field sort, it is to be expected that occasional samples will weigh less than the 200-pound target because of variation in the density of the waste. This discrepancy is more likely to occur with commercial loads that contain a significant fraction of corrugated boxes, foam packaging, or other light material. Conversely, some of the denser samples may be significantly heavier than 200 pounds. Because the data analysis was performed by

averaging the percentage composition of all the samples, and not on the actual weight of the sample, heavy or light samples are not over- or under-weighted in the results. Less than 6 percent of samples were significantly (more than 10 percent) below the target sample weight.

Specific samples were selected by visually dividing the load or an unbiased portion of the load into six to eight rectangular cells, then using a random number table to determine from which cell to collect the sample. Due to facility traffic and scheduling constraints, it was occasionally necessary to take more than one sample from a load. In such instances, two cells were randomly selected. To minimize bias, the loader operator was directed to take a vertical slice from the pile at the selected cell of the load. As a precaution – and when facility and R. W. Beck safety protocols permitted – the visible characteristics of the full waste load were observed by the Field Supervisor.

Sorting

All sorting was conducted in a designated area of the host site, out of the way of ongoing facility operations. Facilities, to the best of their space limitations, supplied a 900 square foot work area, with access to utilities, a lunch/break room with running water (for clean-up), and restrooms. In addition to the 900 square foot work area, the host facilities offered space to stage up to four samples awaiting sorting (roughly 100 square feet each) on the ground in the vicinity of the work area.

Once samples were staged for sorting, each sample was manually loaded onto a specially designed sorting table. Bagged waste was carried to the table, while loose waste was scooped and loaded into a 40-gallon container to be moved to the table top. Certain large or bulky items were carried to a scale for direct weighing.

At the sort table, which was covered by half-inch screening, solid waste was manually sorted into labeled bins or baskets. Bagged or boxed materials were opened and all waste was sorted. Sorting continued until the screen-top material reached a particle size of one-half to two inches. Material particles ranging from one-half to two inches (typically shredded paper, plastic caps and lids, etc.) were apportioned to the appropriate material category by the Crew Chief. When the half-inch screen was cleared of material, the layer of fines beneath the screen was placed in a “fines” category. Special effort was made to totally separate all waste above the screen into the component material categories and remove or shake off to the appropriate category as much contamination (grit and moisture) as possible.

Manual sorting was performed by a crew of about four or five sorters, typically light-industrial temporary laborers. All sorting personnel were trained in the specific safety and technical requirements of this sorting protocol prior to performing the sort. An average of ten 200-pound samples was manually sorted by each crew during an eight- to ten-hour day. All samples were manually sorted into the 39 categories of material defined by DCA.

Moisture Analysis

After the first season of field data collection, DCA and R. W. Beck discussed possible accuracy issues when characterizing the composition of samples delivered by transfer trailers. At transfer stations, waste is handled and piled up by heavy machinery. It was thought that this additional handling could result in higher levels of cross-contamination – where porous materials absorb moisture and wet, sticky materials adhere to others causing them to be heavier – that would potentially skew the average percent composition by weight of the samples. Though this possibility is common to all waste composition studies – and only a small percentage of studies perform moisture analysis and adjust data – the project team decided to evaluate this hypothesis and make corrections to the data if it proved to be a significant issue.

During the three remaining sort seasons, portions of selected materials, from random samples, were sent to the environmental engineering lab at the University of Florida where the moisture content in various samples was determined and compared.

Table 3-6 Materials Identified for Moisture Analysis

Material Group	Material Category
Paper	Corrugated cardboard
	Magazine/glossy paper
	Mixed recyclable paper
	Newspaper
	Non-recyclable paper
	Office paper
	Paperboard
Plastic	#1 PET Bottles
	#2 HDPE Bottles
Metal	Aluminum cans
Organics	Textiles

Table 3-6 lists the materials most susceptible to moisture contamination and those on which moisture analysis was performed.

Table 3-7 Count of Moisture Sub-samples

Material Group	Material	Residential Sub-samples	Commercial Sub-samples	Transfer Trailer Sub-samples	Grand Total
Paper	Corrugated cardboard	3	7	4	14
	Magazine/glossy paper	3	6	4	13
	Mixed recyclable paper	3	7	4	14
	Newspaper	3	7	4	14
	Non-recyclable paper	3	7	4	14
	Office paper	3	7	4	14
	Paperboard	3	7	4	14
Plastic	#1 PET Bottles	3	7	4	14
	#2 HDPE Bottles	3	7	4	14
Metal	Aluminum cans	3	7	4	14
Organic	Textiles	3	7	4	14
	Grand Total	33	76	44	153

Table 3-7 shows the number of moisture sub-samples, by generating sector, sent for analysis.

The results of the moisture analysis, by generating sector and on average, are discussed in Section 4.

Data Recording

On the first and last day of a sorting event at a facility, the Crew Chief recorded tare weights for each of the containers used in the sort. Tare weights must be backed out from gross container weights to obtain accurate net material weight data.

After material from a given sample was sorted into the appropriate bin, the Crew Chief and sorters systematically weighed and recorded the gross weights of containers on an individual data collection sheet. Bulky items too large to fit into a labeled container were weighed out separately and recorded as net weights. Especially large items were noted on the data collection sheet. All weights were recorded to the nearest 0.1 pound. A blank data recording form is included in Appendix O.

Weighed material was deposited in an adjacent area or in a container designated and provided by the facility, to await final processing/disposal. For facilities with recyclable material handling capability, and provided that facility management was able to supply a suitable container for collection and transport, sorted recyclables were kept separate for processing rather than disposal.

R. W. Beck provided all sorting baskets/containers; tables; a digital scale (with a 500-pound capacity and accurate to 0.1 pound); signs/labels; data forms; hand tools; tarps and other ground cover; protective clothing and other safety-related equipment not already on site.

Attainment of Sampling Targets

Table 3-8 Comparison of Targeted Vs Actual Samples by Regional Development Center

Regional Development Center	Samples		
	Targeted	Actual	Coverage
Atlanta Regional Commission	120	100	83%
Central Savannah River Area	40	50	125%
Chattahoochee Flint	40	40	100%
Coastal Georgia	40	31	78%
Coosa Valley	40	40	100%
Georgia Mountains	40	40	100%
Heart of Georgia-Altamaha	40	41	103%
Lower Chattahoochee	40	40	100%
McIntosh Trail	0	30	N/A
Middle Georgia	40	37	93%
North Georgia	40	0	0%
Northeast Georgia	40	40	100%
South Georgia	40	40	100%
Southeast Georgia	40	39	98%
Totals	600	568	95%

Table 3-8 compares the targeted number of samples with the actual number of samples obtained in the study by Regional Development Center.

In total, 95 percent of the targeted samples were obtained. Some of the sampling shortfalls were caused by operational obstacles beyond the Project team's control, such as those described earlier in this section. Additionally, one sample was eliminated from the analysis based on a quality control review designed to exclude samples with a weight insufficient for statistical validity.

Table 3-9 Comparison of Samples Taken by Season

Generator	Sample Count	Percent Distribution
Fall	120	21%
Winter	132	23%
Spring	161	28%
Summer	155	27%
Total	568	100%

Table 3-9 shows how the samples were distributed by season.

Table 3-10 Comparison of Samples Taken by Generating Sector vs. National Average

Generator	Sample Count	Percent Distribution	Estimated National Average
Residential	240	42%	40%
Commercial	226	40%	40%
Mixed Loads	102	18%	20%
Total	568	100%	100%

Table 3-10 compares the samples taken by generating sector.

Table 3-11 Comparison of Samples Taken by Facility Type vs. State Average

Facility Type	Sample Count	Percent Distribution	State Average
Private	330	58%	75%
Public	238	42%	25%
Total	568	100%	100%

Table 3-11 compares the samples taken by disposal facility type.

Statistical Measures

Within each of the RDC result sets, this report presents several statistical measures. These are described below:

Sample Mean – The sample mean composition is the average composition of each material category (or material group) for the samples included in a given result set. Because it is conceptually easy to understand, the sample mean values are often cited as a definitive estimate of the actual mean (i.e., the mean of the entire population). It is important to remember that the sample mean has associated uncertainty, described below.

Standard Deviation – The standard deviation measures the level of dispersion of the underlying data around the sample mean. Higher standard deviation indicates the individual data points are more widely variant (i.e., spread across a wider range) compared to lower standard deviation.

Confidence Intervals – The lower and upper confidence intervals indicate the likelihood that the population mean (i.e., the actual composition of the entire waste stream) falls close to the sample mean (i.e., the samples analyzed in the study). The lower and upper bound throughout this report have been calculated at a 90 percent

level of confidence. In layman's terms, this means we can be 90 percent confident that the true fraction of this material in the overall population falls between the lower and upper bound shown. The inverse is also true—that there is a ten percent chance that the true mean falls outside the intervals. For example, the sample mean composition of all paper in the Atlanta Regional Commission RDC samples was 40.0 percent. We can be 90 percent confident that the actual fraction of paper in the state's municipal solid waste stream falls between 37.7 percent and 42.3 percent.

Complete results of the analysis of all sample data are shown in the remaining sections and appendices of this report.

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Section 4
STATEWIDE MSW COMPOSITION

Interpretation of Results

This section provides a detailed summary of the aggregate composition of Georgia's disposed municipal solid waste stream. Within the section are many graphical and tabular summaries of statewide municipal solid waste composition. To adequately interpret these data, it is important to have a layman's understanding of the statistical analysis that was used to generate the results. Details of the statistical analysis are described in the "Methodology" section of this report.

Throughout this section, material names are used to categorize waste in the MSW stream. Definitions of these material categories can be found in Appendix N.

Aggregation of Data

A total of 568 samples – more than 60 tons of waste – were sorted for this study. Preparing the statewide results for the study involved multiple steps of analyzing and aggregating these samples. The statewide results presented here actually represent several layers of statistical analysis and aggregation. RDC averages were first produced. Then the RDC figures were turned into a state average using a weighted average process. The results of these calculations are the focal point of the study and are shown in this section.

Moisture Analysis

A limited number of moisture samples were taken for this study in order to evaluate whether the process of transferring waste leads to increased levels of cross-contamination. Results of the moisture analysis performed did not support that hypothesis.

Table 4-1 Moisture Analysis Results (Sorted by Average Moisture Percentage)

Material	Commercial Moisture %	Residential Moisture %	Transfer Trailer Moisture %	Average Moisture %
Non-recyclable paper	13.01%	8.60%	19.29%	**13.86%**
Corrugated cardboard	16.36%	8.74%	12.94%	**13.75%**
Newspaper	18.07%	5.54%	11.17%	**13.41%**
Textiles	10.20%	3.78%	15.53%	**10.35%**
Magazine/glossy paper	10.16%	4.74%	6.16%	**7.68%**
Office paper	9.10%	3.46%	6.00%	**7.00%**
Paperboard	6.47%	3.33%	9.41%	**6.64%**

Material	Commercial Moisture %	Residential Moisture %	Transfer Trailer Moisture %	Average Moisture %
Mixed recyclable paper	4.57%	4.28%	8.15%	**5.53%**
#2 HDPE Bottles	1.19%	2.68%	4.07%	**2.33%**
Aluminum cans	1.86%	1.05%	1.84%	**1.68%**
#1 PET Bottles	1.41%	1.37%	1.31%	**1.37%**
Average Moisture %	**8.38%**	**4.32%**	**8.72%**	**7.60%**

The table above shows the results of the moisture analysis by generating sector. Though a slight variation can be seen in the sample mean averages between generating sectors, transfer trailer moisture percentages were only found to be higher than the average moisture percentages for slightly more than half of the material categories. Statistically no difference can be asserted for the actual mean (the mean of the entire population). Adjustment to data for moisture content was not performed.

Georgia Aggregate Disposed MSW Composition Results

The remainder of this section provides a range of graphical and tabular summaries of the composition of disposed waste in Georgia, and by generating sector – residential, commercial, and transfer trailer.

Figure 4-1 Georgia Statewide Aggregate Disposed MSW Composition

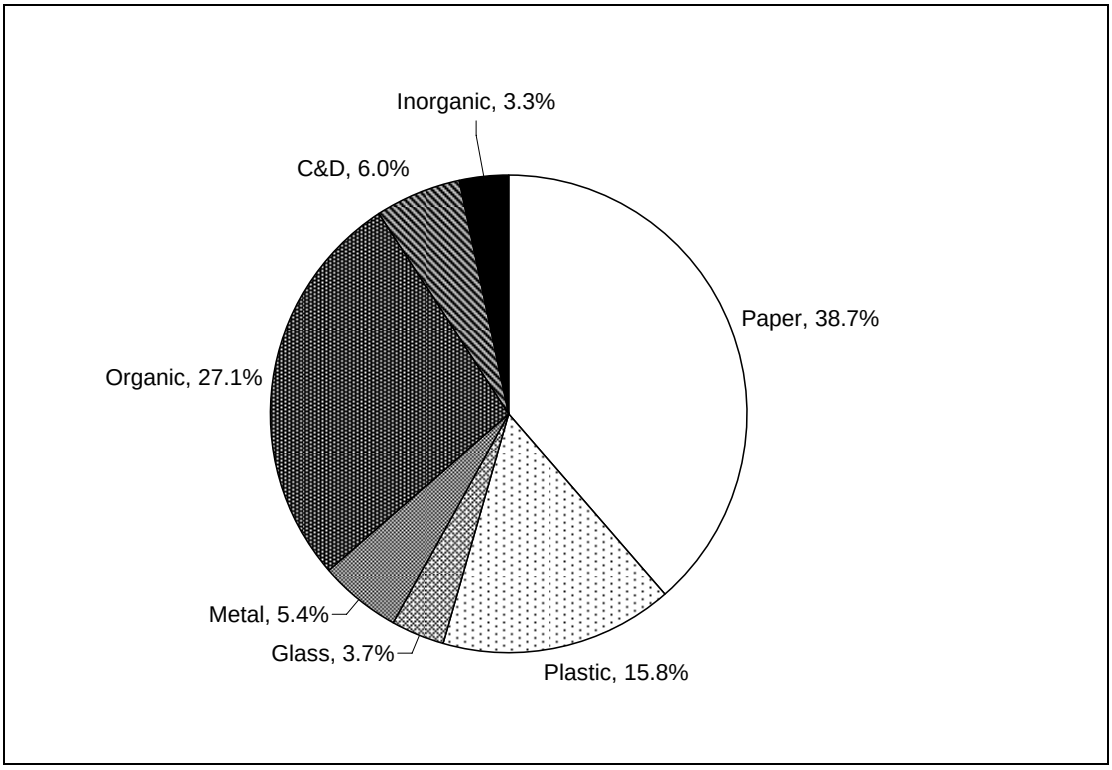


Figure 4-1 presents the aggregate composition of major material groups in Georgia's disposed municipal solid waste stream. As shown, paper and organics make up the largest fractions of the waste stream, followed by plastics. Metals and C&D made up

the fourth and fifth largest fractions of the waste stream, with glass and inorganics making up the smallest portion of the waste stream.

Figure 4-2 2003 Total US MSW Disposal[1]

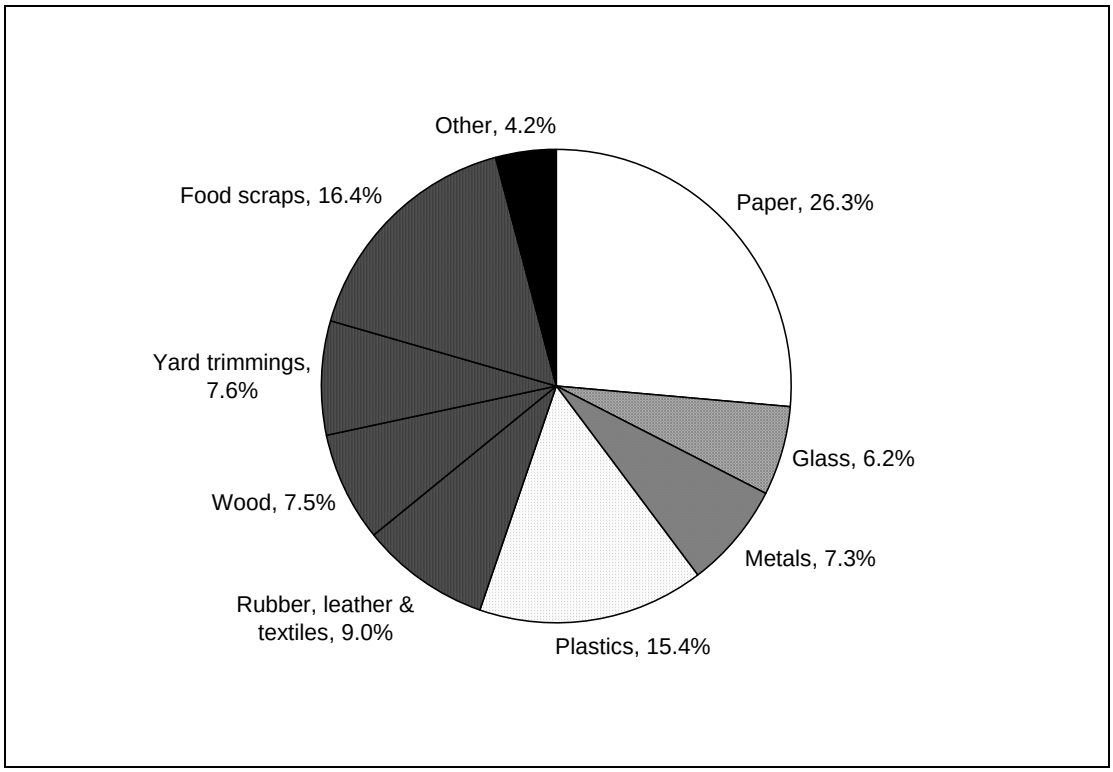


Figure 4-2 presents the aggregate composition of major material groups disposed in the United States' municipal solid waste stream in 2003, as shown in the United States Environmental Protection Agency's ("EPA's") publication "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: 2003 Data Tables". The nation-wide data includes "generated" materials (including waste that was recycled or composted) and data for "disposed" waste in the US. The Georgia state-wide results in this report indicate "disposed" materials – meaning these numbers show the amounts of waste that were not recycled or composted.

[1] United States Environmental Protection Agency's Municipal Solid Waste Generation, Recycling, and Disposal in The United States: 2003 Data Tables

Table 4-2 Comparison of US and Georgia Material Groups

Materials in US Study	Materials in Georgia Study
Paper	Paper
Glass	Glass
Metal	Metal, Televisions, Computers, and Other Electronics
Plastics	Plastics
Rubber, leather, and textiles	Tires, textiles, carpet
Wood	Non-C&D wood, C&D wood
Yard trimmings	Yard Waste
Food scraps	Food Waste
Other	Diapers, Fines, Other Organics, Drywall, Inerts, Other C&D, HHW, Other Inorganics

Table 4-2 shows a comparison of material groups in the US study to material groups in this Georgia study.

Table 4-3 Comparison of US and Georgia MSW Streams

Material Group	US Disposal	Georgia Disposal	Difference
Paper	26.3%	38.7%	-12.4%
Glass	6.2%	3.7%	2.5%
Metal	7.3%	7.4%	-0.1%
Plastics	15.4%	15.8%	-0.4%
Rubber, leather, and textiles	9.0%	5.6%	3.4%
Wood	7.5%	4.4%	3.1%
Yard trimmings	7.6%	2.7%	4.9%
Food scraps	16.4%	12.0%	4.4%
Other	4.2%	9.8%	-5.6%
Total	**100.0%**	**100.0%**	**0.0%**

As Table 4-3 indicates, more paper is disposed, on average, in Georgia than in the US. The amount of yard waste disposed in Georgia's MSW stream is considerably less than in the US MSW stream. The Georgia Comprehensive Solid Waste Management Act places restrictions on yard waste in Georgia's MSW stream, therefore a lower than average amount should be expected.

Figure 4-3 Statewide Aggregate MSW Tons Disposed

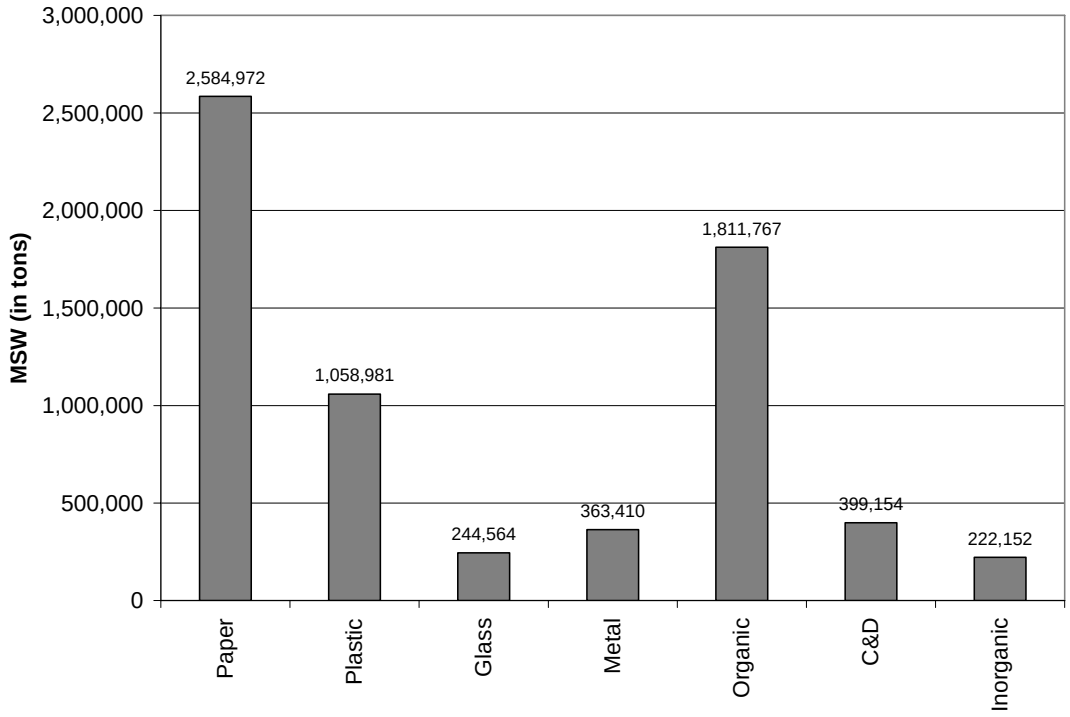


Figure 4-3 shows a bar graph of the tons of Georgia's waste that are estimated to be disposed in the State's landfills (based on 2004 EPD facility reports). As the figure shows, paper and organics were by far the highest tonnage of material disposed in 2003-2004, at approximately 2.6 million tons and 1.8 million tons respectfully.

Figure 4-4 Statewide Aggregate Disposal of Commonly Recycled Materials

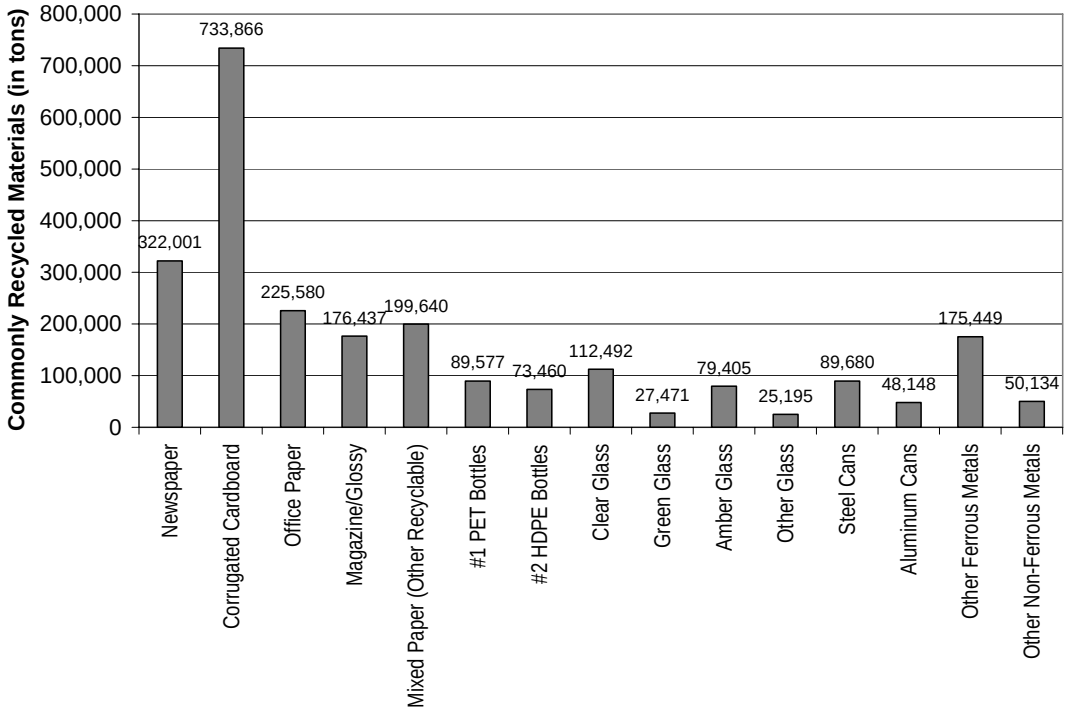


Figure 4-4 focuses on the tons of commonly recycled materials that were disposed. Overall, paper was found to be disposed in significant quantities in Georgia. Nearly twenty-five percent of the adjusted disposed municipal solid waste stream (6,685,002 tons) is commonly recycled paper materials (1,657,524 tons). Recyclable metals, glass, and plastics were found at relatively lower disposal rates – five percent, four percent and two percent respectively – but still significant quantities. This suggests the State may be able to increase diversion from landfills by evaluating recycling market development strategies, recycling outreach activities, and residential recycling incentive programs.

Figure 4-5 Top 10 Most Prevalent Materials Disposed in Georgia

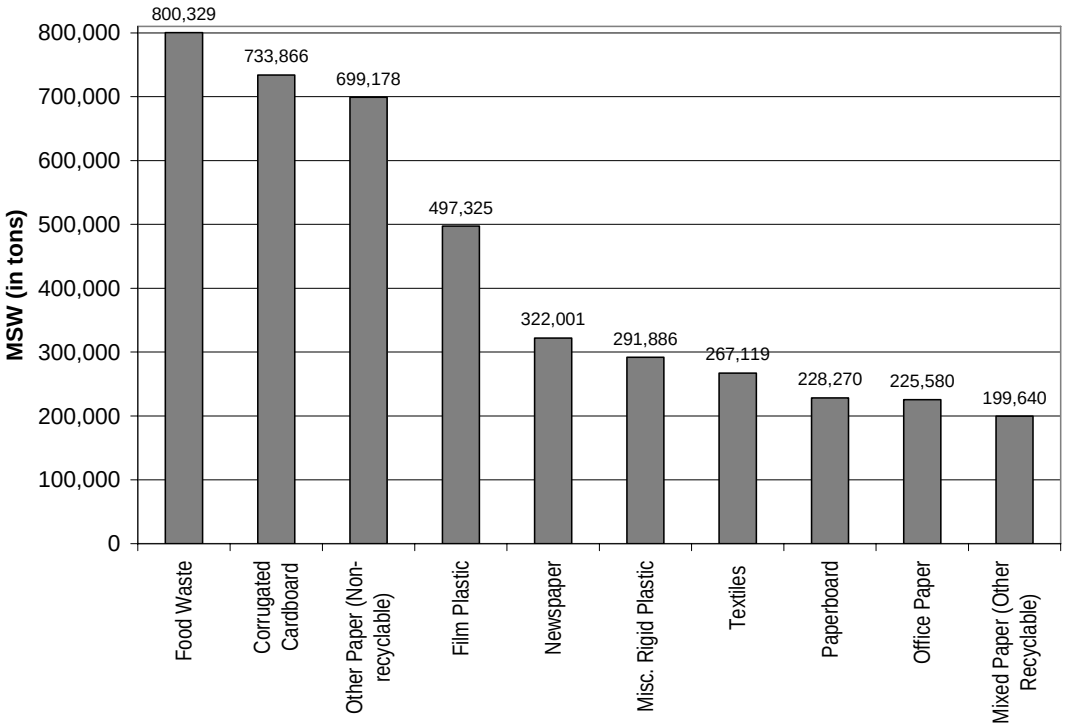


Figure 4-5 shows the top ten individual materials that were most prevalent in the statewide disposed waste stream. Statewide, food waste makes up the largest fraction of disposed waste at 12.0 percent, followed by corrugated cardboard (11.0 percent), nonrecyclable paper (10.5 percent), and film plastic (7.4 percent). Newspaper makes up 4.8 percent of the waste stream while miscellaneous rigid plastics and textiles make up 4.4 percent and 4.0 percent, respectively. No other materials make up more than 4.0 percent of the State-wide waste stream. The top ten most prevalent materials make up 63.8 percent of the disposed waste stream.

Table 4-2 Statewide Aggregate Landfilled MSW Composition Detail (Weight Percent)

Group	Material	Tons Disposed	Statewide Aggregated Average
Paper	Newspaper	322,001	4.8%
	Corrugated Cardboard	733,866	11.0%
	Office	225,580	3.4%
	Magazine/Glossy	176,437	2.6%
	Paperboard	228,270	3.4%
	Mixed (Other Recyclable)	199,640	3.0%
	Other (Non-recyclable)	699,178	10.5%
	Total Paper	2,584,972	38.7%

Group	Material	Tons Disposed	Statewide Aggregated Average
Plastic	#1 PET Bottles	89,577	1.3%
	#2 HDPE Bottles	73,460	1.1%
	#3-#7 Bottles	12,552	0.2%
	Expanded Polystyrene	94,182	1.4%
	Film Plastic[2]	497,325	7.4%
	Other Rigid Plastic	291,886	4.4%
	Total Plastic	1,058,981	15.8%
Glass	Clear	112,492	1.7%
	Green	27,471	0.4%
	Amber	79,405	1.2%
	Other	25,195	0.4%
	Total Glass	244,564	3.7%
Metal	Steel Cans	89,680	1.3%
	Aluminum Cans	48,148	0.7%
	Other Ferrous	175,449	2.6%
	Other Non-Ferrous	50,134	0.7%
	Total Metal	363,410	5.4%
Organics	Yard Waste	177,880	2.7%
	Wood (non-C&D)	125,174	1.9%
	Food Waste	800,329	12.0%
	Textiles	267,119	4.0%
	Diapers	170,308	2.5%
	Fines	187,011	2.8%
	Other Organics	83,945	1.3%
	Total Organic	1,811,767	27.1%
C&D	Drywall	24,747	0.4%
	Wood	168,764	2.5%
	Inerts	29,052	0.4%
	Carpet	94,514	1.4%
	Other C&D	82,076	1.2%
	Total C&D	399,154	6.0%

[2] There has been a rise in the plastic content in the disposed waste stream for many years, as more and more products are manufactured using plastics. MSW disposal contributions from plastic bags and other film plastics are commonly ranging from 5 to 8 percent as published in recent reports for New York City, Iowa, Pennsylvania, and Washington.

Group	Material	Tons Disposed	Statewide Aggregated Average
Inorganics	Televisions	3,785	0.1%
	Computers	8,720	0.1%
	Other Electronics	117,286	1.8%
	Tires	15,324	0.2%
	HHW	26,454	0.4%
	Other Inorganics	50,584	0.8%
	Total Inorganics	222,152	3.3%
	TOTAL	6,685,002	100.0%

Table 4-2 presents a detailed statistical summary of the composition of disposed MSW in Georgia.

Result Comparisons by Generating Sector

Table 4-3 Landfilled Aggregate MSW Composition by Generating Sector
(Statewide Aggregated Average Percent of Waste Stream)

Group	Material	Residential	Commercial	Transfer Trailer
Paper	Newspaper	6.5%	3.2%	4.8%
	Corrugated Cardboard	6.0%	14.0%	14.2%
	Office	2.9%	4.2%	2.6%
	Magazine/Glossy	3.4%	1.9%	4.0%
	Paperboard	4.6%	2.4%	3.7%
	Mixed (Other Recyclable)	3.0%	2.7%	3.7%
	Other (Non-recyclable)	10.7%	10.9%	9.0%
	Total Paper	**37.1%**	**39.3%**	**42.0%**
Plastic	#1 PET Bottles	1.7%	1.2%	1.1%
	#2 HDPE Bottles	1.4%	0.9%	0.8%
	#3-#7 Bottles	0.3%	0.1%	0.2%
	Expanded Polystyrene	1.4%	1.4%	1.4%
	Film Plastic	7.4%	7.6%	7.2%
	Other Rigid Plastic	4.4%	4.3%	4.1%
	Total Plastic	**16.6%**	**15.6%**	**14.8%**
Glass	Clear	2.4%	1.4%	1.1%
	Green	0.5%	0.4%	0.4%
	Amber	1.4%	1.1%	0.8%
	Other	0.4%	0.4%	0.4%
	Total Glass	**4.6%**	**3.2%**	**2.7%**
Metal	Steel Cans	1.7%	1.1%	1.2%
	Aluminum Cans	0.9%	0.6%	0.6%
	Other Ferrous	1.7%	3.0%	3.4%
	Other Non-Ferrous	0.7%	0.8%	0.8%
	Total Metal	**5.1%**	**5.5%**	**5.9%**
Organics	Yard Waste	2.1%	3.0%	2.3%
	Wood (non-C&D)	1.4%	1.7%	3.1%
	Food Waste	13.4%	12.4%	8.3%
	Textiles	5.1%	3.7%	3.2%
	Diapers	3.6%	1.8%	1.9%
	Fines	3.0%	2.6%	2.7%
	Other Organics	1.3%	1.6%	1.4%
	Total Organic	**29.8%**	**26.8%**	**23.1%**

Group	Material	Residential	Commercial	Transfer Trailer
C&D	Drywall	0.3%	0.3%	0.4%
	Wood	1.3%	2.3%	4.4%
	Inerts	0.2%	0.6%	0.3%
	Carpet	1.1%	1.5%	1.9%
	Other C&D	1.0%	1.1%	2.0%
	Total C&D	**3.9%**	**5.8%**	**9.0%**
Inorganics	Televisions	0.0%	0.1%	0.0%
	Computers	0.0%	0.2%	0.2%
	Other Electronics	1.5%	2.0%	1.2%
	Tires	0.0%	0.3%	0.6%
	HHW	0.3%	0.5%	0.1%
	Other Inorganics	0.9%	0.7%	0.4%
	Total Inorganics	**2.8%**	**3.9%**	**2.5%**
	TOTAL	**100.0%**	**100.0%**	**100.0%**

Table 4-3 shows a comparison of the amounts of materials in the residential, commercial and transfer trailer MSW streams. Definitions of the material categories may be found in Appendix N. Transfer trailer waste contains materials from both the residential and commercial MSW streams. For most material categories, the percentage in the transfer trailer waste is between the amounts in the residential and commercial MSW. Transfer trailer waste, however, may also contain construction and demolition ("C&D"), and industrial-type materials. This is evident in the total amount of C&D in the transfer trailer MSW.

The residential waste contains more of newspapers, magazines, and paperboard. Commercial waste contains more corrugated cardboard and office paper. Plastics appear at a comparable rate in all three streams, with residential having a slightly higher amount of PET and HDPE. Glass, metals, organics, and inorganics also appear at a similar rate in all three streams.

Figure 4-6 Top 10 Most Prevalent Materials in Georgia Residential Waste

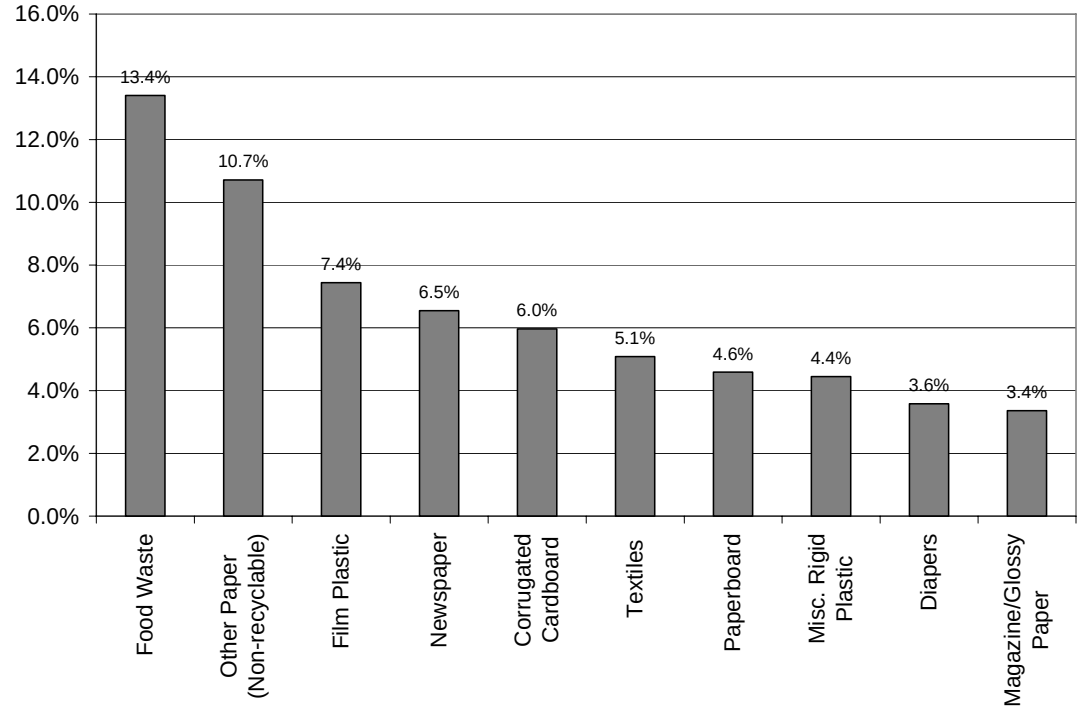


Figure 4-7 Top 10 Most Prevalent Materials in Georgia Commercial Waste

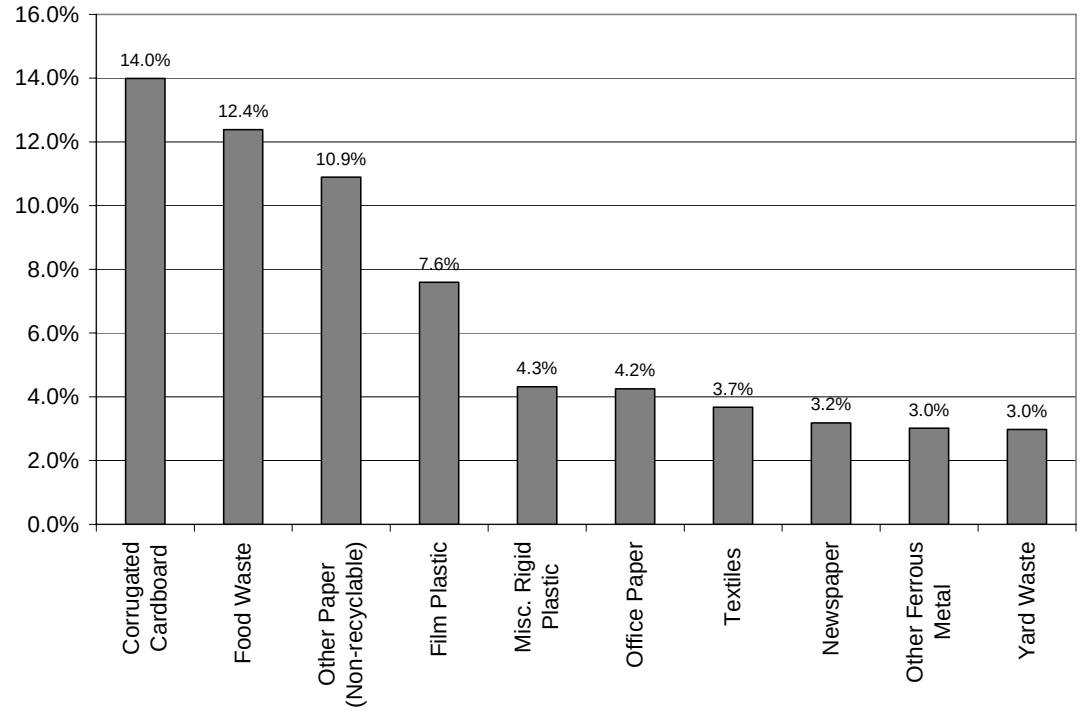
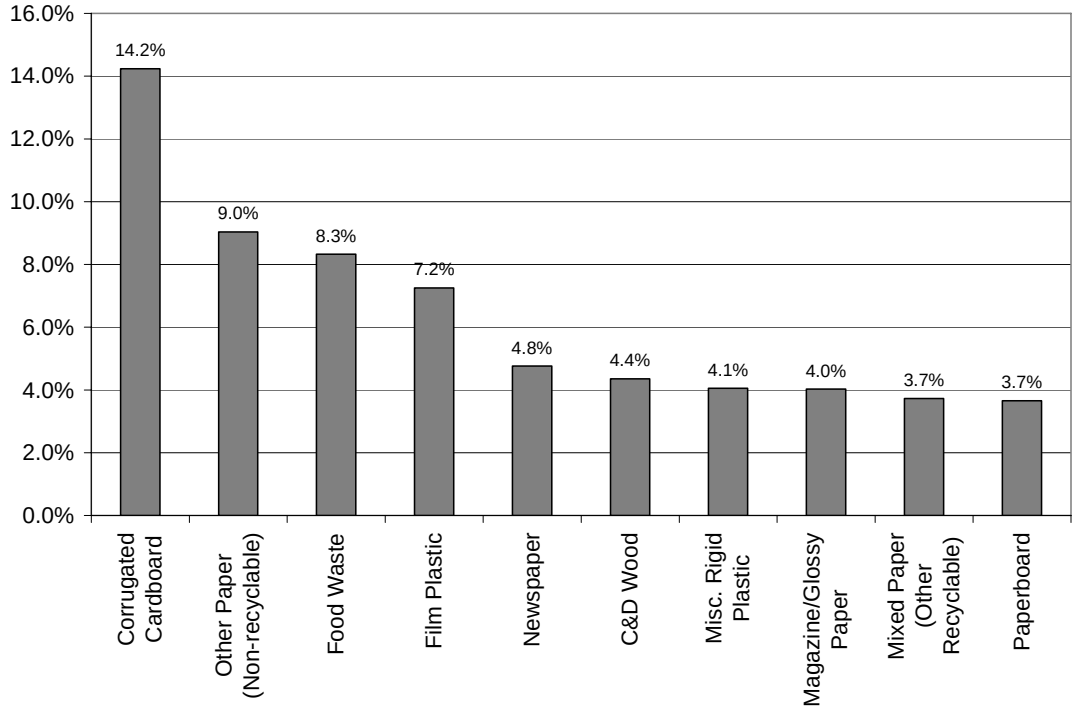


Figure 4-8 Top 10 Most Prevalent Materials in Georgia Transfer Trailer Waste



The charts in Figures 4-6 through 4-8 compare the composition percentage by material group for residential, commercial, and transfer trailer waste in Georgia.

Figure 4-6 shows the top 10 most prevalent materials in Georgia Residential Waste. Food waste is disposed in the highest quantity, with other paper (non-recyclable) and film plastic as the second and third highest disposed items respectively. Note that, in the residential MSW disposal stream, corrugated cardboard places fifth highest in materials disposed. However, when comparing the residential generating sector to the commercial and transfer trailer generating sectors (Figures 4-7 and 4-8), the latter show corrugated cardboard disposed in the highest quantity, with food waste placing second in the commercial sector and third in the transfer trailer sector.

Yard waste makes up three percent of the states commercial MSW stream. Though yard waste is more prevalent in certain regions, it does not appear to be strictly a regional issue – five of the 13 regions studied have yard waste in the top 10 most prevalent materials in their commercial MSW streams.

Figure 4-9 Commonly Recycled Materials Disposed by Residential Sector

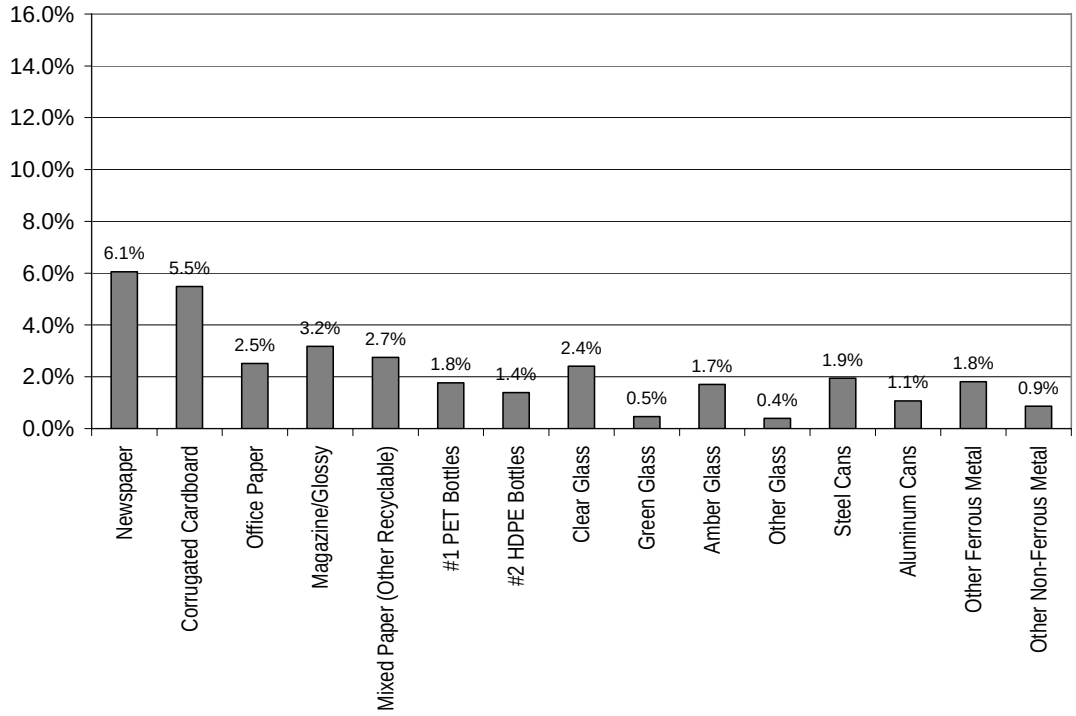


Figure 4-10 Commonly Recycled Materials Disposed by Commercial Sector

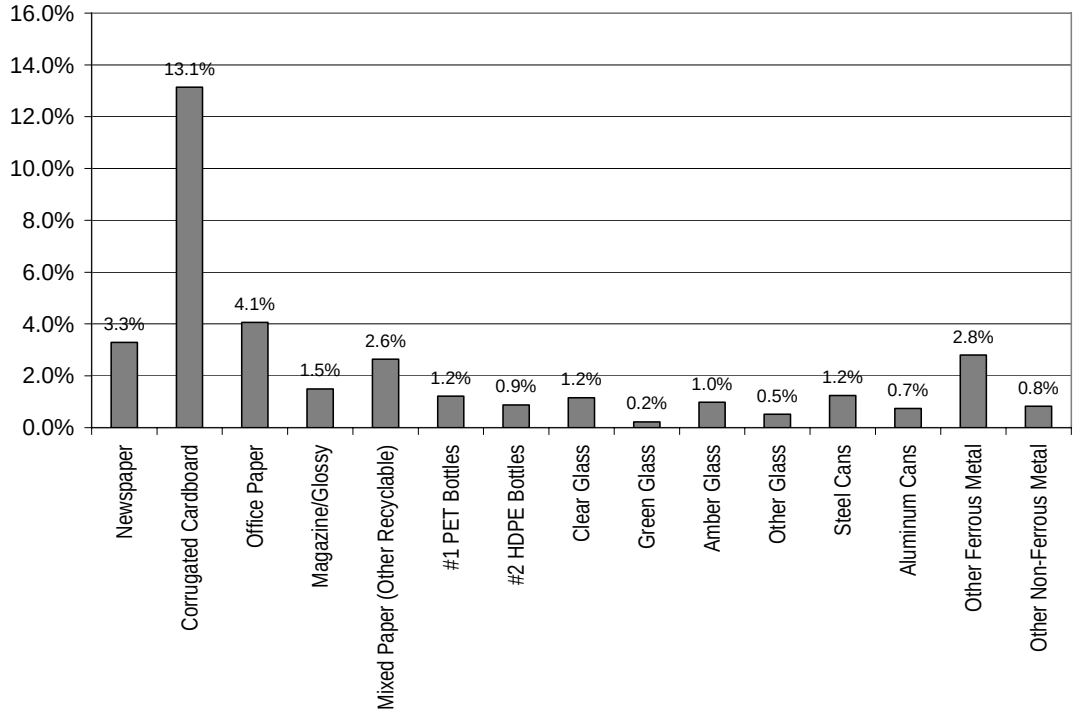
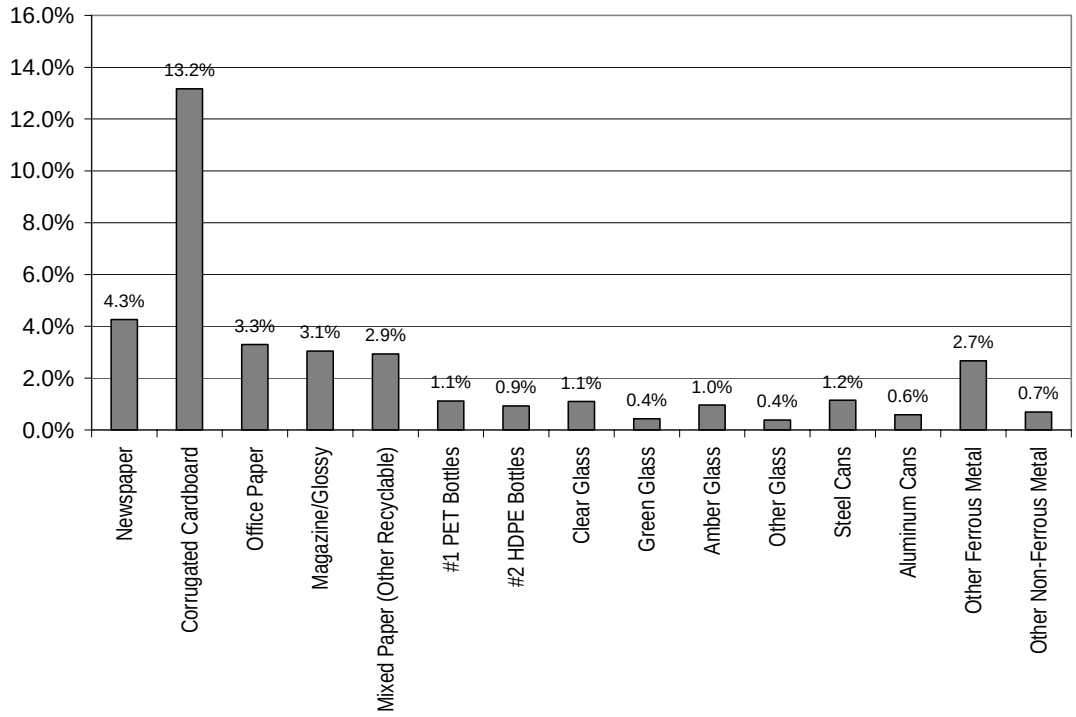


Figure 4-11 Commonly Recycled Materials Disposed by Transfer Trailer Sector



Figures 4-9 through 4-11 compare the amount of commonly recycled materials disposed in the municipal solid waste stream by generating sector. Note that paper is being disposed of in the highest quantities from all three generating sectors, with metal as the second highest item disposed. This suggests that the State can target programs for additional diversion opportunities for paper and metal in all three generating sectors.

Conclusions

The aggregate Georgia disposed MSW composition shown in this section highlights the percentages and quantities of materials that are still being disposed in the State's landfills, MSW composting, and waste-to-energy facilities. Solid waste planners can use these results to better target the materials that have the highest potential for additional diversion. Appendices A through M of this report provide comparable results for 13 of the State's 16 RDCs.

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