ALACHUA COUNTY WASTE COMPOSITION STUDY

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Prepared for: Alachua County Public Works Department

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Executive Summary

In January, 2009 the Alachua County Department of Public Works, Division of Waste Management commissioned a municipal solid waste composition study, the first performed since 1997. The objectives of the study were to provide a detailed characterization of the principal waste sources – residential, commercial and institutional and describe how the characterization compares to the findings of the 1997 study, as well as to state and national composition studies. The study also aimed to evaluate current levels of source reduction and recycling efforts and estimate potential additional targets for increasing efforts to divert waste from landfills in order to meet the 75% waste diversion goals established in the 2008 Florida Energy Act. The statute states its goal is to cut down the amount of recyclable waste being disposed by 75% by 2020. Current methods of calculating recycling rates may have to be adjusted in order to determine the rate of recyclable materials counties and cities are currently recycling. The statute also states that using waste to energy, burning waste to produce energy, could count towards the goal, in addition to recycling.

Two one- week waste composition study events were conducted at the Alachua County Transfer Station during January and March of 2009. Target waste sources were identified from incoming disposal vehicles; these targets included waste from residential, commercial, and institutional sectors. After a waste load was unloaded onto the transfer station floor, a representative subsample (minimum 200 lbs) was selected and placed in the sorting area. A detailed analysis of the subsamples was performed during the 2 weeks of sampling. The waste was manually sorted into ten major categories with 72 subcategories. Waste components of a small size (less than 2 inches) were treated as a separate category and removed from the rest of the commodities using a screened table. In combination, both events resulted in the characterization of 39 subsamples representing more than 10,000 pounds of waste.

The composition results from individual loads were used to estimate the overall composition of the MSW disposed at the transfer station (see Figure ES1) as well as the composition of different sectors of the waste stream. Paper products (29%), organics such as food waste (18%), and plastics (16%), comprised the greatest fraction of the waste stream. Another notable fraction of the waste stream composition was the residual and fines fraction (consisting of small difficult to identify materials passing through the tables screens); together these materials represented 12% of the waste stream. The top four subcategories were food waste (14.3%), corrugated cardboard (8.9%), compostable/soiled paper (7.2%), and film plastic (6.7%).

Based on a current Alachua County MSW recycling rate of 37% (2008), the potential for increasing recycling by targeting specific waste component categories was examined using the composition study data and the statistics on the amount of waste recycled (109,396 tons) and landfilled (184,827 tons) waste in Alachua County for 2008 (see Figure ES2). If County residents and businesses were to reach 100% efficiency in diverting the commodities currently accepted as part of the recycling program, the recycling rate could increase from 37% to 55%. If an organics treatment system (e.g. composting) were to be added, 100% efficient operation of the system (in combination with 100% efficiency in current recycled materials) could lead to an overall recycling rate of approximately just under 70% could be achieved. The results underscore the challenges that will be faced in reaching a recycling rate target of 75%. Not only would existing recycling participation need to become much more efficient, waste diversion for additional commodities not currently recycled would have to be added (boxboard, film plastic, organics). The relatively large fraction of residuals and fines, materials that

would typically be separated from MSW in a recycling facility, pose a limitation to the overall recycling rate which could be achieved.

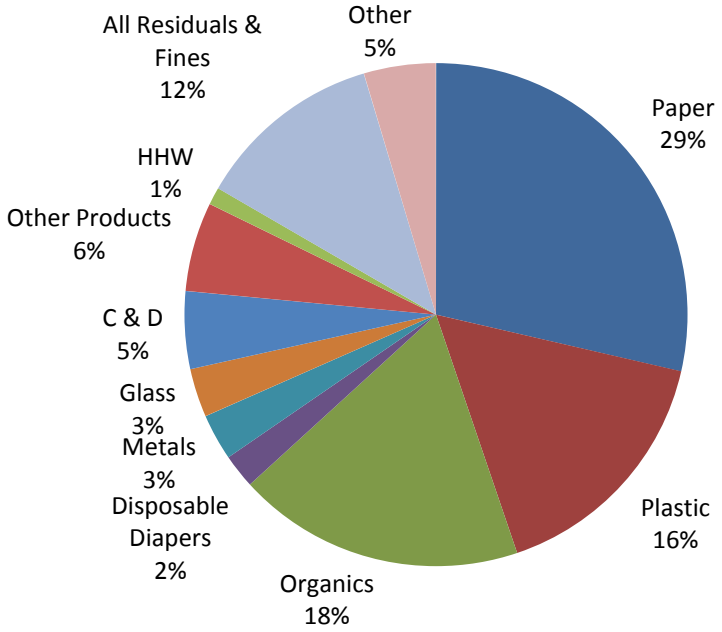
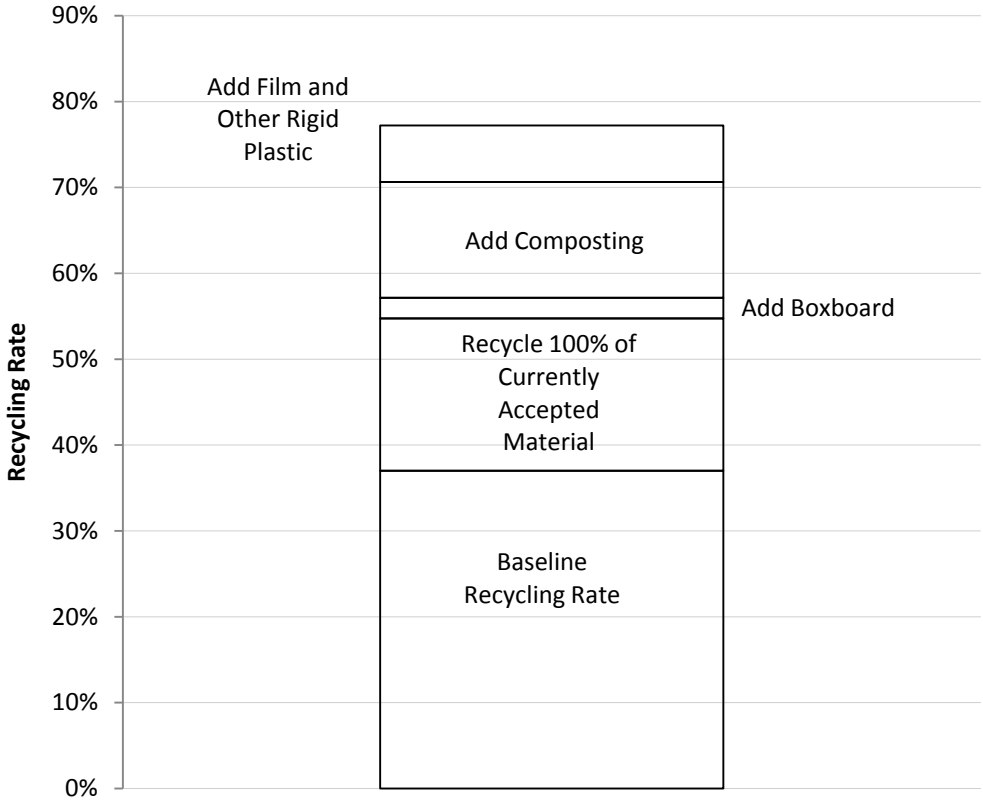


Figure ES 1. Composition of MSW Disposed at the Alachua County Transfer Station based on Manual Sorts Conducted on Thirty-nine Loads of Waste



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ACKNOWLEDGEMENTS

The authors of this study would like to thank students Scott Karwan, Stewart Finkel, Shrawan Singh, Saraya Sikora, and all of the students that assisted with sorts, especially the Solid and Hazardous Waste Research Group. We would also like to thank EWS employees Josh Robinson, Daniel, Tommy, Eugene, and the drivers, Alachua County Employees Ed Lontz and Sally Palmi, and transfer station operators Jim, Bobby, and Junior.

1. Introduction

1.1. Scope and Organization of the Document

Alachua County (hereafter referred to as the County), located in North Central Florida, requested that the University of Florida perform a waste composition study at the Alachua County Transfer Station (the transfer station) located in the Leveda Brown Environmental Park in Gainesville, Fl. The main purpose of the study was to identify the composition of the waste being disposed of by the county and to evaluate alternatives to divert waste from the New River Regional Landfill (NRRL) based on the results of the study. Two one-week waste sorting periods (called phase I and phase II) were conducted at the transfer station to identify the composition of the waste and areas of improvement. During both phases, volunteers sorted over 10,000 pounds (lbs) of waste and collected a total of 39 representative samples.

The introduction serves to provide fundamental information regarding the project. The subsections detail the study objectives and design to provide a basic understanding of the work completed. The background, demographic overview, and waste disposal overview subsections provide information about Alachua County and the current waste management practices. A summary of the previous waste composition study, conducted by SCS consultants and contractors in 1997, is included. Commentary on the current state of the economy and the economy's effects on the rate of production as well as the recycling industry are provided at the end of this section.

Section 2 describes the methodology followed for the development and implementation of this study. Section 3 reviews the results by generator type, while section 4 identifies diversion opportunities. Section 5 provides a summary of the conclusions derived from this study. Following the written report are the appendices which include:

- Appendix A contains the glossary for the technical language used throughout the report;
- Appendix B contains historical data from the 1997 Alachua County Waste Composition Study;
- Appendix C includes the material definitions that were defined for the study to provide a comprehensive evaluation of waste production;
- Appendix D contains the project safety plan;
- Appendix F contains a blank data collection form from both weeklong sorting events that were designed for the study;
- Appendix F has the complete results of the study, contained in digital format,
- Appendix G contains the statistical analysis with examples from the study,
- Appendix H contains the Alachua County 2007 Florida Department of Environmental Protection Municipal Solid Waste Collection and Recycling report data, and
- Appendix I contains photographic records from the sorts that highlight different elements of the waste composition.

1.2. Study Objectives

Alachua County commissioned the Solid and Hazardous Waste Management Research Group at the College of Engineering of the University of Florida for the completion of a countywide waste composition study. The County identified three main study objectives. First, develop a countywide waste characterization identifying the composition of municipal solid waste (MSW) taken to the transfer

station at the Leveda Brown Environmental Park (the landfilled waste). Second, estimate the types and quantities of potentially recoverable and compostable materials. Alachua County currently recycles a limited range of materials through its residential curbside and the commercial recycling programs, and is considering the expansion of these programs to encompass more materials in order to achieve the Florida Energy Bill goals mentioned below. Also, an evaluation of the composition of grocery store waste was completed to determine the amount of pre-consumer organic waste that could be considered for composting or anaerobic digestion. Third, evaluate the success of the current residential curbside recycling and commercial programs. This would help identify the need to increase proper recycling awareness in the residential curbside recycling program, as well as low recycling rate groups which could then be targeted for recycling education. For the commercial recycling program, this would ascertain whether current county ordinances are sufficient or if the ordinances need to be changed to increase recycling rates.

By estimating the amount of recyclable and organic waste that can be diverted from landfilling, Alachua County can begin to work towards the goals of the Florida Energy Bill[1]. The bill, which was signed in June 2008 by Governor Charlie Crist, provides a comprehensive energy and economic development policy to encourage alternative energy and "green" industry technologies. Two main statewide objectives are established involving recycling and organics diversion. Florida Statutes Section 94 Title XXIX, Chapter 403, 403.7032 Recycling, establishes a statewide target to reduce the amount of recyclable solid waste disposed of in waste management facilities, landfills, or incineration facilities by a statewide average of at least 75% by the year 2020. Any solid waste used for the production of renewable energy counts toward the goal. Diversion opportunities to be considered are composting, increasing recycling rates, and increasing the amount of accepted recyclable materials. The way counties and municipalities measure their recycling rate may have to be adjusted in the process of trying to reach this goal, as the current measurement standard used by many areas is to use the total tons of waste produced and the total tons of recycled material to calculate the recycling rate. However the goal may make it necessary to adjust this method to count the rate as the tons of recycled materials divided only by the tons of currently accepted recyclable materials.

1.3. Study Design

To achieve the objectives of the study, the following steps were conducted:

- Determined material categories to identify specific components of the landfilled waste stream;
- Formulated materials sort protocol to ensure safe and proper sorting techniques;
- Conducted sorting and sampling events in two one week phases;
- Compiled and reviewed collected data; and
- Completed statistical modeling.

A total of 39 samples representing more than 10,000 pounds of municipal solid waste (MSW) were sorted for the 2009 Study. The materials were sorted into 89 material categories which are detailed in Appendix C. The samples were complied by source/generator type (i.e., residential, commercial, and institutional) and the weights of materials in each category were determined on site.

[1] Florida Senate, Florida House of Representatives, Florida Energy Bill, 2008, 7/10/2009, http://www.flsenate.gov/data/session/2008/House/bills/billtext/pdf/h713503er.pdf

The results were then combined to characterize the MSW on a countywide basis by generator type and overall composition.

1.4. Background

Prior to the 1997 study, commercial businesses were not required to recycle. The study provided evidence that sufficient recyclable material was present in the waste stream and, thus, needed to be handled properly.

In 2007, according to reports from Florida Department of Environmental Protection, the overall County recycling rate was 30%[2]. These numbers are calculated by the state of Florida based on reported waste production rates and reported recycling rates. The state implemented the calculation method, which is still currently used, in 1997 to keep better records of recycling rates. This method takes only certain recycled materials into account. For example is that only 15% of the recycled yard waste is documented, also construction and demolition (C&D) recycling, and out of state recycling facilities, and recycling facilities that generate less than 600 tons a year are not counted towards the reported recycling rates[3].

Currently, mandatory commercial recycling ordinances are in place in the City of Gainesville and Alachua County. The Mandatory Commercial Recycling Ordinance, Chapter 27, Article III, Division 3, Sec. 85-88[4] applies to all hotels, motels, restaurants, bars, and retail stores. Businesses are provided with educational tools, resources, and expertise offered through the complimentary waste survey. These ordinances only have soft enforcement. No business has been brought before the code enforcement board for noncompliance since the ordinance was created. Also, in Gainesville, the city ordinance currently lacks enforceable penalties. In 2001, Alachua County instituted a mandatory commercial recycling program for commercial properties in Alachua County Code Section 75.100[5]. This code applies to businesses located in the unincorporated areas of Alachua County, namely owners of commercial properties must recycle. The 2009 study shows the need for more stringent/rigorous enforcement of what is currently recycled by commercial businesses.

1.5. Demographic Overview

Alachua County is located in north central Florida with a population of 247,561 people in 2007[6]. Despite the county's urban designation, it has large expanses of rural areas outside the city of Gainesville, which has more than 100,000 residents. Eight municipalities are scattered throughout the county: Alachua, Archer, Hawthorne, High Springs, LaCrosse, Micanopy, Newberry and Waldo. Figure 1 provides a map of the county and its municipalities. The five rural collection centers are included on the

[2] Florida Department of Environmental Protection, County MSW & Recycling Data Summary Sheets: Alachua County, 7/01/2009, http://www.dep.state.fl.us/waste/categories/recycling/SWreportdata/07_data.htm

[3] Florida Department of Environmental Protection, Bureau of Solid & Hazardous Waste, State of Florida's Recovered Materials Certification and Reporting Program, 5/05/2009, 8/26/2009, http://www.dep.state.fl.us/waste/categories/recycling/pages/rmdealercert.htm

[4] Code of Ordinances, City of Gainesville, 4/2/2009, http://www.municode.com/Resources/gateway.asp?pid=10819&sid=9

[5] Alachua County, Alachua County Board of County Commissioners, Mandatory Commercial Recycling, 1/18/2001, 7/10/2009, http://www.alachuacounty.us/assets/uploads/images/ordinances/2001/01-18.pdf

[6] Florida Estimates of Population 2007, Bureau of Economic and Business Research, University of Florida, 4/1/2007 , 8/26/2009, http://www.bebr.ufl.edu/system/files/2007_Estimates_Table01.pdf

map. These include High Springs, North Gainesville, Waldo, Hawthorne, and Archer. Waste, recyclables, and yard trash is accepted at the collections centers. Recyclables included are discussed in Section 1.6.

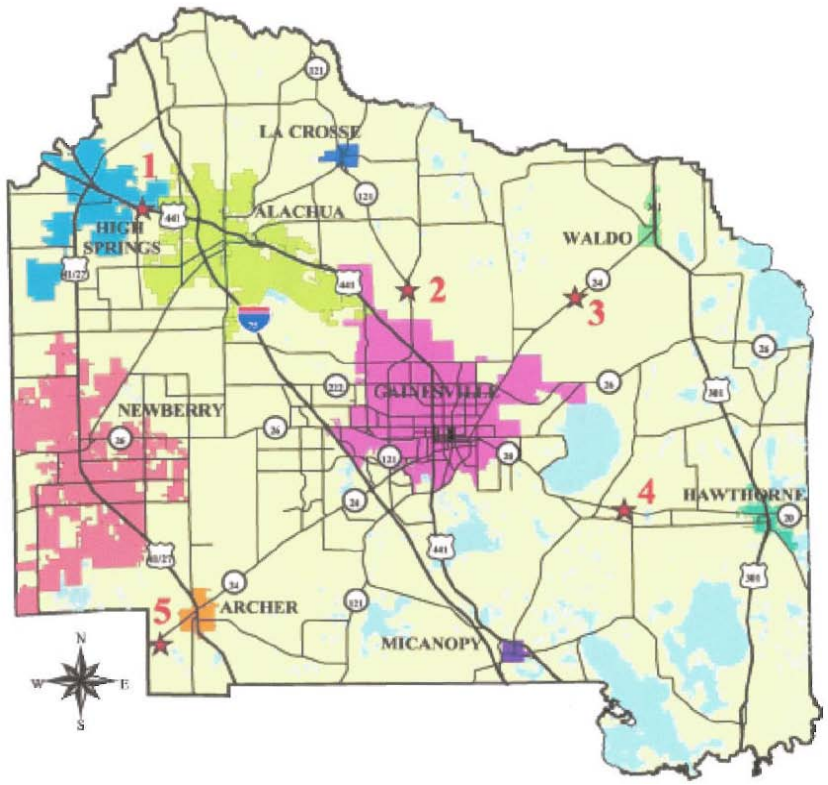


Figure 1 Map of Alachua County's Eight Municipalities and Five Rural Collection Centers.

Population growth in Alachua County is occurring at a rate lower than that of the state's average. The estimated percent change in population for Alachua County vs. that of the state of Florida was 20.5% vs. 23.5% in 2000, 8.0% vs. 9.3% in 2004, and 9.9% vs. 11.5% in 2008 respectively. The county has a predominantly young population, which is attributed to having two large institutions of higher education, the University of Florida and Santa Fe Community College. Between the two colleges, Alachua County has more than 60,000 students. This is best illustrated in the percentage of young adults, 15-24 years old, in Alachua County (25.8%) compared to the state (12.9%) as a whole.

The percent distribution of males (48.7%) is almost equal to the state average. Alachua County residents had a median income of $36,164, which is 81.9% of the state's median income, $44,138. In Florida, one-fifth of individuals 25 years old and over do not have a high school diploma, while in Alachua County only one tenth of individuals 25 years old and over do not have a high school diploma.

1.6. Waste Disposal Overview

Waste from the different sources in Alachua County are collected and handled differently. These differences are also reflected in what is available for recycling. Residential curbside pick-up is offered in certain areas in Alachua County. The pick-up includes solid waste, recycling, and yard waste. In addition, bulk items can be picked up on the curbside by placing a special waste pick-up request. Half of each week is designated to county solid waste and recycling collection days and half to city of

Gainesville solid waste and recycling collection days. Five rural collection centers are also provided (Figure 1).

MSW in Alachua County is collected by contracted commercial local haulers and is currently hauled to the Leveda Brown Environmental Park in Gainesville where the Alachua County transfer station and the Recovered Materials Processing Facility are located. The waste is then hauled by trucks with a larger capacity, 100 yd^3, to NRRL for final disposal. Baker County, Bradford County, Union County, Alachua County, and Levy County all dispose of their waste at the NRRL. The County has contracted with NRRL until 2018. In 2007, the transfer station processed approximately 500 to 600 tons per day or 163,000 tons per year of household and commercial waste generated in the County7. In 2008, the transfer station processed approximately 152,000 tons and additional waste was hauled directly to the NRRL, totaling 194,000 tons of household and commercial waste generated in the County in 2008[8]. In 2009, it is estimated that the County will process approx. 172,000 tons for the entire fiscal year waste, with no direct hauling to NRRL. The waste reduction could be related to the poor economy, thus less goods are being purchased and disposed of. The waste is transported from the Alachua County transfer station to the NRRL in Raiford, Union County, Florida via tractor trailers. The transfer station accepts self hauled waste as well as illegal dump site material (i.e. materials illegally dumped on the side of a road), white goods, and special handling waste. The Alachua County transfer station records all commercially hauled waste that enters the transfer station as commercial, residential, institutional, or governmental.

The recyclables are picked up as part of the residential curbside collection program by a contracted hauler. Currently SP Recycling Inc. is contracted to handle all the incoming recyclables at the Recovered Materials Processing Facility

Currently the county's residential curbside recycling program includes the following materials:

- Metal Cans
- Aluminum Cans
- Glass Bottles and Jars
- Plastic Bottles, Jugs, Jars and Tubs (#'s 1-7)
- Newspapers
- Magazines/Catalogs/Phone Books
- Office Paper/Junk Mail
- Corrugated Cardboard

The mandatory commercial recycling program in the City of Gainesville and unincorporated Alachua County were designed to fundamentally mirror one another. The City of Gainesville requires the collection of commodities broken down by business type. The county program allows businesses to choose 3 of the 8 commodities listed above, realizing that commodities fall into place by business type. Both programs recognize and require the recycling of commodities that represent more than 15% of a businesses waste stream. Property owners are required to provide their tenants with recycling facilities and the opportunity to recycle. The contracted hauler then takes the collected recyclables to the Recovered Materials Processing Facility operated by SP Recycling Inc.

[7] Alachua County, Transfer Station, 7/4/2009, http://www.alachuacounty.us/government/depts/pw/waste/environmental/transferstation.aspx

[8] Ron Bishop, Personal Communication, 2009

The same materials that are recycled residentially are accepted commercially; in addition other materials are collected exclusively for the commercial sector such as bulk ferrous metals. It should also be noted that business that employ large numbers of employees will produce waste that has a similar waste composition to residential waste due to the nature of the presence of residential employees. Exemptions are available by request from the owner if the property produces less than 4 (four) cubic yards of solid waste per week or produces designated recyclables that constitute less than 15% of their solid waste.

1.7. Historic Composition, Generation, and Recycling Rates

The 1997 waste composition study investigated disposal at the Alachua County Southwest Landfill (which is currently closed), as well as waste production by the generator and the retail industry. Within these categories there was a characterization of waste type. The landfill waste types included single-family residential, commercials/institutional and rural collection sites/drop-off centers. The generator was classified as commercial office building or commercial/institutional. The retail was broken into bars/restaurants, grocery stores, and cafeterias. Commercial/institutional, single-family, and multi-family all had around 30% paper, 25% organics, and 15% plastic by weight. The commercial waste has a lower percentage by weight of paper (27%) and a higher percentage of plastic (17.6%) than the residential loads, approximately 35% and 14% respectively. It was also noted that the percentage of organics (22.9%) in the commercial category is actually lower than that of the residential. For more information regarding the previous waste composition study completed in 1997, refer to Appendix B.

The amount of waste produced in Alachua County has increased over the past fifteen years since the last waste composition study was performed. The recycling rates are variable and do not demonstrate a clear trend because of the State of Florida's method of reporting recycling rates, as previously mentioned. Clearly the economic downturn has impacted the production rate of MSW in Alachua County as can be seen in Table 1 below. The decline in waste production over the past 2 years has mirrored the economic downfall.

Table 1 Historic Generation and Recycling Rates in Alachua County 2000-2008

Year	Population Estimate	MSW landfilled (tons)	MSW Recycled (tons)	Total MSW Generated (MSW Tonnage Landfilled and Recycled)	MSW Landfilled Per Capita (tons)	Recycling Per Capita (tons)	MSW Per Capita Production (lbs./day)	MSW Recycling Rate
2000	217,955	157,780	58,323	216,103	3.97	1.47	5.43	27%
2001	218,795	164,567	54,960	219,527	4.12	1.38	5.50	25%
2002	228,607	173,576	79,765	253,341	4.16	1.91	6.07	31%
2003	231,296	169,627	74,518	244,145	4.02	1.77	5.78	31%
2004	236,174	133,993	73,424	207,417	3.11	1.70	4.81	35%
2005	240,764	161,554	75,270	236,824	3.68	1.71	5.39	32%
2006	243,779	189,513	81,905	271,418	4.26	1.84	6.10	30%
2007	247,561	194,182	94,432	288,614	4.30	2.09	6.39	33%
2008	252,388	184,827	109,396	294,223	4.01	2.38	6.39	37%

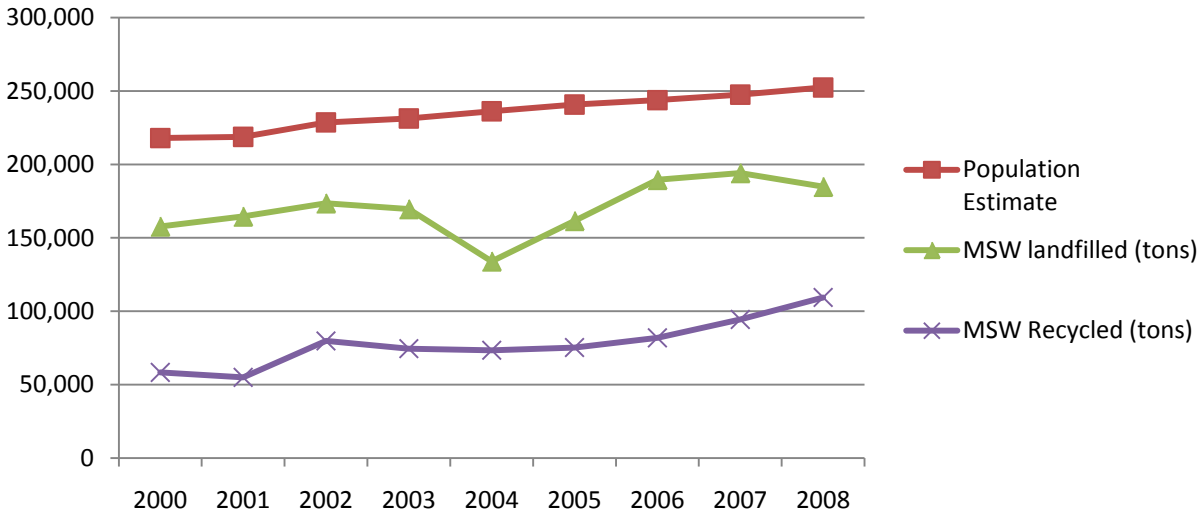


Figure 2 Tons of Landfilled/Recycled MSW and Population Growth in Alachua County 2000-2008

The 1997 waste composition study, performed by SCS, investigated solid waste disposal at the Alachua County Southwest Landfill (currently closed), the study included landfill disposal, generator disposal, and food retailer disposal. The landfill disposal samples included single family, multi family, rural drop off, and commercial/institutional waste. The generator disposal samples consisted of commercial office building and institutional/governmental samples. Both of the aforementioned sample categories were comprised mostly of paper, plastic, and organics (Table 2). The retail food waste (taken from bars/restaurants, grocery stores, and cafeterias) were divided into meat/animal, vegetable, food contaminated paper, and other categories (Table 3). A more detailed synopsis can be found in Appendix B.

Table 2 Summary of 1997 Alachua County Waste Composition-Landfill & Generator Waste

Sample Type	Paper	Plastic	Organics
Landfill Waste	33.0%	15.5%	24.8%
Generator Waste	44.0%	16.6%	25.7%

Table 3 Summary of 1997 Alachua County Waste Composition-Food Retail

Sample Type	Meat/Animal	Vegetable	Food Cont Paper	Other
Food Retail	7.0%	25.1%	25.6%	42.3%

*Tables shown above are not representative of weighted averages of all waste divisions within the sample type, only of numerical averaging assuming each waste division holds equal weight.

2. Methodology/Study Design

2.1. Introduction

This section describes what was completed as part of the 2009 waste composition study performed by the University of Florida. The fundamental tasks were to:

- determine material definitions,
- formulate materials sort protocol,
- conduct sampling and sorting events,
- compile and reviewed collected data, and
- analyze statistical results.

2.2. Material definitions

A total of ten broad main categories, as well as seven specific categories, with 72 material subcategories were determined for this study. Listed in Table 4 are the ten categories and a general description of the category which includes the main subcategories. Appendix C contains detailed explanations of each of the subcategories.

Table 4 General Description of the Ten Categories Used in the 2009 Study

Category	General Description
Paper	Any material composed of paper. Mainly composed of corrugated cardboard (OCC), boxboard, and office paper.
Plastic	Any material composed of paper. Mainly composed of film and rigid plastics.
Glass	Any glass products. Include glass containers as well as flat glass.
Metals	Any metal products. Mostly consists of food service containers (aluminum, cans, and foil), but also aerosols, propane tanks, and composite metals.
Organic	Any organic waste primarily food waste, but also includes yard waste and animal by-products.
Disposable Diapers	Due to the plastic content in diapers, they were considered separately from Organics, which can all be composted.
Other Products	Include a variety of products such as tires, rubber, textiles, apparel, and electrical appliances, computer related electronics, and portable electronics
Bulky Items	Include large items such as carpet, furniture, and mattresses.
C&D	Construction and demolition debris such as gypsum (drywall), wood, ceramics, and roofing materials.
HW	Hazardous waste such as harmful fluids (auto related, paints, solvents, pesticides, and cleaners), batteries, and mercury containing products

The material categories included as part of the 1997 Study were used as the categories in the 2009 study to allow for a comparison of the results. However, numerous subcategories were added to

the 2009 study as compared to the 1997 study, such as compostable paper, plastic #3 - #7, other rigid plastic, plastic products, other aluminum containers, computer related electronics, etc.

Since the main categories remained similar, the results from each study can be compared. In 2009, the subcategories were significantly expanded to investigate current recycling and composting opportunities. For instance, the paper category was divided into subcategories of recyclable paper to evaluate current recycling efforts and the viability of recycling other paper types. Accordingly, the junk mail subcategory can relay information about the effectiveness of the current recycling program (i.e. if there is a low amount of junk mail in the waste stream, examiners infer the program is likely effective). Also, the compostable and soiled paper were lumped together to examine the potential for composting. The plastic category is divided into many subcategories to analyze what percent of the waste stream is filled by other rigid plastics and film, which are not currently recycled by Alachua County.

Multiple subcategories for hazardous waste (HW) are included to investigate the presence of different types of HW, including mercury containing products. Construction and demolition (C&D) materials are categorized separately into categories such as wood, metals, and gypsum because these materials should not generally enter the transfer station, but are entering in high volumes. Separate categories for computer-related electronics and portable electronics are included because these items are anticipated to become more prominent components of the waste stream.

2.3. Sampling Plan and Generator Types

The sampling plan was devised based on the source (generator type) and the percent contribution to the waste stream by weight as shown in Table 5. This data was provided by Ed Lontz at the Alachua County Transfer Station. The percent contribution by weight differs from the percent contribution by volume because of differences in density. The commercial waste tends to be denser, and therefore constitutes a larger percent of waste by weight. In Alachua County the commercial sector contributes to 53% of the waste stream by weight, but only 41% of the trucks that enter the transfer station bring commercial waste; this is because commercial generators often have trash compacters on site, making the waste denser, thus requiring fewer trucks to haul. Thus more commercial samples were collected to achieve a proper sampling distribution.

Table 5 Annual Tonnage of Municipal Solid Waste by Source Provided by the Alachua County Transfer Station from 2/1/2008 and 1/31/2009

Source	Count (Trucks/yr)	Pct by Count	Weight (Ton/yr)	Pct by Weight	Pct by Weight
----------	----------	----------	----------	----------	----------
Residential	17,900	51%	63,733	40%	41%
Commercial	14,454	41%	85,500	53%	55%
Institutional	842	2%	5,001	3%	3%
Government	2,071	6%	5,993	4%	-
----------	----------	----------	----------	----------	----------
Total	35,268		160,227		
Total without Government	33,197		154,234		

As requested by the county, commercial waste was also sampled more since the residential curbside recycling program is better established than the commercial program. Thus, the commercial waste source would have the biggest potential for waste reduction, since with an enforced mandatory recycling ordinance businesses would have an incentive to recycle properly which would increase recycling rates and reduce contamination in the recycling stream.

Table 6 contains a breakdown of the number of samples from each source that were taken, total sample weight, mean sample weight, as well as a percent breakdown by count as well as by weight. The sources, residential, commercial, and institutional, are evaluated and explained below.

Table 6 Description of the Sources Sampled in the 2009 Alachua County Municipal Solid Waste Composition Study, Featuring the Distribution between the Sources

Source	Count (Number of Samples)	Total Sample Weight	Mean Sample Weight	Pct by Count	Pct by Weight
----------	----------	----------	----------	----------	----------
Commercial	19	5,024	264.4	50.0%	47.8%
Residential	13	3,845	295.7	34.2%	36.6%
Institutional	6	1,641	273.6	15.8%	15.6%
----------	----------	10,509	277.9	----------	----------

2.3.1. Residential

For the purpose of this study, residential waste is considered to be that generated from the day to day activities in single-family households. Private haulers serve residents biweekly with large side loading, compactor trucks that collect waste from households. The waste from households is thoroughly mixed during the collection and tipping process. Due to the homogeneity of residential loads it was simpler to obtain representative samples of this waste than from the more variable commercial loads. This conclusion is based on the assumptions that residential waste composition does not differ materially based on the time of day or day of the week it is collected.

2.3.2. Commercial

Commercial waste in Alachua County is considered the waste that is disposed of in dumpsters, roll-offs, and compactors. The waste is generated from the activities of restaurants, retail stores, offices, multi-family housing, and manufacturing establishments among others. All of this waste is typically mixed together with front loading compactor trucks. Thus, the commercial sector typically has the greatest variation in waste composition from sample to sample. Some of the same assumptions hold true for commercial waste as for residential waste. For example, waste generated at a restaurant will not differ materially based on the day of the week it is generated; only the volume of waste will change. Offices, retail, grocery, etc will not vary as well. However, the composition of commercial loads arriving at a facility for disposal is variable during the course of a single day due to the deviations in what is collected in one truck.

During Phase I, trucks were randomly selected by generator type, but trucks were predetermined during Phase II to ensure certain types of commercial loads were investigated. Loads

consisting of multi-family housing waste that were selected for sampling typically came from complexes with trash compactors onsite.

2.3.3. Institutional

The University of Florida comprises almost a fourth of Alachua County's population. Consequently, the campus produces the majority of the institutional waste, an estimated 90%. The university and its private contractors haul the waste to the transfer station. The waste from local schools is mixed with other sources of waste, and therefore cannot be easily sampled. Samples were collected to fully represent the campus academics, administration, food services, as well as Shands Hospital.

2.3.4. Governmental

Alachua County Transfer Station personnel classify trucks as governmental based on the paying account. Examples of the governmental category sources are Gilchrist County, the Household Hazardous Waste Center, City of Gainesville Public Works, Roads and Bridges, Parks and Recreation, and Facility Management. Since governmental waste represented such a variable sector and the county expressed little interest in its composition, it was not sampled for this study.

2.4. Sampling and Sorting Protocol

2.4.1. Sampling

Two one-week phases of sorting were conducted during the spring of 2009 at the Alachua County Transfer Station resulting in a total of 39 samples, representing more than 10,000 pounds of MSW handled by the transfer station. All samples were collected from the tipping floor at the Transfer Station after the hauler had dumped the load. Vehicle selection varied from Phase I to Phase II due to a desire to evaluate certain residential, commercial, and institutional loads. During Phase I all loads were randomly selected by category source, while sampling in Phase II consisted of a more in-depth analysis of vehicle origins and targeted loads.

When each truck was selected the sample weight for sorting was a minimum of 200 pounds. Two to three hundred pound samples are considered the appropriate size to provide representative results per accepted industry standards. Each sample was taken to accurately represent the selected load using the transfer station operator and team leader's best judgment.

2.4.2. Sorting

Once each sample was selected, the materials were pre-sorted for the presence of any hazardous or infectious wastes. If any of such materials were found, it was recorded in the sampling form and the waste was removed from the sample in accordance with the safety plan located in Appendix D. Supervisor and Assistant Supervisors completed a visual assessment of the entire sample selected. Items scanned for were as follows:

- Sharps
  - Needles
  - Razors
- HW
  - Flammable
  - Corrosive
  - Reactive
  - Toxic
- Infectious Waste
  - Biomedical bags (often red bags)
  - Syringes
  - Items that may transfer disease or infection to another person (bloody medical items)

The Supervisor and Assistant Supervisors then placed waste on the sort table and created a thin layer that would be easily sorted. The waste was again visually inspected for the presence of any potential hazards (as identified above) prior to the sort by the research team.

After the material on the table was deemed free of obvious hazard, the materials were then sorted into individual containers representing the various 72 material subcategories. Subcategory items were carefully picked from the surface of the waste. Sorters avoided grabbing handfuls of waste as to prevent the possibility of puncturing the protective gloves. Sorters were instructed to only sort for those material subcategories whose bins were located nearest to the sorters location. This was implemented to reduce the hazard of any accidents around the sorting table by minimizing the amount of necessary movement with waste in the sorters hands.

Waste was sorted as it was presumed to enter the waste stream. For example, if a shopping bag was not containing any waste, it was presumed to have begun a clean shopping bag, although by being place in a trash can, compacted in a waste truck, and then dumped on the tipping floor it may have been contaminated and become dirty. Also, OCC that was placed in the waste was presumed to have begun as a dry, non-contaminated piece of cardboard, although at the sort table it may have had food on it, thus it was placed in the OCC plain bin. Yet, pizza boxes, tissues, and paper towels were always placed in the compostable paper which includes food contaminated paper.

The sort table was constructed to achieve optimum efficiency, Figure 3. Once materials reached two inches in size the efficiency of sorting drastically decreased as items could no longer be easily identified. As such the sort table had a 2x2 inch screen to allow smaller particles to pass through (noted as residuals > 2”), this material then landed on a 1x1 inch screen (noted as residuals > 1”), and the material that ended up on the floor was called fines. These different types of residuals were considered as categories, and constituted 13.5% of the overall waste stream. The high percentage of residuals in the waste stream represents an unidentifiable part of the waste stream thus should not be considered as potentially recyclable.

Figure 3 The Sorting Table Constructed to Increases Sorting Efficiency Using Screens

2.4.3. Data recording

After sorting, each container was weighed to determine the weight by material category in each sample. During phase II the weight, volume, and count were recorded for the potential future efforts of analysis. These weights, volume, and counts for each sample were recorded on an individual data sheet, as well as observations and notes on extraneous items, to document the sorting process. The blank sort sheet can be seen in Appendix E, the completed sort sheets and detailed results from the two sorting sessions can be found in Appendix F for every sample.

2.5. Compilation and Review of Data

Upon completing the sampling and sorting events, the data sheets for each sample were reviewed to ensure that individual entries were legible, a description of the origin of the waste materials, comments on the overall appearance of the load, and other items (items not belonging to any given subcategory) that were found while sorting the load were included.

All of the results were entered into an excel file by sort sheet, which is in Appendix F. The category percentages of the total sample, subcategory percentages of the total sample, and subcategory percents of the categories of each sample were then calculated from the results of each sample. Finally, the data was compiled using a bottom approach demonstrated below.

2.6. Statistical Analysis

The waste composition analysis used was a bottom up approach as shown in Figures 4 and 5. First, each sample was processed and the results recorded as mentioned above. Second, the samples were combined according to the generation source by using weighted averaging all the samples from

residential, commercial, and institutional. Figure 4 shows how each samples weight/load weight was used to complete a weighted average for the institutional waste stream.

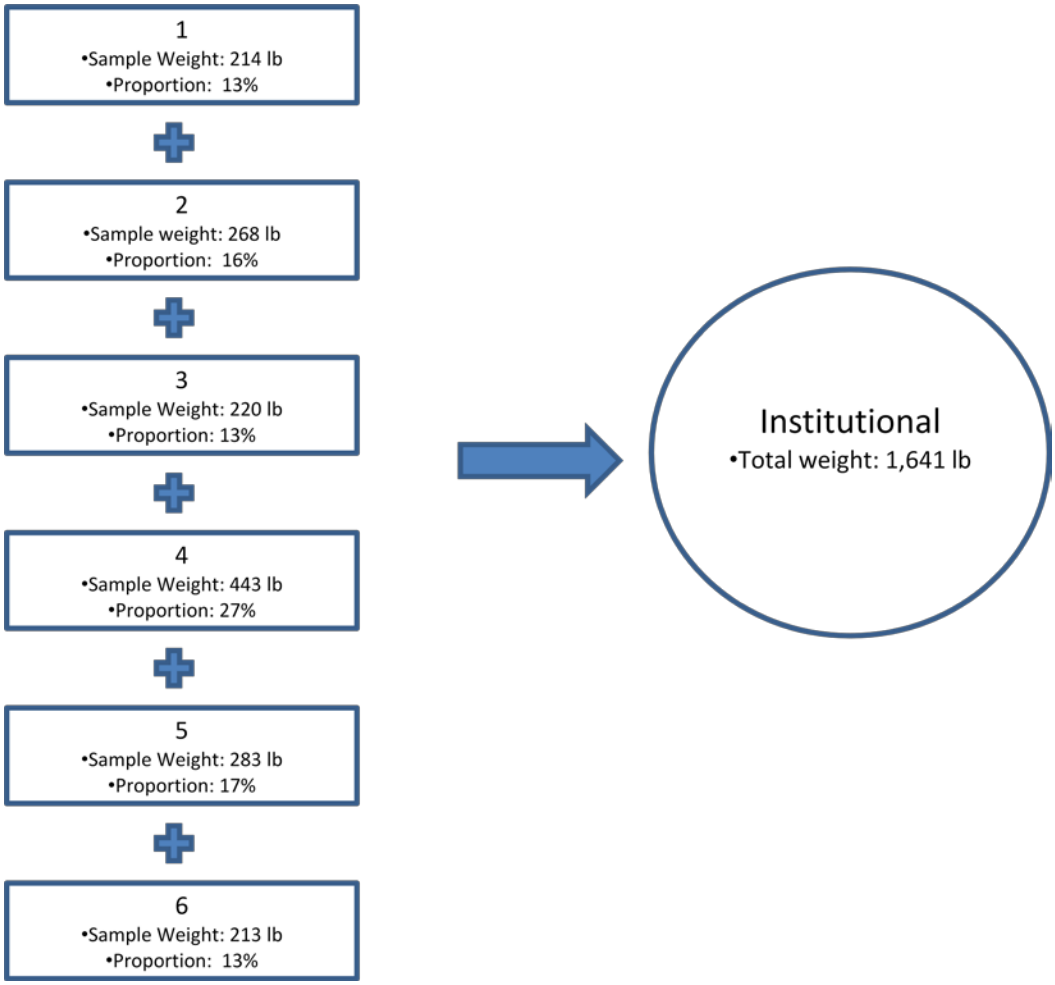


Figure 4 the Bottom up Approach Calculation Method for the Statistical Analysis, Using a Weighted Average to Combine Samples to Calculate Composition by Generator, an Example Using the Institutional Waste

Finally, generating sources were combined using a weighted average for an all over composition of Alachua County's MSW as shown in Figure 5. Table 5 provided the information about the breakdown of the categories and their contribution to the total MSW disposed of annually.

All of the percentages that are presented in the report are means of either material categories or subcategories. The mean is the mathematical average percent of material composing the MSW stream by weight. The results are presented in percentages because these give a better overall feel for the composition of the waste, whereas a tonnage would not give a clear image of how much of the county's waste was being represented. Also, knowing the proportion, allows for simple calculations depending on the total amount of waste produced. Thus, some years had production rates below average but it is probable that rates will not stay low when the economy improves so rates of production are not underestimated for future years when using the proportions. Please see Appendix G for more detail on the statistical analysis.

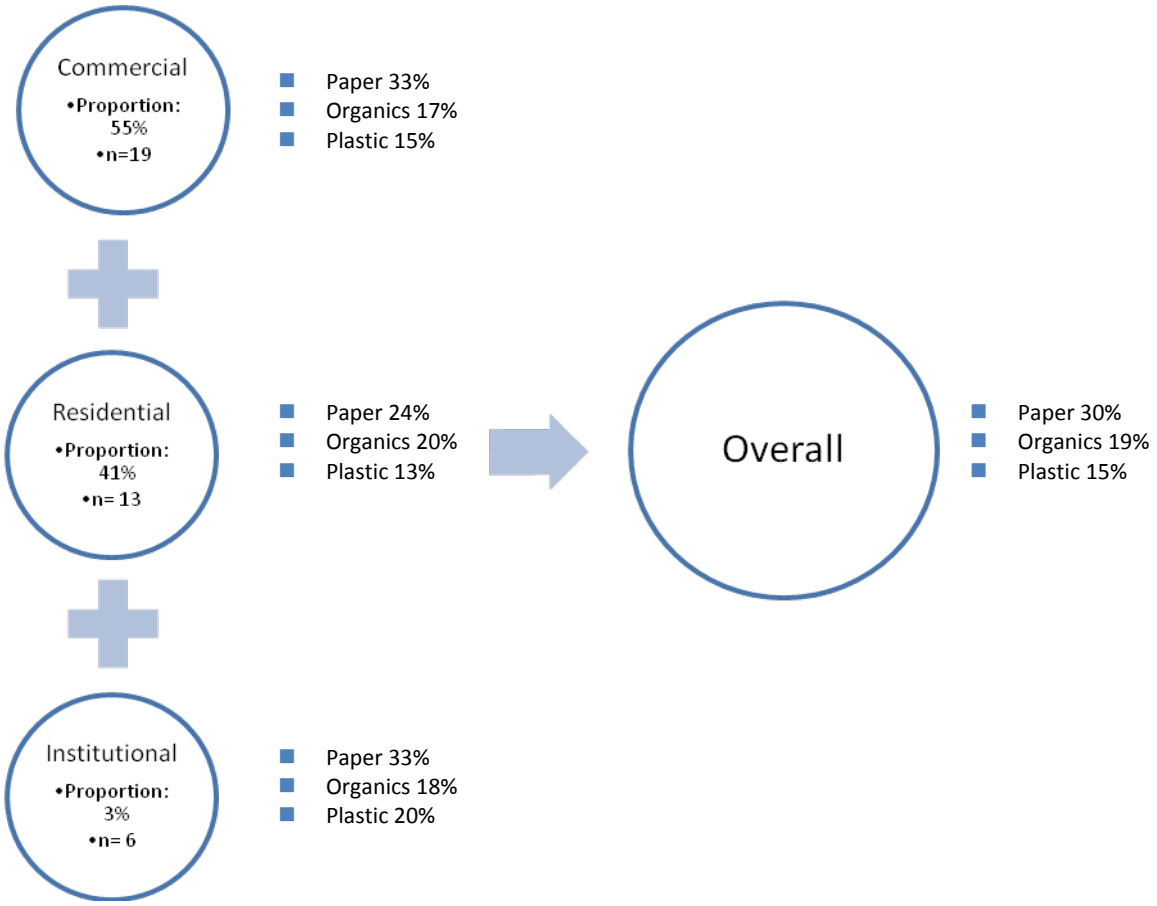


Figure 5 the Bottom up Approach Calculation Method for the Statistical Analysis, Using a Weighted Average to Combine Categories to Calculate the Overall Composition, n=number of samples

Appendix F presents tables with the 90% confidence intervals for each of the waste sources contribution to the entire waste stream, as well as the completed sort sheets, summary tables, and pie charts of the composition by category and for the paper and plastic for all of the loads sorted categories. Paper, plastic, and organics are consistently in the top three of the largest categories. The composition of the organics category consists primarily of food waste, on the other hand the composition of the paper and plastic categories tend to vary. As a result the paper and plastics categories were divided into a multitude of subcategories.

Composition percents presented in this report were calculated at a 90% confidence level, meaning that we are 90% confident each material is between the low and high percentages shown in Appendix F. For example, we are 90% confident that food waste made up between 13.7% and 15.2% of the overall municipal solid waste stream, by weight, but the average is 14.4%. This is the method to calculate each of the low and high percentages in Table 9.

3. RESULTS

3.1. Overview

A total of 39 waste samples were taken and sorted between January and March 2009 for this study. Table 7 summarizes the sample information for the study's four sources, of which only three were sampled. The average sample weight was about 270 pounds for the each of the 39 samples, while the total amount of waste sorted was approximately 10,000 pounds. One sample consisted of the SP recycling reject material that is picked out of their sorting line as contamination. This was sorted to understand what local residents and businesses are not recycling properly.

Table 7 Description of the Sources Sampled in the 2009 Alachua County Municipal Solid Waste Composition Study, Featuring the Total Weight of all Samples taken and the Mean Sample Weight for each Source

Source	Sample Count	Total Sample Wt	Mean Sample Wt
Commercial	19	5,028	264.6
Residential	13	3,845	295.7
Institutional	6	1,641	273.6

In the following sections, composition and quantity profiles are shown for Alachua County's overall waste stream, as well as three sampled sources. The county's commercial source combines commercial waste and multi-family housing waste, but below they are shown compiled as well as separate. In the 2009 Study, multi-family waste is included in the residential section and an overall pie chart is provided for residential waste. This was completed since all waste produced from residencies will be similar in composition, and should be comparable. Each of the waste sources is represented by the following:

1. A pie chart which depicts the composition based on the ten broad waste categories: paper, plastics, organics, disposable diapers, metal, glass, construction and demolition (C&D), other products, household hazardous, and bulk; as well as the residuals, which at times constituted large portions of the samples. Only categories that constituted over 1% of the waste stream are shown in the pie chart to allow for ease of reading. Please refer to the tables in Appendix F for a particular categories presence.

2. A table that lists the ten largest subcategories of the sample by weight. In these tables the percentages will only represent the ten broad primary categories, meaning that the other six main categories (residuals, fines, pharmaceuticals, and such) will not be considered since these consist of unsortable material, non-recyclable material, or represent a very low percentage of the waste. Details on the composition or naming scheme of subcategories can be found in Appendix C.

As previously mentioned, more detailed results the entire waste composition study can be found in Appendix F. The Appendix includes original sort sheets and pie charts of the ten broad primary categories for each sample as well as for the paper and plastic components (consistently two of the largest categories of waste).

3.2. Overall composition

Figure 6 shows the percentage, by weight, of the material categories that compose Alachua County's waste. It can be seen that paper, plastic, and organics compose over 60% of the waste stream, and that the residuals (fines plus residuals) in total are almost 12% of the waste stream.

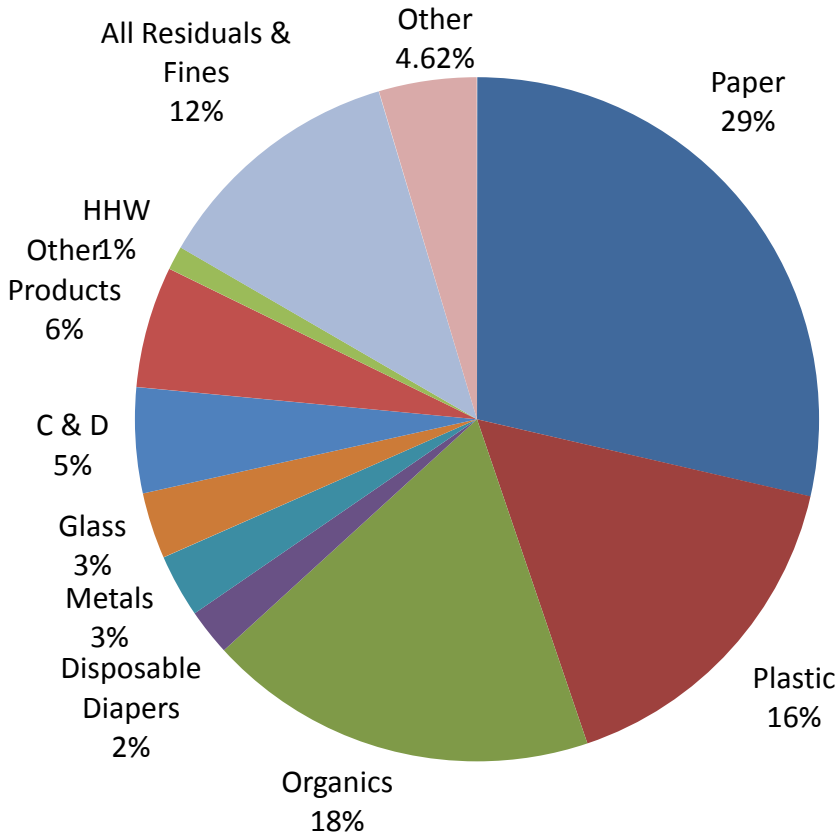


Figure 6 The Overall Municipal Solid Waste Composition for Alachua County Based on the 2009 Study. Percents by Weight

Table 8 lists the top ten waste components found in Alachua County's overall waste stream. When totaled, they equal over 60% of the total, by weight. Food waste was the largest component and OCC the second largest, at 14% and 9%, respectively, and compostable/soiled paper, about 7%, was the third largest component. Note that both film and boxboard are in the top ten.

Table 8 Top Ten Subcategories of the Overall Municipal Solid Waste Composition for Alachua County Based on the 2009 Study.

Subcategory	Pct
Food	14.43%
OCC plain	9.31%
Compostable/ Soiled	7.25%
Film	6.56%
Other	4.24%
Boxboard	3.88%
Misc	3.02%
Textiles & leather	2.60%
Clean Wood	2.57%
High Grade Paper	1.72%

Please see Table 9 below for a detailed profile of Alachua County's overall waste stream, including mean percents and annual tonnage estimates for the waste categories defined for this study. For each material listed in this table, there are three percentages shown: mean, low, and high. The mean is the best estimate of the material's relative percent by weight.

Table 9 Detailed Composition Profile of Alachua County's Overall Waste Stream. Includes the Net Tonnage of each Subcategory

Category	Subcategory	Net Ton	Mean Pct	Lower Pct	Upper Pct
Paper	Newspaper	1,557	0.97%	0.23%	1.71%
	OCC plain	14,947	9.33%	8.59%	10.07%
	High Grade	2,737	1.71%	0.97%	2.45%
	Mixed Recyclable	1,076	0.67%	0.0%	1.41%
	Mixed Recyclable - junk mail	905	0.56%	0.0%	1.30%
	Composite	2,463	1.54%	0.80%	2.28%
	Compostable/ Soiled	11,369	7.10%	6.36%	7.83%
	Boxboard	5,993	3.74%	3.00%	4.48%
	Misc	4,538	2.83%	2.09%	3.57%
	Other	161	0.10%	0.0%	0.84%
Plastic	#1 PET bottles	1,798	1.12%	0.38%	1.86%
	#2 HDPE	741	0.46%	0.0%	1.20%
	#3-#7	224	0.14%	0.0%	0.88%
	Other Rigid plastic	2,562	1.60%	0.86%	2.34%
	Other Rigid plastic - #2,4, and 5	1,197	0.75%	0.01%	1.49%
	Other Rigid plastic - #1,3,6, and 7	1,156	0.72%	0.0%	1.46%
	Other Rigid plastic - nonfood EPS	307	0.19%	0.0%	0.93%
	Other Rigid plastic - food service	1,684	1.05%	0.31%	1.79%
	Film	10,006	6.25%	5.51%	6.98%
	Plastic products	1,134	0.71%	0.0%	1.45%
	Composite	1,119	0.70%	0.0%	1.44%
	Other	106	0.07%	0.0%	0.80%
Organic	Yard waste	1,852	1.16%	0.42%	1.89%
	Food	23,089	14.41%	13.67%	15.15%
	Animal By-products	2,729	1.70%	0.97%	2.44%
	Composite/ o organic	269	0.17%	0.0%	0.91%
Disp. Diapers	Disposable Diapers	2,066	1.29%	0.55%	2.03%
Metal	aluminum drink cont	657	0.41%	0.0%	1.15%
	aluminum foil/cont	631	0.39%	0.0%	1.13%
	other aluminum	216	0.13%	0.0%	0.87%
	food and beverage	1,206	0.75%	0.01%	1.49%
	other ferrous metals	922	0.58%	0.0%	1.31%
	other non-ferrous scrap	48	0.03%	0.0%	0.77%
	empty paint & aerosol	426	0.27%	0.0%	1.00%
	empty propane & o. tank	96	0.06%	0.0%	0.80%
	composite/o. metals	728	0.45%	0.0%	1.19%
Glass	Clear	1,694	1.06%	0.32%	1.80%
	Colored	1,915	1.20%	0.46%	1.93%
	Flat	219	0.14%	0.0%	0.87%
	comp/o mixed cullet	1,623	1.01%	0.27%	1.75%

Table 9 Continued Detailed Composition Profile of Alachua County's Overall Waste Stream. Includes the Net Tonnage of each Subcategory

Category	Subcategory	Net Ton	Mean Pct	Lower Pct	Upper Pct
C&D	Clean Wood	3,948	2.46%	1.73%	3.20%
	Gypsum	333	0.21%	0.0%	0.95%
	Fiberglass Ins	212	0.13%	0.0%	0.87%
	Rock/concrete/bricks	102	0.06%	0.0%	0.80%
	Asphaltic Roofing	39	0.02%	0.0%	0.76%
	Ceramics	2,325	1.45%	0.71%	2.19%
	PVC	30	0.02%	0.0%	0.76%
	Composite/ other C&D	500	0.31%	0.0%	1.05%
Other Products	Tires	0	0.00%	0.0%	0.74%
	Rubber	191	0.12%	-0.62%	0.86%
	Textiles & leather	3,731	2.33%	1.59%	3.07%
	Apparel	2,025	1.26%	0.53%	2.00%
	Electrical Appliances	2,596	1.62%	0.88%	2.36%
	Comp Related Elect	183	0.11%	-0.62%	0.85%
	Portable Elect	80	0.05%	-0.69%	0.79%
HW	Auto Products/Fluids	717	0.45%	-0.29%	1.19%
	Paints & Solvent	198	0.12%	-0.61%	0.86%
	Pesticides, Herbicides, Fungicides	10	0.01%	-0.73%	0.74%
	Household Cleaners	241	0.15%	-0.59%	0.89%
	Lead Acid Batteries	20	0.01%	-0.73%	0.75%
	Other Batteries	99	0.06%	-0.68%	0.80%
	Other HW	55	0.03%	-0.70%	0.77%
	Hg Containing Products	0	0.00%	-0.74%	0.74%
	Cathode Ray Tubes	18	0.01%	-0.73%	0.75%
Bulk	Carpet/ Upholstery	332	0.21%	-0.53%	0.95%
	Furniture	324	0.20%	-0.54%	0.94%
	Mattress	170	0.11%	-0.63%	0.84%
Pharmaceuticals	Pharmaceuticals	241	0.15%	-0.59%	0.89%
CFLs	CFLs	0	0.00%	-0.74%	0.74%
Sharps	Sharps	105	0.07%	-0.67%	0.80%
Residuals >2"	Residuals >2"	7,233	4.51%	3.78%	5.25%
Residuals >1"	Residuals >1"	2,710	1.69%	0.95%	2.43%
Fines/super mix	Fines/ Super mix	11,027	6.88%	6.14%	7.62%
Other	Other	6,596	4.12%	3.38%	4.86%

3.3. Comparison to 1997 Results, the State of Florida, and the United States

3.3.1. 1997 Results

The waste composition results of the 1997 study are similar to those of the 2009 study, as shown in Figures 7, 8, and 9. In Figure 7 it is important to note that the main difference is a 10 percent decrease in Single Family paper waste generation. The decrease in the presence of paper in the waste stream could in part to be due to the fact that SCS included compostable and soiled paper in the organics category, which composed around 5% of each generating sector, whereas compostable and soiled paper were included in the paper category for this study. Another contributing factor could be increased success in the Alachua County curbside recycling program in diverting paper away from the landfill, as well as a shift in technology over the past ten years to reduce the use of paper.

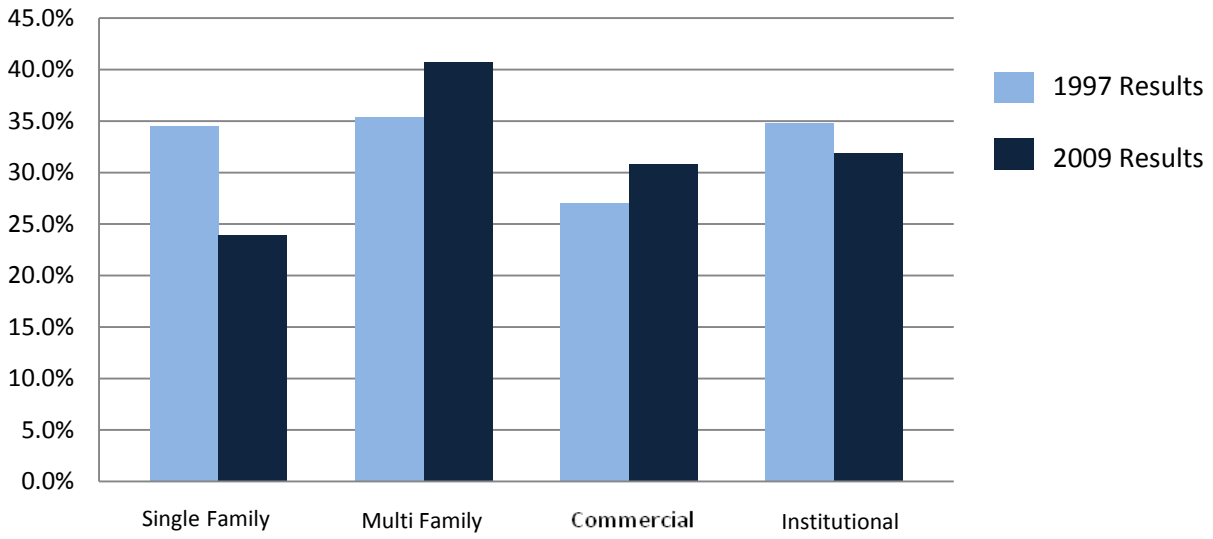


Figure 7 Comparison of Percentage Paper from 1997 Study Results and the 2009 Study Results

Figure 8 shows that the percentage of plastics in the Alachua County waste stream has not changed significantly over the past ten years.

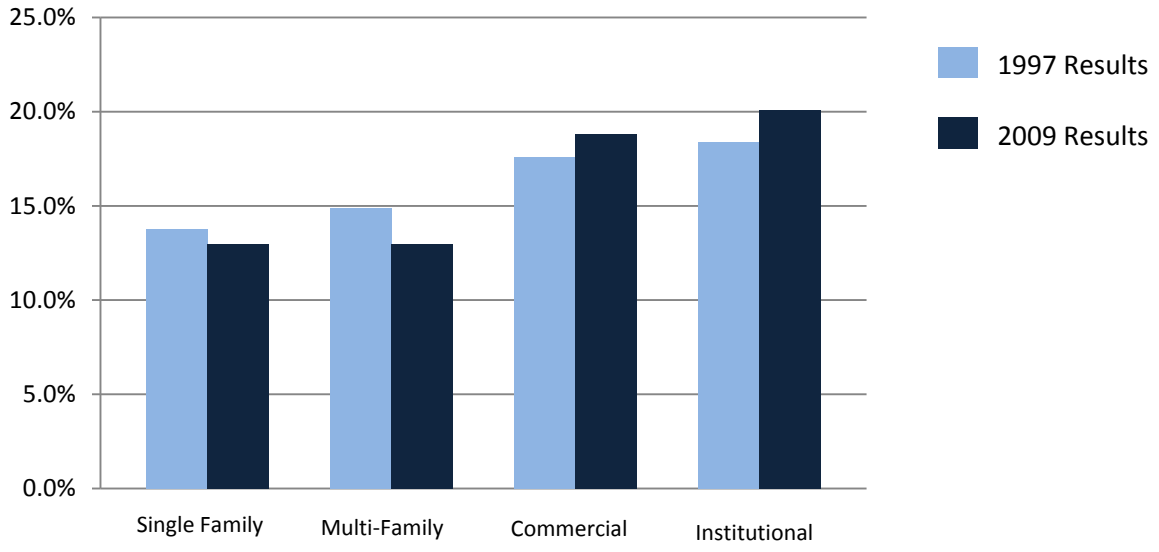


Figure 8 Comparison of Percentage Plastic from 1997 Study Results and the 2009 Study Results

In Figure 9 all of the sources show at least a 5% decrease in the percentage of organics which suggests that the inclusion of compostable and soiled paper under the organics category had a significant effect on the results. This also may be due to differences in the sources of samples, and large differences in the composition of the samples. Due to lack of detail in the 1997 report, conclusions cannot be drawn. The most notable difference in Figure 9 is the 15% decrease in the percent organics of Institutional or Government in the last ten years.

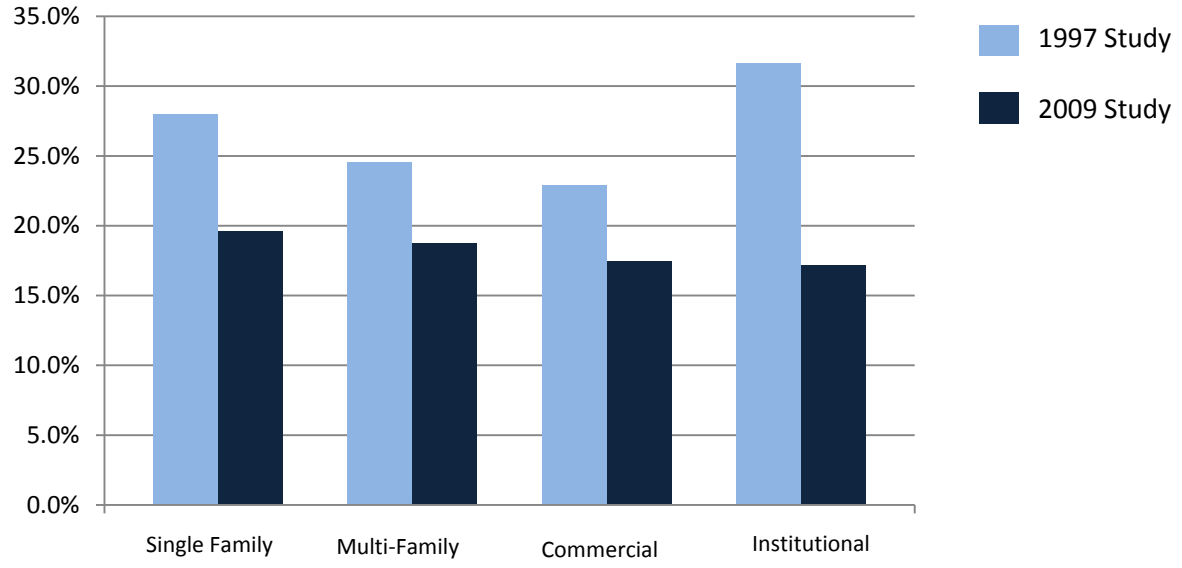


Figure 9 Comparison of Percentage Organics from 1997 Study Results and the 2009 Study Results

3.3.2. State of Florida Composition

The most recent waste composition study completed for the state of Florida was in 2000, Figure 10. The County's waste composition, as compared to Florida's composition, has a lower percent paper (30% vs. 34%), double the amount of plastic (15%) as well as food waste (19%), less than a fifth of the amount of metal (3%), and a small fraction of yard waste (1.16%).

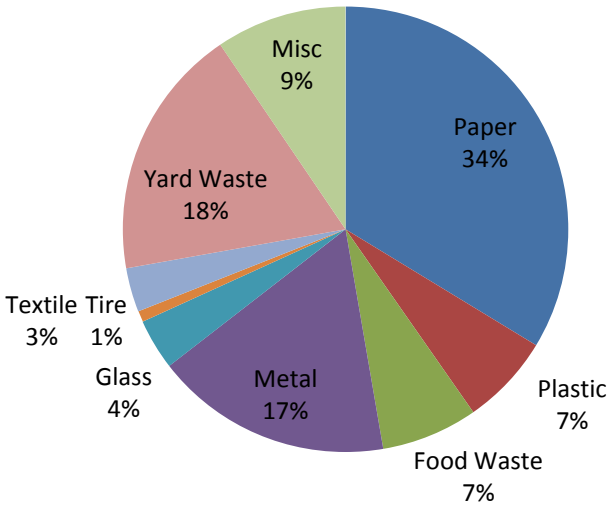


Figure 10 the State of Florida Municipal Solid Waste Composition from 2000

3.3.3. United States National Composition

The most recent waste composition study completed for the United States was in 2007, Figure 11. Alachua County has half of the amount of metal, a small fraction of yard waste, but overall a similar composition to that of the US. Greater similarities between the county study and the US study vs. the county and the Florida study may be due to fact that the study is more recent than that completed by the state and thus will reflect recent trends in waste disposal.

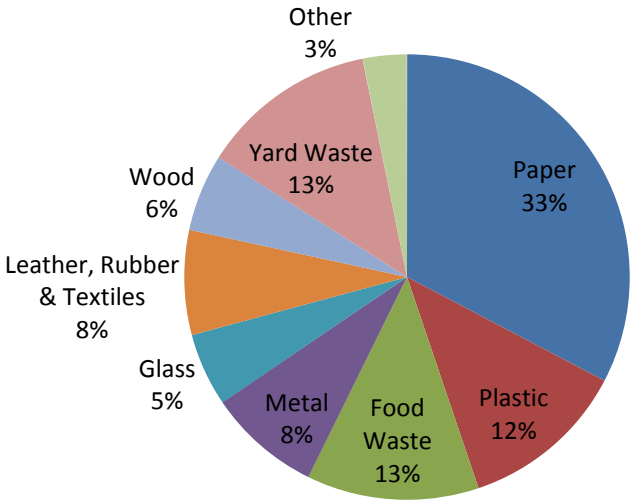


Figure 11 the United States Municipal Solid Waste Composition from 2007

3.4. Composition by Generating Sector

Approximately 40% of Alachua County's MSW was disposed by residents (roughly 64,000 tons per year), while commercial generators produced about 53% of the county's total (approximately 85,500 tons per year). The institutional waste stream contributes to only 3% of Alachua County's waste stream, 5,000 tons per year, in future years this could decrease to an even lower amount due to an increasing amount of sustainability initiatives at the University of Florida.

Table 10 shows a comparison of the percentages of materials in the commercial, single family residential, and institutional MSW streams. Definitions of the material categories may be found in Appendix C. The waste streams are very similar, all three high in OCC, Compostable/Soiled paper, boxboard, film, and food waste. The most notable difference is that the commercial and institutional waste streams have more OCC, where residential has more boxboard than commercial and institutional. Also, the institutional waste film content is very high, although the amount of food waste is half what is produced commercially and residentially. Finally, the amount of compostable/soiled paper in the commercial waste stream is the highest.

Please see sections 3.4.1, 3.4.2, and 3.4.3 below for composition and quantity profiles for the commercial, residential, and institutional sources.

Table 10 Comparison of Alachua County's Municipal Solid Waste by Composition by Waste Source

		Source/ Generating Sector			
Category	Subcategory	COM	RES	INST	OVERALL
Paper	Newspaper	0.8%	1.4%	1.3%	1.0%
	OCC plain	13.7%	2.3%	11.1%	8.9%
	High Grade	2.0%	1.5%	2.3%	1.8%
	Mixed Recyclable	0.4%	1.0%	1.1%	0.7%
	Mixed Recyclable - junk mail	0.2%	1.1%	2.6%	0.7%
	Composite	1.5%	1.9%	1.8%	1.6%
	Compostable/ Soiled	7.4%	6.9%	5.1%	7.2%
	Boxboard	3.4%	4.4%	4.0%	3.8%
	Misc	2.7%	3.2%	2.3%	2.9%
	Other	0.2%	0.0%	0.0%	0.1%
Plastic	#1 PET bottles	1.0%	1.2%	0.9%	1.1%
	#2 HDPE	0.3%	0.6%	0.4%	0.4%
	#3-#7	0.0%	0.3%	0.7%	0.2%
	Other Rigid plastic	2.0%	1.1%	1.7%	1.6%
	Other Rigid plastic - #2,4, and 5	0.7%	0.9%	0.6%	0.8%
	Other Rigid plastic - #1,3,6, and 7	0.6%	0.9%	1.5%	0.8%
	Other Rigid plastic - nonfood EPS	0.3%	0.1%	0.5%	0.2%
	Other Rigid plastic - food service	1.1%	1.1%	1.9%	1.1%
	Film	7.6%	5.1%	11.4%	6.7%
	Plastic products	0.9%	0.6%	0.1%	0.7%
	Composite	0.5%	1.0%	0.3%	0.7%
	Other	0.1%	0.0%	0.0%	0.1%
Organic	Yard waste	1.1%	1.6%	1.8%	1.3%
	Food	14.8%	14.1%	7.5%	14.3%
	Animal By-products	0.2%	3.6%	0.8%	1.6%
	Composite/ o organic	0.1%	0.3%	7.1%	0.4%
Disposable Diapers		0.4%	4.7%	0.2%	2.2%
Metal	aluminum drink cont	0.3%	0.5%	0.8%	0.4%
	aluminum foil/cont	0.2%	0.7%	0.2%	0.4%
	other aluminum	0.2%	0.0%	0.2%	0.1%
	food and beverage	0.3%	1.3%	0.3%	0.7%
	other ferrous metals	0.7%	0.6%	0.2%	0.6%
	other non-ferrous scrap	0.0%	0.0%	0.1%	0.0%
	empty paint & aerosol	0.1%	0.5%	0.2%	0.2%
	empty propane & o. tank	0.0%	0.1%	0.0%	0.1%
	composite/o. metals	0.4%	0.5%	0.4%	0.5%
Glass	Clear	0.7%	1.5%	0.5%	1.0%
	Colored	0.8%	1.7%	0.1%	1.1%
	Flat	0.2%	0.1%	0.0%	0.1%
	comp/o mixed cullet	1.7%	0.4%	0.0%	1.1%

Table 10 Continued Comparison of Alachua County's Municipal Solid Waste by Composition by Waste Source

		Source/ Generating Sector			
Category	Subcategory	COM	RES	INST	OVERALL
C&D	Clean Wood	3.0%	2.3%	0.1%	2.6%
	Gypsum	0.1%	0.4%	0.3%	0.2%
	Fiberglass Ins	0.1%	0.2%	0.0%	0.1%
	Rock/concrete/ bricks	0.0%	0.2%	0.0%	0.1%
	Asphaltic Roofing	0.1%	0.0%	0.0%	0.0%
	Ceramics	2.2%	0.8%	0.0%	1.6%
	PVC	0.0%	0.0%	0.0%	0.0%
	Composite/ other C&D	0.3%	0.3%	2.0%	0.4%
Other Products	Tires	0.0%	0.0%	0.0%	0.0%
	Rubber	0.1%	0.2%	0.4%	0.1%
	Textiles & leather	1.9%	2.9%	8.5%	2.5%
	Apparel	0.4%	2.3%	1.3%	1.2%
	Electrical Appliances	1.5%	2.0%	2.6%	1.7%
	Comp Related Elect	0.0%	0.2%	0.2%	0.1%
	Portable Elect	0.0%	0.1%	0.0%	0.1%
HW	Auto Products/Fluids	1.2%	0.1%	0.1%	0.7%
	Paints & Solvent	0.2%	0.1%	0.2%	0.1%
	Pesticides, Herbicides, Fungicides	0.0%	0.0%	0.0%	0.0%
	Household cleaners	0.2%	0.1%	0.0%	0.2%
	Lead Acid Batts	0.0%	0.0%	0.0%	0.0%
	Other Batteries	0.0%	0.1%	0.0%	0.1%
	Other HW	0.0%	0.0%	0.0%	0.0%
	Hg Containing Products	0.0%	0.0%	0.0%	0.0%
	Cathode Ray Tubes	0.0%	0.0%	0.0%	0.0%
Bulk	Carpet/ Upholst	0.4%	0.0%	0.0%	0.2%
	Furniture	0.4%	0.0%	0.0%	0.2%
	Mattress	0.2%	0.0%	0.0%	0.1%
Pharmaceuticals		0.2%	0.1%	0.0%	0.2%
CFLs		0.0%	0.0%	0.0%	0.0%
Sharps		0.0%	0.1%	0.0%	0.1%
Residuals >2"		5.7%	3.8%	7.4%	5.0%
Residuals >1"		1.2%	2.2%	0.7%	1.6%
Fines/ Super mix		5.3%	9.5%	3.9%	7.0%
Other		6.2%	2.9%	0.2%	4.6%

3.4.1. Commercial

Commercial waste resulting from local businesses was dominated by paper (32%), plastic (18%), and organics (17%) which accounted for half of the waste disposed, Figure 12. The organics contributions to the commercial waste stream can be attributed to a large amount of food waste from restaurants and multi-family complexes.

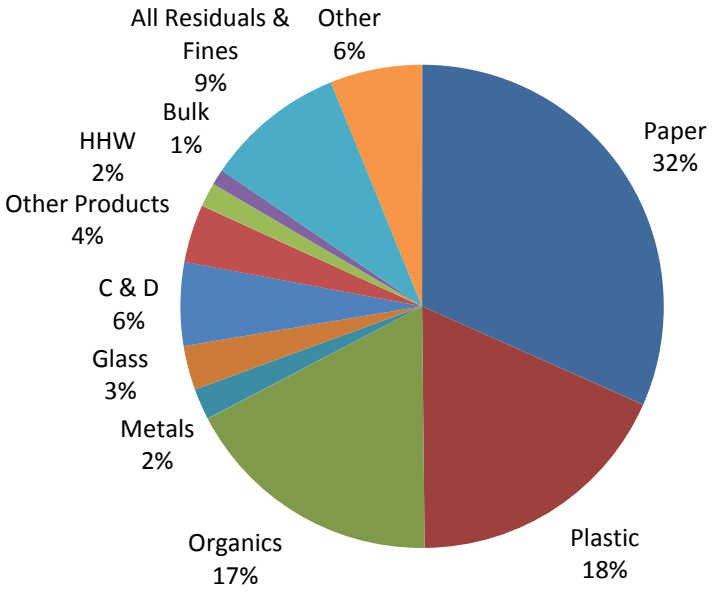


Figure 12 The Combined Commercial Municipal Solid Waste Composition for Alachua County Based on the 2009 Study. Percents by Weight

As visible in Table 11, the top ten waste components of the commercial waste stream accounted for almost 60% of the total. Food (14.8%) and OCC (13.7%) were the two largest components of this sub-stream. Film, compostable paper, and boxboard were the next largest components, accounting for a total of 18% of the total, by weight.

Table 11 Top Ten Components of the Combined Commercial Municipal Solid Waste Composition for Alachua County, Based on 2009 Study

Subcategory	Pct
Food	14.78%
OCC plain	13.67%
Film	7.62%
Compostable/ Soiled	7.45%
Boxboard	3.37%
Clean Wood	3.01%
Misc	2.67%
Ceramics	2.22%
High Grade	2.03%
Other Rigid plastic	1.98%

3.4.1.1 *Commercial – Without Multi-family*

MSW generated by commercial sources (discounting the multi family contribution) was primarily comprised of paper (31%), plastic (19%), and organic materials (17%), Figure 13. Food and corrugated cardboard were the largest components of this waste by weight. Food accounted for about 21%, while corrugated cardboard made up roughly 18% of the waste stream.

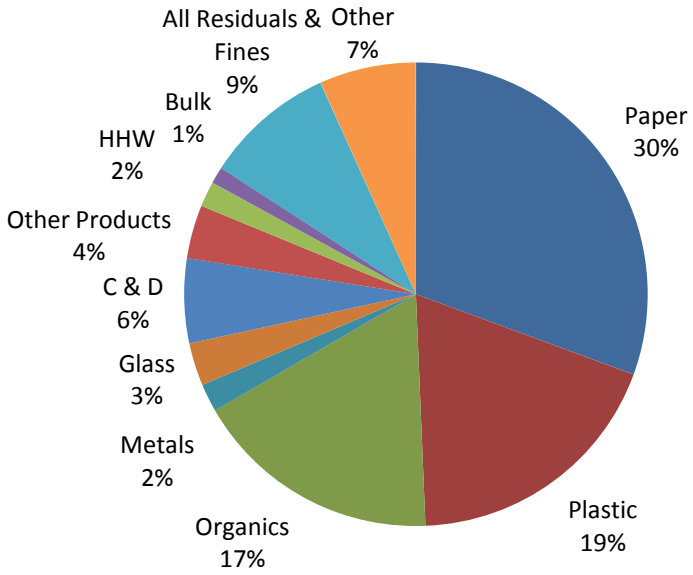


Figure 13 The Commercial Municipal Solid Waste Composition for Alachua County Based on the 2009 Study. Percents by Weight

The top ten waste components of the commercial waste stream accounted for 70% of the total. Food (14.9%) and OCC (13.8%) were the two largest components of this sub-stream, Table 12. Film, compostable paper, other, and boxboard were the next largest components, accounting for a total of 18% of the total, by weight.

Table 12 Top Ten Components of the Commercial Municipal Solid Waste Composition for Alachua County Based on the 2009 Study.

Subcategory	Pct
Food	14.92%
OCC plain	13.77%
Film	7.94%
Compostable/ Soiled	7.26%
Other	6.51%
Boxboard	3.21%
Clean Wood	2.86%
Ceramics	2.51%
High Grade	2.34%
Misc	2.16%

3.4.1.1. Multi-family

Paper (41%) and organic matter (19%) accounted for 60% of the multi-family residential disposed waste, Figure 14. Specifically, food, corrugated cardboard, and compostable/soiled paper were

the largest individual components clearly dominating the waste stream (making up 18%, 18%, and 11% of waste stream respectively).

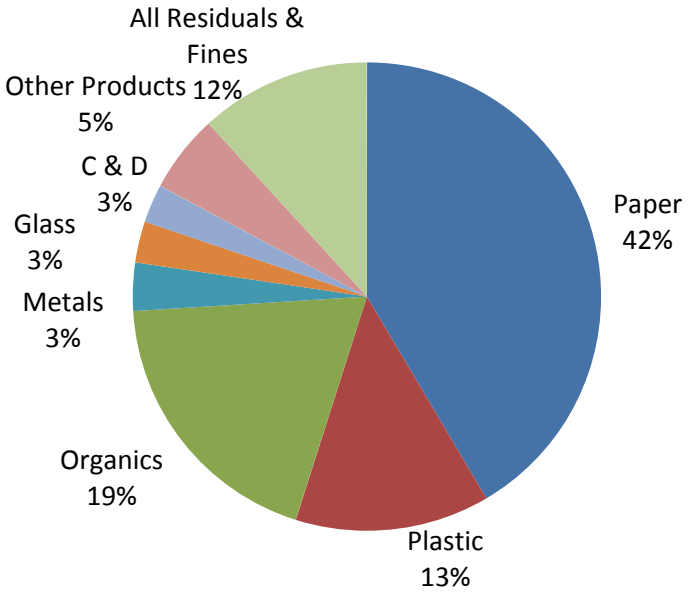


Figure 14 The Multi-family Municipal Solid Waste Composition for Alachua County Based on the 2009 Study. Percents by Weight

The top ten waste components of the multi-family waste stream accounted for 80% of the total, Table 13. OCC and food were the two largest components of this sample (19% and 17%, respectively). Compostable paper, film, and boxboard were the next largest components, accounting for a total of 18% of the total, by weight.

Table 13 Top Ten Components of the Multi Family Municipal Solid Waste Composition for Alachua County Based on the 2009 Study.

Subcategory	Pct
OCC plain	19.83%
Food	17.23%
Compostable/ Soiled	8.85%
Film	5.54%
Misc	4.67%
Boxboard	4.35%
Textiles & leather	2.72%
Other Rigid plastic	2.23%
Clean Wood	2.10%
#1 PET bottles	1.61%

3.4.2. Residential

The composition of residential waste single family home waste is relatively consistent. Although there are some differences in waste generation depending on local characteristics, most households dispose of similar types of waste. Variation generally occurs as a result of the extent of source reduction and recycling activities.

Of the 39 samples sorted during this study, 13 were from the residential source. Organic materials (20%) and paper (24%) accounted for almost half of the residential disposed waste, Figure 15. Specifically, food, compostable paper, and film were the largest individual components of a fairly wide, but uniform distribution of waste (making up 14%, 7%, and 6% of waste stream respectively). The discrepancies in the amount of single family paper waste vs. multi family paper waste can be accounted for by the minimal amount and sizes of paper recycling typically in multi family complexes.

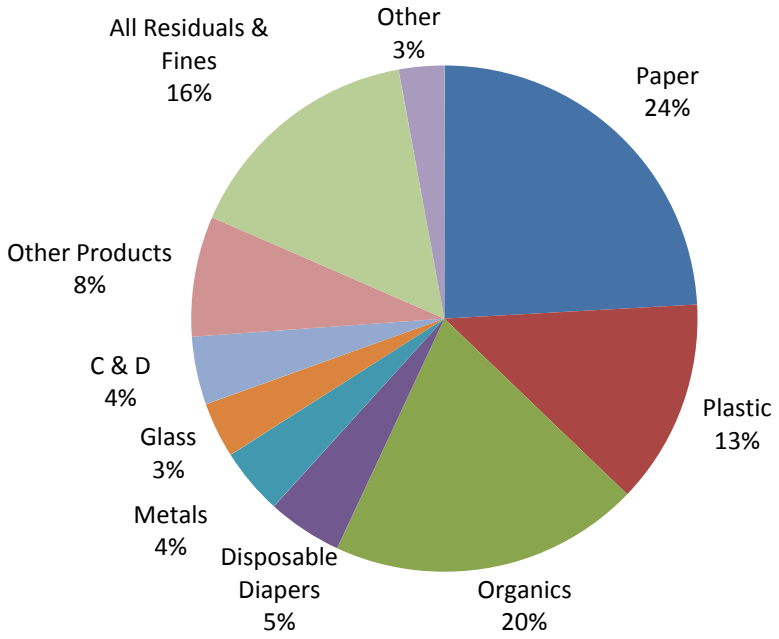


Figure 15 The Single Family Municipal Solid Waste Composition for Alachua County Based on the 2009 Study. Percents by Weight

As shown in Table 14, a total of four individual waste components each accounted for 5% or more of the county's residential waste. These components are food (14%), compostable paper (7%), film (5%), and boxboard (4%).

Table 14 Top Ten Components of the Single Family Residential Commercial Municipal Solid Waste Composition for Alachua County Based on the 2009 Study.

Subcategory	Pct
Food	14.10%
Compostable/ Soiled	6.92%
Film	5.11%
Boxboard	4.39%
Animal By-products	3.64%
Misc	3.21%
Textiles & leather	2.90%
Other	2.88%
Disposable Diapers	2.78%
Clean Wood	2.34%

3.4.3. Institutional

Paper (32%) and plastic (20%) accounted for over half of the institutionally disposed waste, Figure 16. Specifically, food, corrugated cardboard, and compostable/soiled paper were the largest individual components clearly dominating the waste stream (making up 18%, 18%, and 11% of waste stream respectively).

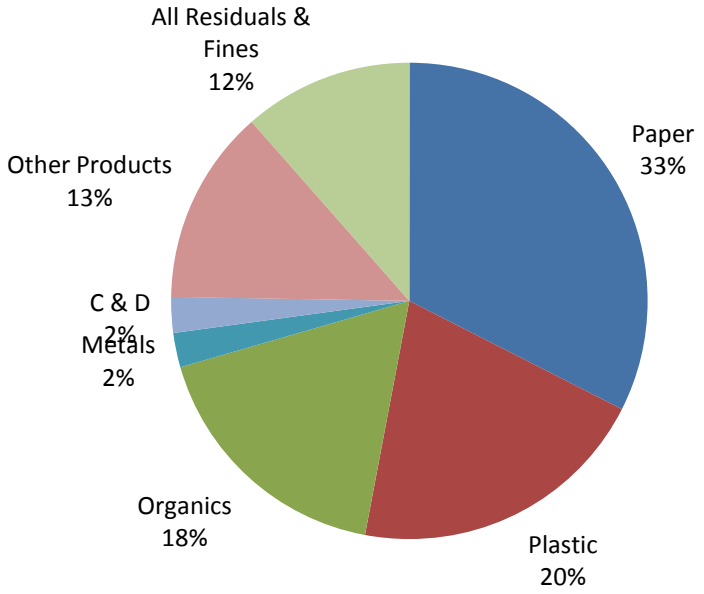


Figure 16 The Institutional Municipal Solid Waste Composition for Alachua County Based on the 2009 Study. Percents by Weight

As detailed in Table 15, the top ten waste components of the institutional waste stream were dominated by film and OCC representing 12% and 10%. The textiles and leather, food, and composite were the next largest components, accounting for a total of 21% of the total, by weight.

Table 15 Top Ten Components of the Institutional Municipal Solid Waste Composition for Alachua County Based on the 2009 Study.

Subcategory	Pct
Film	12.07%
OCC plain	10.41%
Textiles & leather	7.69%
Food	7.18%
Composite/ o organic	6.39%
Compostable/ Soiled	5.36%
Electrical Appliances	4.72%
Boxboard	3.70%
Misc	3.27%
High Grade	2.61%
Mixed Recyclable - junk mail	2.45%
Yard waste	1.83%

3.5. Overall Results

To completely characterize Alachua County's waste it is important to include a breakdown of what already gets recycled, using 2007 data. In total the majority of Alachua County's waste is landfilled, Figure 17. In order to characterize the entire waste stream, the percentages for materials identified in this study will be applied to the overall landfilled portion while the recycled fraction will be broken up based on the Alachua County 2007 MSW collection and recycling data (2007 is the most recent year the data exists), please see Appendix H for this data in spreadsheet format.

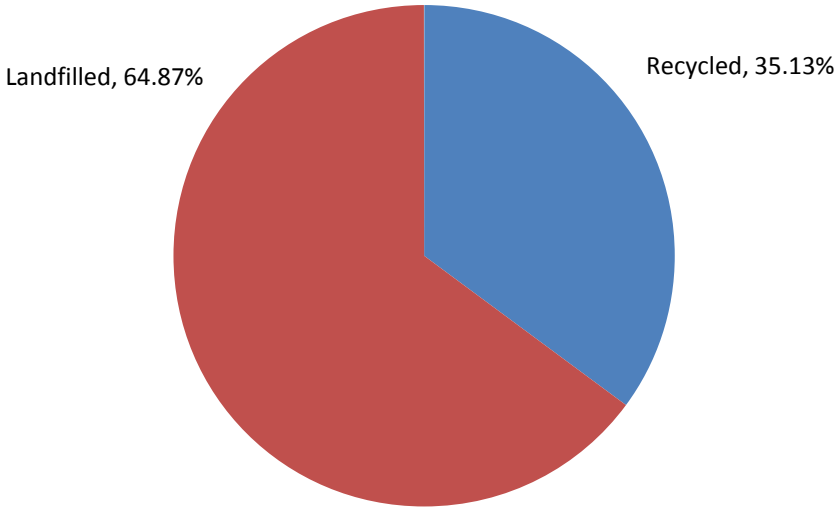


Figure 17 2007 Alachua County Total Waste Stream Handling

As stated, the scope of this study was to investigate waste bound for NRRL. Below is a pie chart merging the results of this study with known 2007 Alachua County recycling data to account for 100% of waste generation in Alachua County. Some categories had to be merged due to discontinuity in grouping of recyclables vs. grouping of materials in the study, i.e. for recycling records the county records the weights of aluminum cans, ferrous metals, and non ferrous metals separately. These recyclables are aggregated under the blanket metals category in the Figure 18. A detailed assay of Alachua County recycling percentages for 2007 can be found in Appendix H.

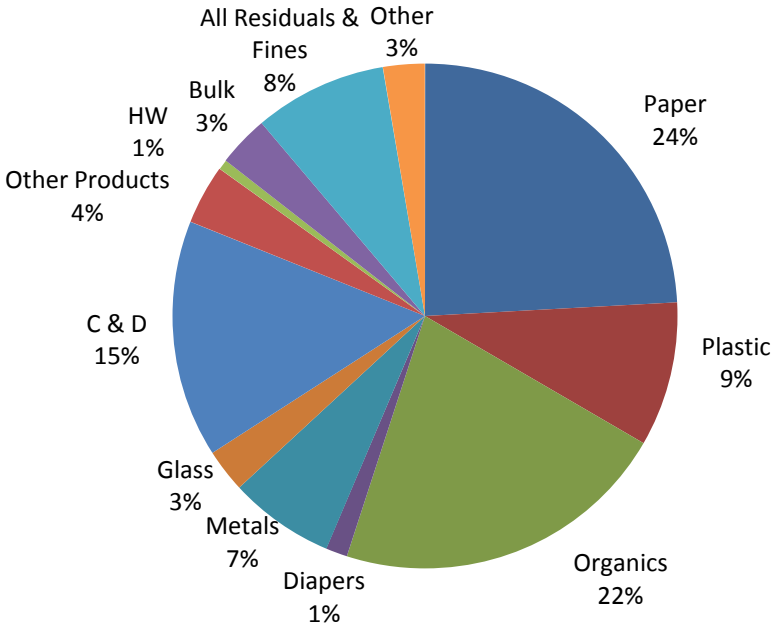


Figure 18 Landfilled and Recycled Waste in Alachua County

3.6. Summary of Results

The compositions of the different categories are very similar both by composition by category as well as subcategory. Two tables are provided with color schemes to demonstrate the similarities, which show the "Top Ten" for each source. Please use the key below for Table 16 and 17.

Table 16 provides a comparison of composition by category, whereas Table 17 provides a comparison of composition by subcategory. The top three categories for each source and the overall MSW composition is paper, plastic, and organics. The top three subcategories for each source are similar, although there are some variations which are a result of the source of the waste. These similarities will be touched on below. Although paper is the largest component in each source of waste, the percentage in each differs greatly. Commercial and institutional have almost 10% more paper than residential, which is a result of the OCC. But it should be noted that the boxboard content is the highest in residential waste, 4.4%, compostable paper is the highest in commercial waste, 6.9, and high grade white paper is the highest in institutional waste, 3.3%. The institutional waste had a higher plastic content, 20.1%, due to such a high loading of film (e.g. plastic bags), 12.1%, shown in Table 15 as constituting the largest part of the institutional waste stream. The film content was much higher than commercial, 7.4%, and over double that of residential, 5.1%. And as noted previously, the residential waste had a 3% higher organic content than commercial waste. This is shown in table 17 to not correlate with the amount of food waste produced, but is the result of the amount of yard waste as well as animal by-products produced from single family households. Also to note is that commercial waste stream has almost double the amount of food waste that the institutional waste contained.

- largest component
- 2nd largest component
- 3rd largest component
- 4th & 5th largest component
- 6th & 7th largest component
- 8th, 9th, and 10th largest component

Table 16 Comparison of Alachua County MSW Composition by Category, Top Ten of all of the MSW Sources (Commercial, Residential, Institutional), and Overall MSW

Category	COM-C	RES-S	INST	OVERALL
Paper	32.87%	23.94%	31.88%	29.15%
Plastic	14.93%	12.96%	20.10%	14.29%
Organics	16.42%	19.63%	17.17%	17.77%
Disposable Diapers	0.00%	4.74%	0.22%	2.18%
Metals	2.45%	4.21%	2.30%	3.18%
Glass	3.16%	3.51%	0.54%	3.22%
C & D	5.34%	4.33%	2.37%	4.83%
Other Products	4.21%	7.61%	12.98%	5.90%
HW	1.43%	0.51%	0.27%	1.02%
Bulk	0.91%	0.00%	0.00%	0.51%
Pharmaceuticals	0.00%	0.10%	0.04%	0.15%
CFLs	0.00%	0.00%	0.00%	0.00%
Residuals >2"	5.31%	3.76%	7.41%	4.74%
Residuals>1"	1.35%	2.22%	0.67%	1.68%
Fines	5.46%	9.47%	3.87%	7.07%
Other	5.48%	2.88%	0.18%	4.24%

Table 17 Comparison of Alachua County MSW Composition by Subcategory, Top Ten of all of the MSW categories (Commercial, Residential, Institutional)

Subcategory	COM-C	RES-S	INST	OVERALL
OCC plain	14.4%	2.3%	11.1%	9.3%
High Grade	1.8%	1.5%	2.3%	1.7%
Compostable/ Soiled	7.6%	6.9%	5.1%	7.3%
Boxboard	3.5%	4.4%	4.0%	3.9%
Misc	2.9%	3.2%	2.3%	3.0%
Other Rigid plastic	2.0%	1.1%	1.7%	1.6%
Film	7.4%	5.1%	11.4%	6.6%
Food	15.1%	14.1%	7.5%	14.4%
Animal By-products	0.3%	3.6%	0.8%	1.7%
Composite/ o organic	0.1%	0.3%	7.1%	0.4%
Disposable Diapers	0.4%	4.7%	0.2%	2.2%
Clean Wood	2.9%	2.3%	0.1%	2.6%
Textiles & leather	2.0%	2.9%	8.5%	2.6%
Electrical Appliances	1.4%	2.0%	2.6%	1.7%
Residuals >2"	5.31%	3.76%	7.41%	4.7%
Residuals >1"	1.35%	2.22%	0.67%	1.7%
Fines/ Super mix	5.46%	9.47%	3.87%	7.1%
Other (See Notes)	5.49%	2.88%	0.18%	4.2%

Food (14.4%), OCC (9.3%), and compostable paper (7.3%) represent some of the greatest opportunities for source reduction and recycling. Food waste and compostable paper account for over 20%, thus representing some of the greatest opportunities for source reduction and recycling through composting in the Solid Waste stream.

4. Diversion Opportunities

4.1. Introduction

Diversion opportunities are considered as any means of reducing the amount of material entering the New River Landfill. The following gives an overview of all the diversion opportunities considered; which include increasing the number of materials accepted for recycling, increasing recycling rates, and diverting organics. The diversion opportunities for residential, commercial, and institutional waste were considered separately since the current methods of collection as well as the instated recycling programs are very different. In addition the compositions of the waste from these sources vary as well. Thus, the sections cover residential, multifamily, commercial, and institutional diversion opportunities separately, as well as Alachua County as a whole. Also, each sector is broken into a recyclables section and, if feasible, an organics diversion section. The recyclable section considers the results of increasing what is recycled (additional potential recyclables) and of increasing the recycling rates. Awareness is addressed as a means of increasing recycling rate, but is also meant to emphasize recycling properly which would result in higher quality product.

All of the suggestions below are based on an evaluation of the data collected in spring 2009. The suggestions are specific to Alachua County. The suggestions take into account how waste is currently handled in the county and the composition of the different sources of waste. The items in the solid waste stream representing the greatest potential for source reduction and recovery (additional potential recyclables) include the following:

- OCC
- Boxboard
- Compostable Paper
- Food waste
- Other Rigid Plastic
- Expanded Polystyrene
- Film

The materials have been identified due to their large volume in the waste stream. The feasibility of recovering each of these materials was considered along with its presence in all of the waste stream sources.

All of the above materials can be recycled, but the feasibility evaluation lies in a few factors. First, the economics of recycling must be addressed. The current contract between Alachua County and SP recycling covers the economic agreements. The county provides a recycling program county-wide by charging local residents for waste disposal and the profits of sale are then divided between SP and the county as predetermined. Hypothetically everything can be recycled, but the cost to the governing body and the tax payer must be evaluated. Included in the cost is the collection and sorting labor, the energy to run the facility, the space to store the product, and finally the sale of the end product which requires markets. If the quality of product is too low due to contamination, then the material may net a lower profit or be landfilled. All of these factors must be considered when evaluating if additional materials should be recycled. The following sections contain evaluations of each of the above materials, and identify in what waste streams, if any, these materials could be diverted from landfilling. These assessments take into account the current markets in the area, as well as the current recycling facility

layout and capacity. If a material conflicted to a large degree with either of these, the material was not considered as feasible.

Table 18 shows at the current recycling rates what effects achieving 100% recycling efficiency with the current instated program could have on the total amount of disposed waste, as well as on the waste produced in Alachua County. Recycling methods that are currently used and those methods that could potentially be used are considered for each sector as explained above. The table represents each subcategories presence in percent by weight in the each generating sector's waste stream due to the 2009 waste composition study. Since many of these materials could be recycled, but were not, a "Currently Recycled" column was created. The total demonstrates what percent of the disposed waste stream consists of recyclables. But to consider the total percent change on the waste stream, the baseline recycling rate must be considered, which is demonstrated in Figure 19. In Table 19 the total considering the baseline shows the effect on all of the waste produced in Alachua County.

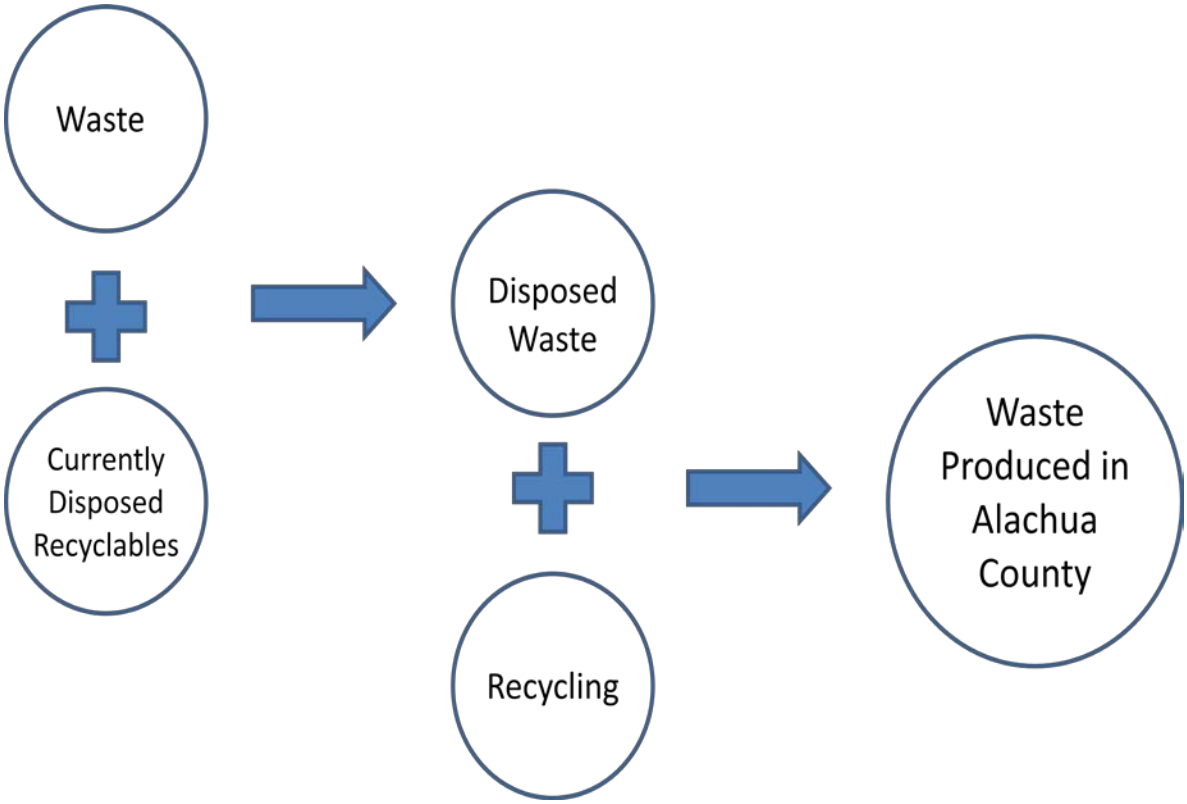


Figure 19 Method of Calculating the Amount of Waste in Alachua County that can be diverted from Landfilling

The materials that are included as potential recycling in Table 18 include those materials that are not currently accepted by the recycling program in Alachua County. This is to evaluate if it is indeed possible to achieve the Florida Energy Bill's goal of 75% recycling/diversion. The overall reductions are consolidated in one table for each sector.

Table 18 Currently and Potentially Recycled Materials in the MSW sources in percent by weight: All Alachua County

Baseline Recycling Rate: 37%		Weight (tons/year)		Percent Increase in Recycling Rate	
Category	**Subcategory**	**Currently Recoverable (Missed)**	**Potentially Recoverable**	**Missed Currently Recoverable (% of Total Waste Stream)**	**Potentially Recoverable**
Paper	Newspaper	1,935	-	0.66%	-
	Old Corrugated Cardboard (OCC)	16,465	-	5.60%	-
	High Grade	3,374	-	1.15%	-
	Mixed Recyclable	2,465	-	0.84%	-
	Compostable/ Soiled	-	13,262	-	4.51%
	Boxboard	7,044		2.39%	
	Composite/Other	-	8,564	-	2.91%
	TOTALS: Paper	**31,282**	**21,826**	**10.63%**	**7.42%**
Plastic	#1-7 Recyclable	2,856	-	0.97%	-
	#1-7 Not Recyclable	-	2,830	-	0.96%
	Food Service	-	3,232	-	0.71%
	Plastic Film		13,208		4.49%
	Nonfood EPS	-	456	-	0.16%
	Rigid Plastic/Other	-	6,179	-	2.10%
	TOTALS: Plastic	**2,856**	**25,905**	**0.97%**	**8.41%**
Organic	Yard waste	2,402	-	0.82%	-
	Animal Byproducts/Other	-	3,767	-	1.28%
	Food/Plant Lab waste	-	26,432	-	8.98%
	TOTALS: Organics	**2,402**	**30,199**	**0.82%**	**10.26%**
Metal	Aluminum drink cont.	809	-	0.27%	-
	Food and beverage	1,303	-	0.44%	-
	Scrap Metal/ Other	3,570	-	1.21%	-
	TOTALS: Metal	**5,682**	**-**	**1.93%**	**-**
Recyclable Glass		9,724	-	2.13%	-
Products		16,688	-	3.66%	-
Potential Increase in Recycling Rate		68,633	77,930	20.15%	26.09%
Potential Recycling Rate, including baseline		178,029	187,326	57.15%	63.09%
Cumulative Potential Recycling Rate		**364,133 tons/yr**		**83.24%**	

4.2 Single-Family Residential Diversion Opportunities

4.1.1. Recyclables

4.1.1.1. Additional Potential Recyclables

With respect to the percent of single family MSW, potential items to add to the materials currently accepted in the residential curbside recycling program, which can be seen in Section 1.6, include (Figure 20):

- Plastic films (5.1%)
- Other rigid plastic (4.1%)
- Aluminum foil/containers (0.7%)

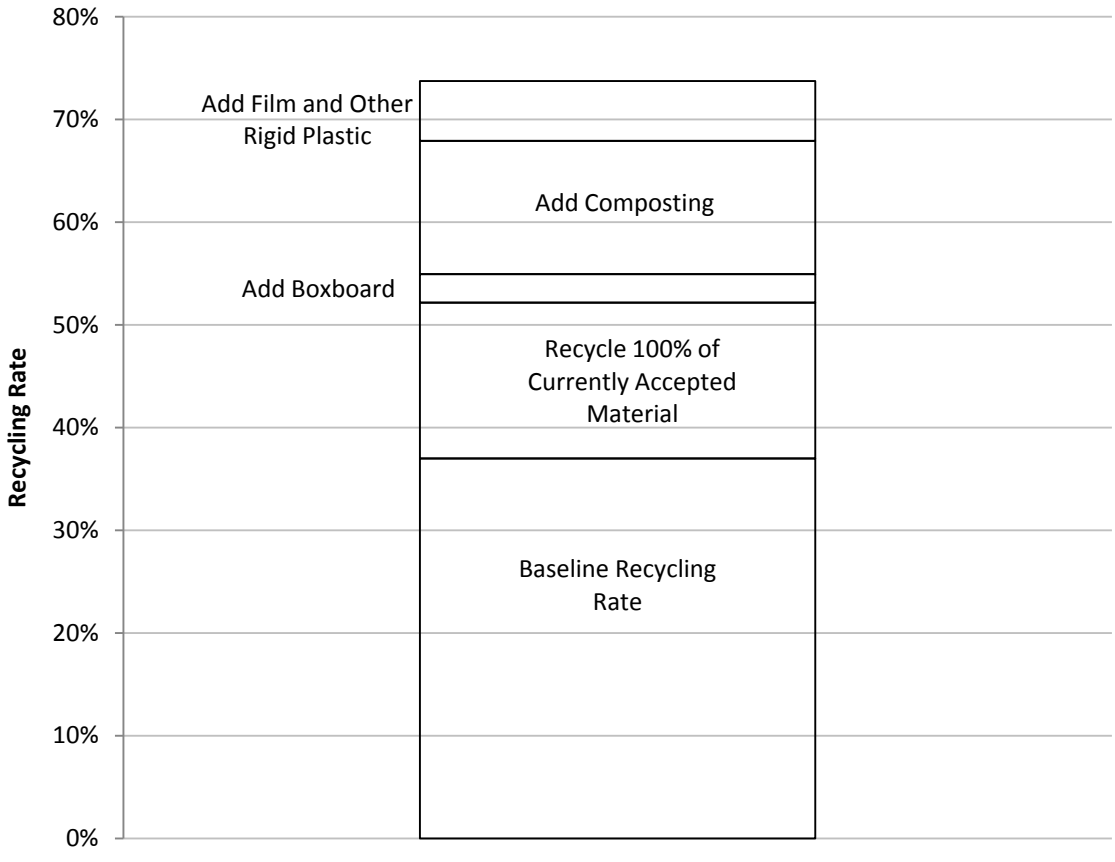


Figure 20 Alachua County's Total Potential for Landfill Diversion for the Single-Family waste stream

The figure above depicts what the highest potential recycling rate would be, considering 2008 waste generation tonnages and thus a baseline recycling rate of 37% (Alachua County recorded rate for that year). This of course doesn't 100% accurately describe the residential single family recycling rate, but it does allow us to see the impact of the addition of various materials to the recycling program as well as the impact of recycling everything which is already accepted into the Alachua County curbside recycling program. With these additions in the figure above to the recycling program the residential rate could be increased to roughly 69%. Please see the overall results in Appendix F for a more detailed

breakdown of what actual percentages of recyclable components are present in the current non recycled residential waste stream.

Boxboard. Boxboard is commonly recycled throughout the country and state and is a current addition to the Alachua County recycling stream. There is a relatively high percentage of boxboard in the residential single family waste stream, 4.4% of the total residential waste stream (non recycled portion). Boxboard is manufactured from recycled materials, but the majority of the fiber comes from the poorest quality of previously recycled paper. Thus individual fiber strands are short, and near the end of their useful life. Recycled boxboard can be combined with higher quality paper to produce more boxboard. The main issue with boxboard is that it could degrade the quality of the newspaper it is comingled with, and result in a downgrading of newspaper recycling. While recycling boxboard is not cost prohibitive, it also does not generate revenue. A common practice is for the governing body and recycling company to do revenue sharing. While boxboard does not have much value, it does contribute to a large part of the waste stream and therefore would be a good material to begin to recycle if cutting down on landfill use is a premier goal.

Plastic Films. Dirty film can be recycled as is or with a process of shredding and cleaning the film. Recovered plastic bags and film can be recycled into many useful products, including durable backyard decking, fencing, railings, shopping carts, and, new bags. SP does not currently recycle film residentially because of the very high processing costs as well as the problems that would be caused in processing the waste. The film would be caught in the machinery and the high volume of film would make storage difficult. After all this the cost of collecting and processing the waste must be factored in. Currently dirty film is selling for only 7 cents a pound whereas clean film (called stretch) is selling for 15 cents a pound out of Tampa, Fl. These rates must be considered to be during a lag in the rate of the recycling markets. Though there are many negatives, film does however makes up a relatively large portion of the residential waste stream at 5.1%

Other Rigid Plastic. The category of other rigid plastics encompasses many different types of plastic or resins, and includes expanded polystyrene (EPS). Typically, these materials have a high volume to low weight ratio, which makes it costly to process, store, and bail similar to the film. The majority of EPS in the study is from food service and this contamination would be of concern. Although it is possible to recycle other rigid plastics, and some states, such as California, are able to do so with residential waste; the cost of processing the waste as well as the lack of markets would make it cost prohibitive.

Aluminum Foil. Aluminum foil and containers constitute a very small part of the waste stream, but have a high value because it is infinitely recyclable. The foil and containers would need to be properly washed as to avoid contamination, but should be considered to be added the curbside recycling program. The combination of recycling boxboard and aluminum foil/containers would divert an additional 5.1% from being landfilled, as much as solely diverting plastic films. However aluminum foil makes up such a small portion of this 5.1% (about 0.45%) it was not considered on the diversion graphs.

4.1.1.2. Increase Recycling Rates

The following materials are currently accepted by the county's curbside program, and are listed from greatest to smallest percent in the currently landfilled waste stream by percent weight:

- Misc Paper (3.21%)
- OCC (2.3%)
- Colored Glass (1.7%)
- Yard Waste (1.6%)
- High Grade (1.5%)
- Clear Glass (1.5%)
- Newspaper (1.4%)
- #1 PET bottles (1.2%)
- Mixed Recyclable – junk mail (1.1%)
- Mixed Recyclable (1.0%)
- #2 HDPE (0.6%)
- Aluminum Drink containers (0.5%)
- Empty paint & aerosol (0.5%)
- #3-7 (0.3%)

These percents are also above in Table 18 which shows for all of the MSW sources what can currently be recycled as well as what can potentially be recycled. The miscellaneous paper subcategory which contains magazines, phone book, and other glossy or bound paper represents the largest part of the single family recyclable stream (3.21%). It is interesting to note what a large percent of #1 PET bottles (1.2%) are present in the landfilled waste stream. If all of these materials were properly recycled an additional 20% of the single family residential waste stream could be diverted from landfilling.

Proper Education/Community Awareness

To determine on average the income, trash can size, and activeness in recycling, different routes were sat in on. The following were observations made from drivers and students that sat in on these routes. There is a clear correlation between low income households and low recycling rates. It has been determined that the recycling rate is less than 10% in designated low income neighborhoods, Middle and upper level income households tend to have higher recycling rates at approximately 80%. Yet it was noticed that boxboard was present in many upper level income households. Also, lower percentages of boxboard were observed in upper and middle income households then in lower income households. This suggests that the boxboard is being improperly disposed of in the recycling bin with other paper instead of in the garbage. Since high grade (1.5%) and mixed recyclable paper (2.1% total) is in the currently landfilled waste stream, the community may not be aware that these forms of paper are now accepted in the recycling bins.

An increase in overall community awareness is necessary to increase residential recycling rates. Most importantly is lower income education on the importance of recycling and upper to middle income education on what can be recycled.

4.2. Commercial Diversion Opportunities

4.2.1. Recyclables

4.2.1.1. Additional Potential Recyclables

The commercial waste stream has different constraints than the residential single family curb-side recycling program, as well as the residential multi-family recycling program. The materials that could potentially be added to the recycling system are (Figure 21):

- Food waste (14.8%)
- Compostable Paper (7.6%)
- Film (7.4%)
- Other rigid plastic (4.7%)
- Boxboard (3.4%)

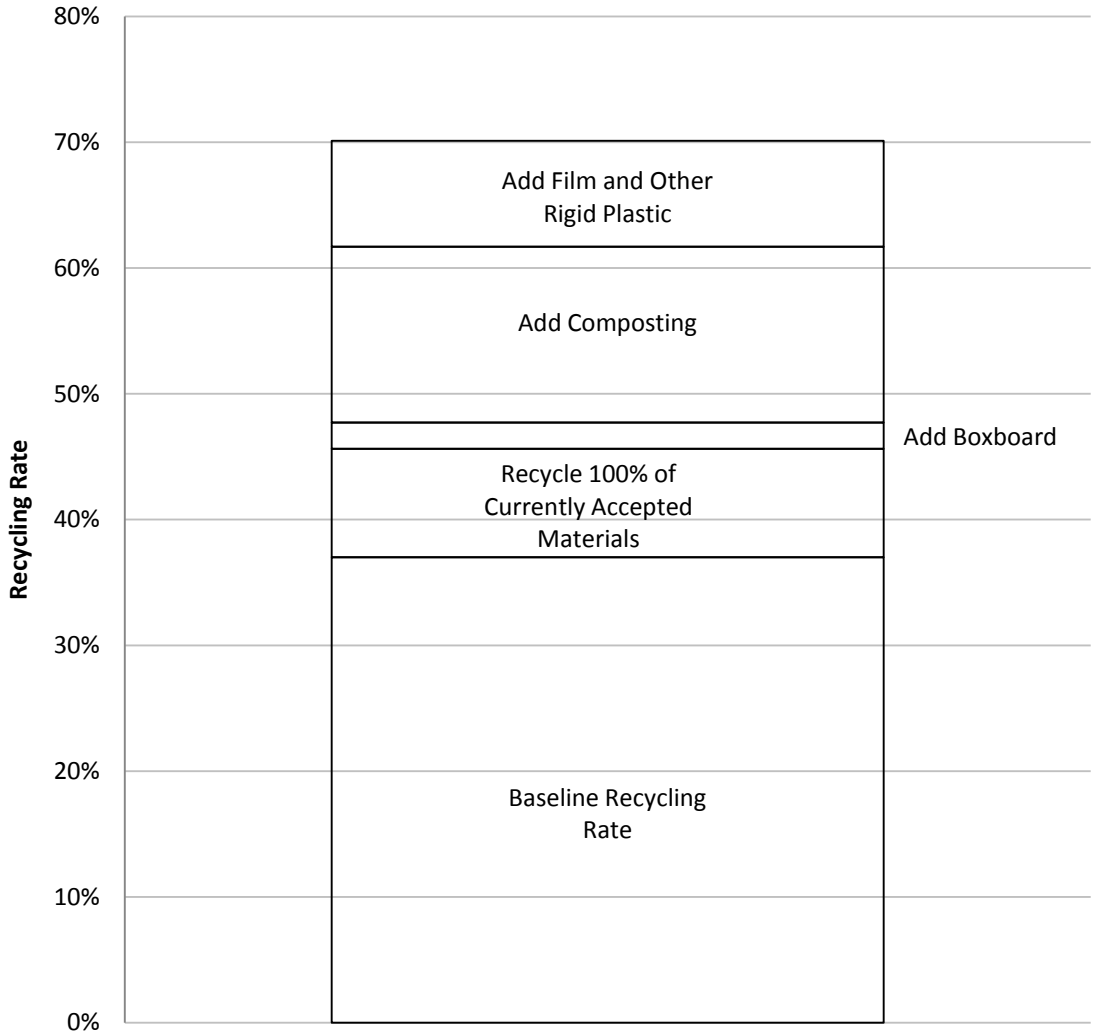


Figure 21 Alachua County's Total Potential for Landfill Diversion for the Commercial waste stream

Within this system there is more ability to capture food waste and compostable paper, which accounts for over 20% of the waste produced. The diversion of these two subcategories will be discussed in section 4.4.2. As in the calculations for the residential single family recycling, the baseline Alachua County 2008 rate of 37% was used, which again, may not be an accurate rate for the commercial sector. However an estimate can be appropriately determined with the data available, and so the commercial recycling rate could potentially be pushed to around 69%. See Appendix F for a more detailed breakdown of all recyclable components present in the currently landfilled commercial waste stream.

4.2.1.2. Increase Recycling Rates

OCC should be diverted from the waste stream since it is easily recognizable and has well established end use markets. Since it is a singular material only one dumpster would be necessary. Recycling OCC could divert an additional 13.0% of the waste from NRRL.

- High Grade Paper (2.2%)
- Miscellaneous Paper (2.5%)
- #1 PET bottles (1.0%)
- Other Rigid Plastic (4.8%)
- Clear Colored Glass (0.6%)
- Colored Glass (0.7%)

4.2.2. Organics Diversion

The organics in MSW originates from three different sources, residential, commercial, and institutional, each of which has a different composition and feasibility of capture. The ease of capturing the organic material is important as well as the quality of the organics, since the county would want the "most bang for the buck". The county wanted to evaluate the upward limit of organic waste that could be considered for diversion. Diversion opportunities for the county could consist of composting or biodigestion, but more emphasis has been placed on composting. As a result, composting will be referred to from this point forward to represent any potential form of organics diversion.

The quality of the organics would depend on whether the materials were pre or post-consumer. Pre-consumer waste is mainly composed of OCC, whereas post-consumer is mainly compostable or soiled paper. Typically pre-consumer waste consists of organics that have not been cooked or processed and tend to be very homogeneous. They presumably would have less fatty animal matter and other forms of contamination, which make for bad compost, and would be easily collected from grocery stores. Post-consumer waste would be collected from restaurants and bars and would possibly be harder to collect.

Currently in Alachua County, residentially capturing organic waste is not feasible, and as a result the county suggests backyard composting and subsidizes "compost machines". Overall commercial organic materials consist of both pre- and post-consumer waste, and therefore cannot be considered as one source. Also of the two potential commercial sources of organics, only pre-consumer waste is to be considered in the study for the reasons mentioned above. In Alachua County the primary grocery store is Publix Supermarkets, as a result two samples were taken from these grocery stores, as well as one from Albertson's Supermarkets.

The amount of compostable material, food waste and compostable paper, in the entire waste stream is 21.7%, but as discussed above it is not possible to collect all of this organic waste initially. Additional items could be added to the system; such as yard waste and OCC, but it is preferred that OCC is recycled as mentioned above, this is because recycling OCC can produce a higher valued end product than composting. The following analysis will only consider the composition of the waste produced from grocery stores. A total of three samples were collected, and the results were varied as shown in Table 19. The Publix samples had a very different composition than the Albertson's samples. The Publix waste is composed mainly of food, averaging around half, whereas Albertson's waste is dominated by OCC around 50%. These samples provide a good starting point for investigating grocery store waste; however

conclusions about the usage of OCC recycling dumpsters and overall composition were not reached due to the limited sample sizes.

Table 19 Composition of Three Grocery Store's Municipal Solid Waste to Determine Percent Compostable

Subcategory	Publix (Sample 7)	Publix (Sample 103)	Albertson's
OCC	10.0%	16.4%	51.8%
Compostable Paper	0.0%	10.5%	1.5%
Food	59.5%	42.4%	20.7%

Due to proprietary information, the exact tonnages produced by Publix in Alachua County cannot be provided. But based on information provided by Publix and their hauler, EWS, an approximation was estimated. Each store was approximated to produce the same amount of waste weekly. Considering the thirteen Publix grocery stores located in Alachua County and approximately that half of each dumpster is compostable material, which is a low estimate from the samples that were completed. On average each Publix has its compactor pulled once every week, and on average the compactor weighs 8 tons which would result in a total of 2,400 tons of food waste produced annually or about 46 tons per week.

4.3. Multi-Family Diversion Opportunities

4.3.1. Recyclables

Although the county currently has a mandatory commercial recycling program, it is not enforced in multi-family apartment complexes. If recycling is offered the collection bins are typically too small for the size of the complex and less recycling dumpster locations are typically provided, which tend to be too far from apartments thus discouraging recycling. Also apartments usually are smaller than single family homes and have limited space indoors and often no space outdoors for storing their recyclables. By changing recycling enforcement ordinances for the county, the recycling rate should also increase. As a result it is considered that the baseline recycling rate is zero for the multi-family generating sector.

4.3.1.1. Additional Potential Recyclables

With respect to the percent of multi-family MSW, potential items to add to the materials currently accepted in the mandatory commercial recycling program, which can be seen in section 1.6, include (Figure 22):

- Plastic films (5.5%)
- Boxboard (5.7%)
- Other rigid plastic (4.3 %)

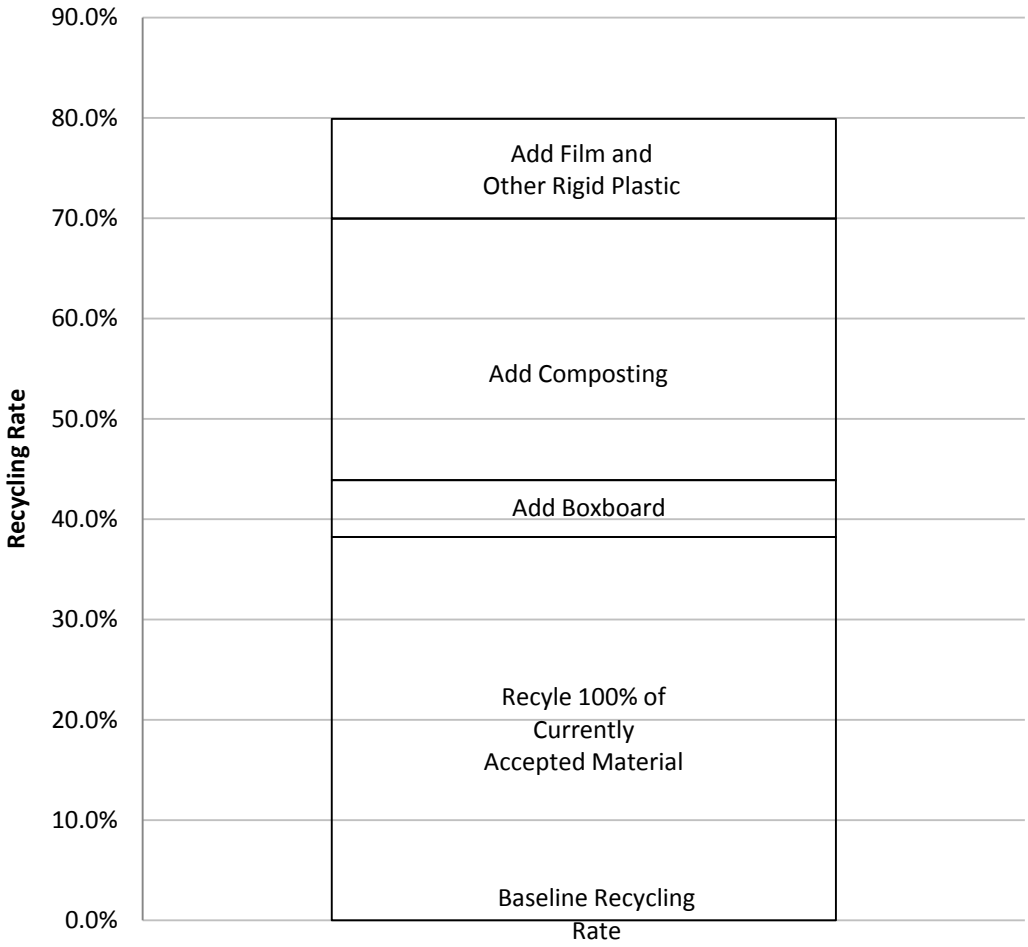


Figure 22 Alachua County's Total Potential for Landfill Diversion for the Multi-Family waste stream

Supposing film plastic and other rigid plastic were added to the recycling collection and were captured at very high rates, the recycling rate for multi family complexes could increase by nearly 10%. With the recent addition of boxboard and more importantly an increase in the accessibility of recycling containers at multi family complexes the recycling rate could increase dramatically.

4.3.1.2. Increase Recycling Rates

If the current mandatory commercial recycling program was enforced in multi-family complexes, and the program was 100% efficient at capturing the recyclables produced, then there would be almost a 40% reduction in waste sent to NRRL. The following include the materials that are currently accepted:

- Misc Paper (4.7%)
- OCC (19.8%)
- Colored Glass (1.6%)
- Yard Waste (0.0%)
- High Grade Paper (0.6%)
- Clear Glass (1.3%)
- Newspaper (0.4%)
- #1 PET bottles (1.6%)
- Mixed Recyclable – junk mail (0.3%)

- Mixed Recyclable (0.9%)
- #2 HDPE (1.0%)
- Aluminum Drink containers (0.4%)
- Empty paint & aerosol (0.0%)
- #3-7 (0.0%)
- Boxboard (4.9%)

The largest components that are not being recycled are OCC (19.8%) and miscellaneous paper (4.7%). In addition #1 PET (1.6%) #2 HDPE (1.0%) containers are not being recycled, which considering the low density of these materials, demonstrates the high volume of plastic passing through apartment complexes.

4.4. Institutional Diversion Opportunities

4.4.1. Recyclables

4.4.1.1. Additional Potential Recyclables

The source of institutional waste in Alachua County is primarily the University of Florida, as mentioned previously. All institutional samples were taken from the University of Florida and Shands Hospital. The largest component of the waste stream was film at 11.4%. Boxboard, which as previously discussed was added to the recycling collection, should make a decent impact on the institutional recycling rate.

- Film (11.4%)
- Boxboard (4.0%)
- Other rigid plastic (6.2%)

4.4.1.2. Increase Recycling Rates

All of the materials that are currently recycled through the residential curbside program are accepted at the University of Florida. In addition the University offers recycling of electronics and batteries. The highest portion of the waste stream that is already recycled was OCC. OCC is currently recycled throughout the University of Florida's campus. Since an adequate recycling infrastructure is in place, it is education that is needed to inform students, faculty, and staff of the opportunities to recycle. The education should include the different locations of paper and plastic recycling bins.

- OCC (14.4%)
- Miscellaneous Paper (2.5%)
- High Grade Paper (2.3%)
- Newspaper (1.3%)
- #1 PET bottles (1.0%)
- Aluminum Drink Container (0.8%)
- Mixed Recyclable Paper (0.3%)
- Mixed Recyclable Paper – Junk Mail (0.2%)
- #2 HDPE (0.2%)
- #3-7 Plastic (0.1%)

If all of the materials above were properly recycled, the University Florida would cut what is currently sent to NRRL by 26%.

4.4.2. Organics Diversion

The University has 2 dining halls and over 40 other dining options on campus (e.g., Taco Bell, Chik-fil-A, and Subway), each producing large amounts of food waste daily. Both a dining hall and a kitchen of the hospital were sampled in the Institutional waste category. The percent of organics for the dining hall and kitchen were 18 and 30, respectively. The University is undergoing research on biodigestion and considering the potential for the University. The reduction in the amount of waste sent to the New River Landfill cannot be quantified exactly, but would be in the ball park of hundreds of tons per year.

4.5. Overall Alachua County Diversion Results

The combined results of the single family, multi family, commercial, and institutional waste stream diversion are important as well and represent the total Alachua County waste stream and possibilities for diverting it from landfilling. Each generating sectors results was considered on the basis of the weight it contributed to the total amount of waste sampled, a weighted average of each materials contribution to the total Alachua County waste stream was then calculated. That weighted averaged was then adjusted to account for its total contribution to the county waste stream, this was done using the total tons recycled and landfilled in the county. For example newspaper represented roughly 1% of waste sampled in the study; however, factoring in the study only investigated waste headed for landfills, not including the large already recycled fraction. The 1% was adjusted to 0.66%, representing its true fraction of waste produced in the county.

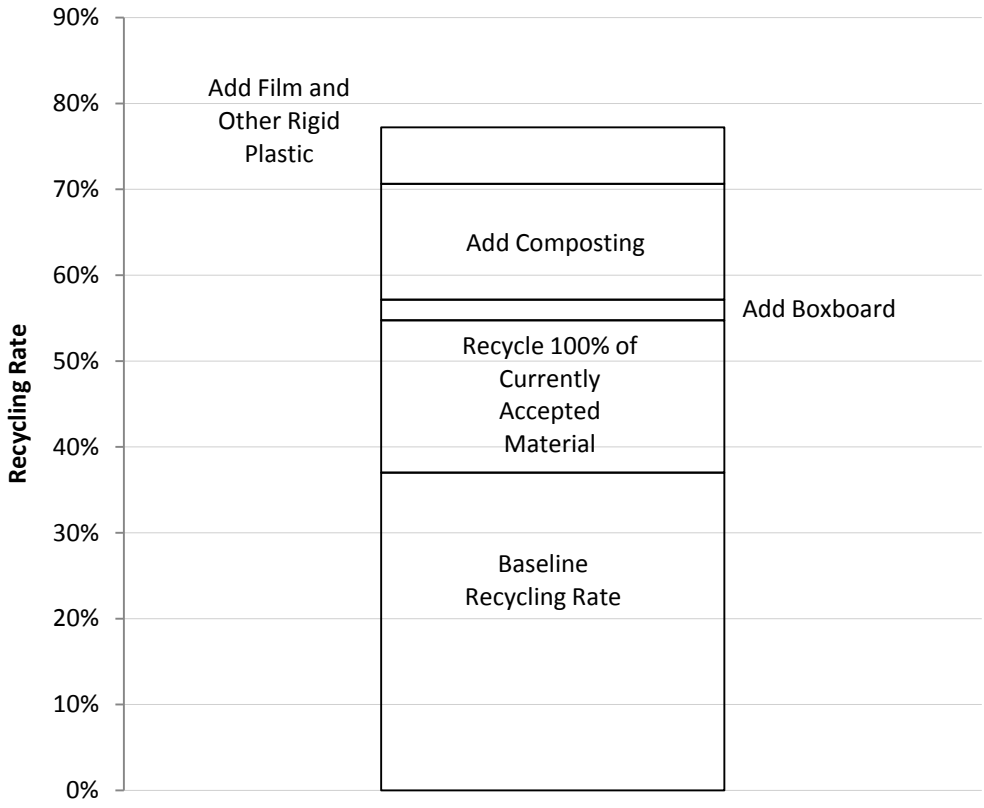


Figure 23 Alachua County's Total Potential for Landfill Diversion by Recovering Specific Target Fractions

The above figure was generated using the overall Alachua County 2008 MSW Baseline Recycling Rate of 37% given by the county, the total tons of waste produced in Alachua County in 2008 reported as 294,223 tons, as well as data gathered during this study on the percentages of currently accepted recyclable materials and materials non yet recycled by Alachua County.

Recycling all of currently accepted recyclable materials would bring the Alachua County recycling rate up to 57%. In order to reach the 75% diversion goal set by the state of Florida other materials will have to be added to the current recycling program. Adding composting to divert the large organic matter fraction of the waste pie would have one of the greatest impacts, increasing the recycling rate by 13% if all compostable food waste, plant waste, and soiled paper waste was integrated into a composting program. Capturing all currently landfilled plastic film would increase the rate by about 4.5%, coupled with other rigid plastic this would increase the rate by about 7%. The total recycling rate which could be reached for the county as calculated above would be around 77%, slightly above the 75% Florida goal.

4.6. Summary

It is important to note what a large percentage of the samples were comprised of residuals. These unsortable pieces of waste demonstrate that it may not be feasible to consider diverting 75% of what is currently produced from entering landfills. Additionally in Florida the humidity has a large effect on the moisture content of the waste. Moist cardboard is virtually valueless. Further studies should be

undergone to analyze the impact of residuals on recycling and the moisture content of waste in Florida. Some of the key conclusions that can be drawn from the above analysis include the following:

- Increasing the recycling rates could have big effects on the amount of waste diverted from landfilling, much more than adding any materials to what is currently recycled.
- OCC, high grade, mixed recyclable, and miscellaneous paper represent some of the greatest opportunities for source reduction and recycling through composting.
- Recycling and composting of the materials reflecting the greatest opportunities as identified above represent more than 20% of the commercial waste stream, and around 40% of the grocery store waste stream.

Considering all options to increase the diversion rate, currently a 75% reduction does not appear feasible in diversion alone. The maximum that can currently be achieved is 64.6% for residential sources, 66.5% for commercial sources, and 68.7% for multi-family sources, and 73% for the county at large. These percentages also consider methods that may incur large costs and recycling materials which currently may not have markets in the vicinity of Alachua County.

5. Conclusions

The overall composition of the county's waste follows the national average as well as the results of the 1997 composition study. The follow suggestions are provided based on evaluations of the results and the diversion opportunities for all the waste generators in the county. The largest contributor to the waste stream in Alachua is the commercial waste stream. If acted upon, the suggested changes would result in a large opportunity for waste diversion of the Alachua County's MSW. Suggestions are broken up in the same manner as the Waste Diversion section. All calculations were performed using the baseline recycling rate as well as waste generation rate taken from 2008 Alachua county records.

First, single-family residential recycling rates could be greatly improved by proper education of what is currently recycled. If all the materials that are currently allowed were recycled, 15.2% of the waste produced in single family households could be recycled (including the recently added boxboard component). Different means of informing citizens on what belongs in each recycling bin should be taken. Flyers, posters, magnets, and commercials could all be considered to raise awareness to proper recycling. If further education and community awareness did not increase the recycling rate it would be possible to instate an ordinance, allowing residents to be fined for not recycling or improper recycling.

Second, multi-family recycling programs represent the second largest area for improvement. Since very few multi-family complexes offer recycling options for their residents, it was assumed that this impact on recycling rates was negligible. Thus, by recycling the same materials that are accepted by the residential curbside program, there could be a 42.6% reduction in the amount of multi-family waste sent to landfill. Also if the multifamily housing recycling program was to have an expanded amount of items they accept (other rigid plastic and aluminum foil), another 4.5% of waste could be diverted. Again, educational mechanisms would have to be put in place in order to raise awareness about what is recycled in Alachua County. Again, if residents continued to not recycle it would be possible to instate a fine to encourage participation and increase awareness.

Third, commercial businesses represent the single largest area of possible improvement. Businesses produce just over the half of the waste produced in the county and many are not recycling actively. Of the materials that are currently recycled, OCC was a large component, 13.7%, of the commercial landfilled waste stream and it is easily identified and recycled. Also most businesses should have recycling means in place. This emphasizes that there is a need for more forceful regulation that fines parties that are not complying with the current ordinance. If materials that are currently accepted to the county system made it to a recycling container, the commercial industry could improve its recycling rates by 23.1%.

As evaluated for the previous sections, additional materials could be diverted from the waste stream. Namely, food waste, compostable paper, and non-food service EPS. The food waste and compostable paper will be considered an organics diversion and discussed last. EPS should be considered to be added to the waste stream not due to its weight but volume. High quantities of EPS were observed passing through the transfer station, and it is recommended that further studies take place. The recent addition of boxboard into the recycling program should provide a substantial benefit to the county wide recycling rate in the realm of a few percentage points.

The diversion of food waste and compostable paper could potentially reduce the amount of waste landfilled by 21.8%. But, collecting all food waste from Alachua County may not initially be

feasible, and therefore it is better to consider collecting organics only from grocery stores. This will provide a more homogenous, consistent, and easily attended source of organics. It was estimated that accepting waste from Publix alone could result in 46 tons of organics being diverted from NRRL weekly.

Appendices

Appendix A: Glossary

90% Confidence Interval – represents that there is a 90% level of confidence that the true mean for the overall population falls within the upper and lower bounds of the confidence interval.

Confidence Interval – the upper and lower limits of the "actual" mean for the overall population.

Commercial Waste- waste generated by restaurants, retail establishments, offices, manufacturing establishments, warehouses, general contractors, multi-family housing, and other waste types are typically all mixed together with front loading compactor trucks.

Generator Type – major waste-generating categories, including residential, commercial, intuitional, and governmental.

Mean – the mathematical average or average percent of material composing the MSW stream by weight.

Municipal Solid Waste (MSW) – garbage, refuse and other solid waste from residential, commercial, industrial and community activities that the generator of the waste aggregates for collection. MSW does not include autos, street sweepings, ash, dedicated construction debris, mining waste, sludge, agricultural wastes, and other materials collected, processed and disposed of as separate waste streams.

Residential Waste – waste generated then collected by side loading vehicles, typically single family housing.

Solid Waste – garbage, refuse, rubbish, and other similar discarded solid or semisolid materials, including but not limited to such materials resulting from industrial, commercial, agricultural, and domestic activities.

Special Waste – any industrial process waste, pollution control waste, or toxic waste which presents a threat to human health or the environment or a waste with inherent properties which make the disposal of the waste in a sanitary landfill difficult to manage. Special waste does not include domestic, office, commercial, medical, or industrial waste that does not require special handling or limitations on its disposal.

Appendix B: 1997 Alachua County Waste Composition Study

The main objectives, as noted from the final report, of the 1997 waste composition study, completed by SCS, were to characterize MSW from residential, commercial, and rural generators and to quantify the residential, commercial, and institutional disposal and recycling. The study also aimed to quantify the amount of commercially-generated food waste (bars/restaurants, cafeterias, and grocery stores). Lastly, its purpose was to support the county's application for Recycling and Education Grant funds; and assist with future recycling education and solid waste management.

The 1997 composition study investigated disposal at the Alachua County Southwest Landfill (which is currently closed), as well as by the generator and the retail industry. Within these categories there was a characterization of waste type. The landfill waste types included single-family residential, multi-family residential, commercial/institutional, and rural collection sites/drop-off centers. The generator waste was classified as commercial office buildings or commercial/institutional. The retail waste was broken into bars/restaurants, grocery stores, and cafeterias (no alcohol service). The landfill disposal study and the generator disposal study sorted the waste into 7 major categories with 27 subcategories, whereas the retail food waste study sorted waste into 4 categories (meat/animal waste, vegetable waste, food contaminated paper, and other waste, mainly waste which is unidentifiable).

The study results are summarized below in Tables and Figures A-C. Commercial/institutional, single-family, and multi-family all have around 30% paper, 25% organics, and 15% plastic by weight. The commercial waste has a lower percentage by weight of paper (27%) and a higher percentage of plastic (17.6%) than the residential loads. It can also be noted that the percentage of organics (22.9%) in the commercial category is actually lower than that of the residential.

Table A: Alachua County Municipal Solid Waste Composition (by weight) Based on the Results from the 1997 Landfill Disposal Waste Composition Study

	Paper	Plastic	Organics
Single-Family	34.50%	13.8%	28.0%
Multi-family	35.40%	14.9%	24.5%
Rural/Drop-off Centers	35.10%	15.7%	23.9%
Commercial/Institutional	27%	17.6%	22.9%

Table B: Alachua County Municipal Solid Waste Composition (by weight) Based on the Results from the Generator Disposal Waste Composition Study

	Paper	Plastic	Organics
Commercial Office Building	53.20%	14.70%	16.70%
Institutional/ Governmental	34.80%	18.40%	31.60%

Table C: Alachua County Municipal Solid Waste Composition (by weight) Based on the Results from Food Industry Waste Disposal Waste Composition Study

	Meat/Animal	Vegetable	Food-Cont Paper	Other
Bars/Restaurants	5.60%	26.70%	26.90%	40.80%
Grocery Stores	11.60%	29.90%	20.70%	37.80%
Cafeterias (no alcohol service)	3.70%	18.80%	29.30%	48.20%

The figures below show the composition of the commercial/institutional, single-family, and multi-family waste streams. As noted above the largest category was paper at around 35%, then organics at around 25%, and finally plastic at 15%.

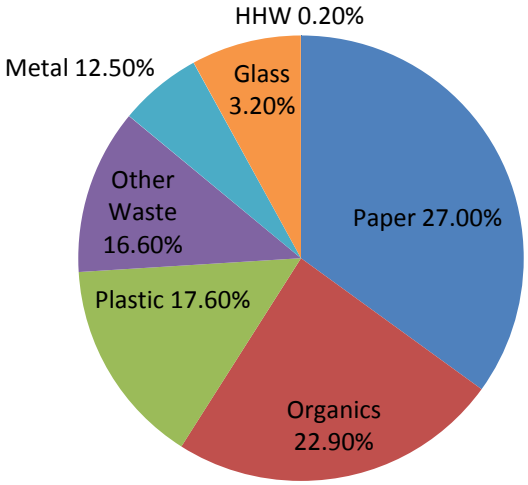


Figure A: Alachua County Commercial/Institutional Composition Results, 1997

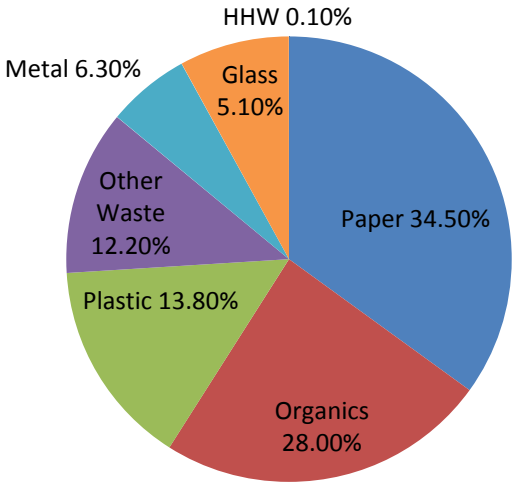


Figure B: Alachua County Single-Family Residential MSW Composition Results, 1997

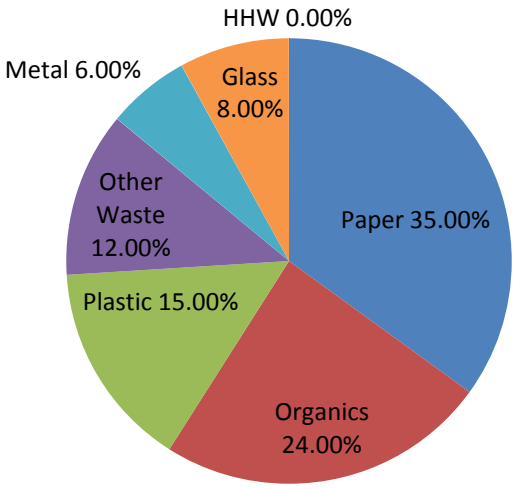


Figure C: Alachua County Multi-Family Residential MSW Composition Results, 1997

Appendix C: Material Definitions

Category	Sub-Category	Part	Description/Examples
Paper	Newspaper		High cellulose content, high photo degradation paper, i.e. Gainesville Sun, The Alligator
	OCC	plain	Regular boxes
		brown paper bags/ craft paper	
	High Grade Paper		Manila envelopes, note cards, printer paper, tablets with binding
	Mixed Recyclable Paper		Junk mail, carbonless paper, envelopes with and without windows, toilet paper cores and other mixed recyclable papers. Includes paperback books
		junk mail	Included as it's own category due to Alachua County's Recent Inclusion as a Recyclable
	Composite	polycoated paper	Bleached and unbleached paperboard coated with HDPE. This includes polycoated milk, juice, ice cream cartons, paper cups, takeout containers, and frozen/refrigerator packaging
		metal coated	Pringles cans, gum wrappers
		aseptic	Drink box containers
	Compostable/ Soiled Paper		Paper towels, paper plates, waxed paper, tissues, and other papers that are soiled with food during use (e.g. pizza boxes)
	Boxboard		Cereal boxes, egg cartons (not coated with wax, plastic or metal)
	Miscellaneous		Magazines, phone books, glossy paper
	Other		Anything that does not fall into the above categories

Category	Sub-Category	Part	Description/Examples
Plastic	#1 PET bottles	clear	Soda Bottles with necks
		colored	Soda Bottles with necks
	#2 HDPE	Translucent Bottles	Milk, juice, beverages, oil, vinegar, and water bottles with necks
		Colored Bottles	Liquid detergent bottles and some hair care bottles with necks
	#3-#7 (Other Plastic Bottles)		All with necks, not currently recyclable
	Other rigid plastic	#2,4, and 5 Tubs, cups, and lids	Wide mouth cups and tubs, without a neck, and lids, such as yogurt, cottage cheese, and margarine containers
		#1,3,6, and 7 tubs, cups, and lids	Wide mouth cups and tubs, without a neck, and lids, such as polystrene drink cups, and food, cosmetic, cleaning, auto, and other products and packaging
		Nonfood expanded polystyrene	Styrofoam products such as packaging peanuts and blocks
		Other food service plastics	Plates, bowls, clamshells, salad trays, microwave trays, cookie tray inserts, untensils, straws, stirrers, and condiment packaging
	Film	clean shopping	Grocery or check out bags. Dry cleaner bags. Bags intended to contain produce, bread, merchandise, and newspapers. Does not include food, liquid, or grit contaminated bags
		other clean film	
		other film	Contaminated with food, liquid, or grit during use. Is woven together (e.g. grain bags); contains multiple layers of film or other materials that have been fused together (e.g. potato chip bags). This category also includes photographic negatives, shower curtains, and used garbage bags. This category also includes supermarket and shopping bags that were contaminated with food, liquid, or grit during use. Plastic bags (sandwich bags, zipper-reclosable bags, newspaper bags, produce bags, frozen vegetable bags, bread bags), food wrappers such as candy-bar wrappers, mailing pouches, bank bags, x-ray film, metalized film, and plastic food wrap
	Plastic products		Plastic such as toys, toothbrushes, vinyl hose, and lawn furniture
	Composite		Items are predominately plastic with other materials attached such as disposable razors, pens, lighters, toys, and binders
	Other		Anything that does not fall into the above categories

Category	Sub-Category	Part	Description/Examples
Glass	clear		Food, beverage, wine, liquor, and beer containers
	green/blue		Food, beverage, wine, liquor, and beer containers
	brown		Food, beverage, wine, liquor, and beer containers
	flat		Clear or tinted window, door, shelf, tabletop, flat auto, and other flat glass, included tempered.
	composite/ other mixed cullet		Mirrors, glassware, crystal, Pyrex and corningware, and laminated curved glass such as windshields.
Metals	aluminum beverage		Cans and bi metal cans
	aluminum foil/containers		Food containers, trays, pie tins, and foil
	other aluminum		Aluminum products such as window frames and cookware
	food and beverage		Tin and steel food, pet food, and other containers, including bi-metal cans mostly of steel. Excluding aluminum
	other ferrous metals		Magnet will adhere to, ferrous and alloyed ferrous scrap metals
	other non-ferrous scrap		Non-ferrous metal scrap such a brass, copper, or other non-magnetic metal
	empty paint and aerosol cans		Empty, metal paint and aerosol cans, including metal lids
	empty propane and other tanks		Metal tanks used for storage and distribution of propane and other compressed fuels
	composite/ other metals		Motors, insulated wire, appliances, and other products or parts containing a mixture of metals, or metals and other material
Organic	yard waste		
	Food		Food preparation wastes, food scraps, spoiled food
	Animal By-products		Animal carcasses not resulting from food storage or preparation, animal wastes, and kitty litter
	Composite/ other organic		Combustible materials including wax, bar soap, cigarette butts, feminine hygiene products, vacuum cleaner bag contents, leather, briquettes, and fireplace, burn barrel, and fire-pit ash, and other organic material not classified elsewhere
Disposable Diapers			Diapers made form a combination of fibers, synthetic and/or natural, and made for the purpose of single use

Category	Sub-Category	Part	Description/Examples
Other Products	Tires		Vehicle tires of all types. Inner tubes are put into the rubber category.
	Rubber		Finished products and scrap materials made of natural and synthetic rubber, such as bath mats, inner tubes, rubber hoses, and foam rubber.
	Textiles & leather		Rag stock fabric materials and clothing including natural and synthetic textiles such as cotton, wool, silk, woven nylon, rayon, and polyester.
	Apparel		Shoes, tennis shoes, purses, and other composite accessories
	Electrical & Household Appliances		Toasters, stereos, other small appliances and electronic equipment (non-refrigerant)
	Computer Related Electronics		
	Personal Portable Products		Cell phones, chargers, camcorders, gaming devices, cameras, and etc.
Bulky Items	Carpet/ Upholstery		General category of flooring applications and non-rag stock textiles consisting of various natural or synthetic fibers bonded to some type of backing material. Also includes non-rag stock grade textiles such as heavy linens and draperies.
	Furniture		Mixed material furniture such as an upholstered chair
	Mattresses		
C&D	Clean Wood		2 x 4's and 2 x 6's and sheets of plywood, strand board, and particleboard (processed wood)
	Gypsum		
	Fiberglass Insulation		
	Rock/concrete/bricks		
	Asphaltic Roofing		
	Ceramics		
	Composite/other construction Debris		
	PVC		

Category	Sub-Category	Part	Description/Examples
HW	Automotive Products/Fluids		Oil filter, motor oil/diesel oil
	Paints and Solvent		
	Pesticides, Herbicides, Fungicides		
	Household cleaners		
	Lead Acid Batteries		
	Other Batteries		
	Other HW		
	Mercury Containing Products		Barometers, thermostat switches, thermometers, car switches, blood pressure cuffs
	Cathode Ray Tubes		Large monitors

Appendix D: Safety Plan

1.1 Objective of this Plan

The personal safety and health of each staff person is a primary consideration of the Team. The prevention of occupationally-induced injuries and illnesses is a high priority during the sort. The Project Team will provide industry standard equipment, training, and physical facilities necessary for maintaining the personal safety and health of staff members. It is the responsibility of each and every staff person to contribute to his or her and fellow worker's health and safety by learning and exercising safe work practices and complying with all requirements of this site safety plan.

1.2 Standard Operating Procedures

This basic procedure for sorters will be to identify different materials in an MSW sample that has been placed on a waist-high sorting table and to place the materials in nearby appropriately labeled containers. Before receiving the waste on the table it will have been examined by the Site Supervisor (or an appropriately trained assistant) for red bag medical waste, household hazardous, hazardous, and infectious waste. This is considered the pre-sort and is critical to site health and safety. After the material is sorted, the supervisor or an assistant will weigh the containers. After the containers are emptied, the next sample will be brought to the table and the sort will begin.

1.3 Location of Safety Equipment

The following items will be located near the sorting tables for immediate access:

- Fire Extinguisher
- Spill Containment Kit
- Protective Clothing
- First Aid Kit
- Eyewash Unit
- Water Supply

1.4 Employees and Personal Protective Equipment

1.4.1 Site Supervisor

The Site Supervisor is the site safety officer and the emergency coordinator. The Site Supervisor will be overseeing the entire work area and will be responsible for presorting the waste samples for hazards before the sample is categorized by the sorters. The sorters may not approach the areas where unexamined waste samples are being stored or examined. In the event of a spill of hazardous material from a sample, the supervisor is responsible for cleanup of the spill or for calling the appropriate authorities. The site supervisor will be in charge of training the sorters in the sorting protocol.

1.4.2 Assistant Supervisor

The Assistant Supervisor will assist the Site Supervisor as necessary, as well as act on the behalf of the Site Supervisor when the Site Supervisor is unavailable. The focus of the Assistance Supervisor's role is to facilitate the sorting process for the sorting crew.

1.4.3 Sorters

Sorters are volunteers of the Project Team and will sort and categorize the waste being sampled. Training by the Assistant Supervisor and Site Supervisor will take place for sorters. Sorters will be advised to wear a dust mask and steel toed shoes. The waste will have been presorted by the Site Supervisor or Assistant Supervisor to remove the hazardous, household hazardous, and infectious waste, and the sorters will be limited to working only in the vicinity of the sort tables and taking breaks in a predetermined area.

1.4.4 Need for Personal Protective Clothing

Municipal solid waste is not considered to be a hazardous material by definition. But, it may contain items and substances that may be encountered in close range, picked up by hand, or may have leaked from a broken container and mixed with other waste materials. These conditions could result in situations which could be hazardous to the health of the sorters conducting the study. For these reasons, it will be necessary for each sorter to wear the personal protective clothing that will be provided. This protective clothing is listed below.

- Safety glasses or goggles, or prescription safety glasses
- Dust mask (suggested)
- White Tyvek full-piece suit (optional)
- Nitrile gloves or leather driving gloves (latex gloves will be provided as a liner)
- Steel-toed boots (suggested)

1.4.5 Presorting Protection

The waste will be presorted for hazardous, household hazardous, and infectious waste with caution and with safety glasses, dust masks, nitrile gloves, and steel-toed boots. The Site Supervisor and Assistant Supervisor will be the only staff conducting the presorting and have received safety training associated with wearing the additional respiratory protection.

1.4.6 Spills

In the unlikely event of a spill or a release of a hazardous substance in a quantity still manageable by on-site personnel, the Site Supervisor will apply a spill kit to the area while wearing a Tyvek suite with duct tape to seal the wrists and ankles, double gloves (nitrile gloves with inner vinyl gloves). The media will be disposed of in a designated area.

1.4.7 Likelihood of Heat Stress

Because the study will be taking place inside the tipping floor building, environmental factors are an important consideration in worker health and safety.

Additionally, the personal protective clothing required for the study can aggravate situations caused by uncomfortable weather. A large Tyvek suit will be worn over layers of clothing. Frequent breaks will be encouraged in the event of extremely hot weather. A work/rest schedule will be adapted to weather conditions. Also, water coolers and beverages will be provided throughout the sort.

1.4.8 First Aid for Heat and Cold Stress

The following are First Aid procedures for conditions caused by hot and cold temperature extremes that may be aggravated by required personal protective equipment:

1.4.8.1 Heat Exhaustion

Caused by: Prolonged hot spell, excessive exposure, physical exertion.

Symptoms: Profuse sweating, weakness, dizziness, and sometimes heat cramps; skin is cold and pale, clammy with sweat; pulse is thready and blood pressure is low. Body temperature is normal or subnormal. Vomiting may occur. Unconsciousness is rare.

First Aid: Move to a cooler environment. Provide rest and a cool drink of water or beverage like Gatorade. Seek medical attention if the symptoms are severe.

1.4.8.2 Heat Stroke (Heat Collapse)

Caused by: Failure of the body to regulate its temperature because excessively warm weather and physical exertion has depleted it of fluids needed to perspire.

Symptoms: 1. Weakness, dizziness, nausea, headache, heat cramps, heat exhaustion, excessive sweating; skin flushed and pink.
2. Sweating stops (usually) and body temperature rises sharply. Delirium or coma is common; skin changes from pink to ashen or purplish.

First Aid: Immediate medical care is needed; heat stroke is very serious. The body must be cooled soon. Move the victim to a cooler place, remove protective clothing, and bathe in cold water. Use extreme care and frequently check ABCs (airway, breathing, and circulation) if the person is unconscious.

1.5 Waste Handling Procedures

1.5.1 Presorting

Sorters hired to sort and categorize the waste samples will be wearing a layer of protective clothing and respiratory equipment which will not allow them to work with an unexamined sample of solid waste. The Site Supervisor or Assistant Supervisor will presort the waste sample, looking for hazardous, household hazardous, or infectious waste before it may be shoveled onto the sort table. Once the load is dumped on the floor, the Site and Assistant Supervisors will walk around the load to ensure that no red bag waste is visible, chemicals that have been improperly disposed of, or any hazardous or infectious waste. Sorters will stay near the sort tables and will carefully sort the waste that is placed on the sorting table.

1.5.2 Sorting MSW

Sorting and categorizing waste requires that it be picked up with the hands. Nitrile gloves with latex gloves as liners will be provided to protect the skin from dirt and potential hazards, and should protect against most sharp materials, but caution should still be used. To avoid being cut or receiving a puncture wound, items will be picked up gingerly from the surface of the waste on the sorting table.

Moving the waste to the containers used for categorizing and weighing the garbage will be done with care. Sorters will station themselves at a single position near a table and sort for the family of materials identified on the barrels nearest their location.

Sorters will be trained to avoid grabbing handfuls of waste. One could easily trip, be knocked down, hit with an item, or at the very least startle a fellow worker by being behind them when unexpected. Materials in other categories will be passed to fellow workers nearer those barrels. Throwing or tossing the garbage will not be allowed.

Sorters will be advised to continue to look for hazardous items that could be in the waste, with special attention to the potential presence of sharps.

Prior to initiating the sorting event, the Site Supervisor will provide each sorter with a list of the various material categories and their definitions. The Site Supervisor will review the materials to be sorted and address any questions about the various categories.

1.5.3 Lifting

When shoveling garbage onto the tabletop, sorters will be reminded not to load the shovel with more weight than they can comfortably lift.

The following tips will be used when lifting:

- Maintain the three natural curves of the spine by keeping the head high, chin tucked in, and back arched.
- Bend hips and knees.
- Use the diagonal lift (one foot ahead, one foot behind) to get the weight in close and maintain a wide, balanced base of support.
- Keep abdominal muscles tight when lifting to help support the back.
- Keep the load close to the body and stand up straight. Keep head up.
- Avoid twisting while lifting. Pivot after lifting, if changing direction.
- Avoid lifting anything heavy above the shoulders.

1.6 Procedure For Handling Hazardous Wastes

The waste composition study procedure has been designed so that sorters are not exposed to mixed municipal solid waste that has not first been screened for hazardous, household hazardous, or infectious waste. These materials are defined and appropriate actions outlined for each:

1.6.1 Hazardous:

Materials that were improperly disposed of in municipal waste; e.g., radioactive waste, toxic chemicals, explosives.

Action: If the pre-sorters should miss a hazardous item in a waste sample and it is brought to the waste table and found, work should immediately stop and the area should be cleared. The entire waste sample will be rejected and removed and, depending upon the nature of the hazardous item, the site coordinator will see to the proper disposal action or will call the appropriate emergency agency.

1.6.2 Household Hazardous:

Materials commonly found in the home or work place which can be toxic, especially when discarded; e.g., paints, solvents, strong cleaners, pesticides.

Action: If a sorter becomes aware that something is spilled in the waste and hazardous--e.g., they smell a solvent or chemical odor—they will be advised to stop working, step away, notify the others at the table to stop work, and call the supervisor. If an unidentified chemical has apparently spilled on the mixed waste, the sample will be rejected, the table cleaned, and a new sample brought in. Sorters will set aside items considered hazardous waste (HW) per the material category definitions. The Site Supervisor will designate a location to place the HW upon sorting the material for each sample.

1.6.3 Infectious Waste:

Solid waste that might be able to transfer disease or infection to another person; e.g., extremely bloody medical items, syringes, or an indiscriminately discarded biomedical bag. These biomedical bags are often red in color and they have "infectious waste" or the biomedical symbol printed on them.

Action: If a hospital or veterinary bag or a similar medical waste is found, work will be stopped and the coordinator notified to remove the waste from the table. Single syringes are quite common in mixed municipal waste. If a syringe is found, the sorter finding it should announce to other workers at the table "Syringe." The sorter will then move the syringe to the appropriate container.

1.7 Emergency Contingency Plan

The Site Supervisor will be the emergency coordinator. The Assistant Supervisor will be the emergency coordinator in the event that the supervisor is not available. The Site Supervisor is responsible for understanding and complying with the facilities' emergency contingency plan and will follow site procedures.

1.7.1 Emergency Eyewash Unit

An emergency eyewash unit is located near the sort area. If someone gets a foreign object in his or her eye, the victim's eyes should be flushed with water from the eyewash unit.

1.8 Summary

The Site Supervisor will follow the health, safety, and training procedures specified in this plan. All sorters will be familiar with the policy and procedures specified in the plan prior to initiating the sorting events.

Appendix E: Data Collection Form

Alachua County Waste Composition Study 2009 **Phase I** **Leveda Brown Environmental Park, Gainesville, FL**

Date:_____

Driver:_____

Truck Type:_____

Truck #: _____

Truck Weight:_____

Truck Volume:_____

Load Total Weight:_____

Collection Type: SH COM

Substream: Res Com Insti

Ticket:

Other:_____

General Observations:

Notes:

Paper

Newspaper		
OCC		
	plain	
	waxed	
	brown paper	
High Grade		
	white	
	colored	
Mixed Recyclable		
	junk mail	
Composite		
	polycoated	
	metal coated	
	aseptic	
Compostable/Soiled		
Boxboard		
Miscellaneous		
	magazines	
	phone books	
	glossy paper	
Other		

Plastic

#1 PET bottles		
	Clear	
	Green	
#2 HDPE		
	Clear	
	Colored	
#3-#7 (Other Plastic Bottles)		
Other rigid plastic		
	#2,4, and 5	
	#1,3,6, and 7	
	nonfood EPS	
	food service	
Film		
	clean shopping	
	other clean film	
	other dirty film	
Plastic products		
Composite		
Other		

Glass

Clear	
Blue	
Brown	
Green	
Flat	
composite/other mixed cullet	

Organic

yard waste		
	grass	
	prunnings	
	stumps/logs	
Food		
Animal By-products		
Composite/ other organic		

Disposable Diapers

C&D

Clean Wood		
	treated	
	non-treated	
	Pallets & Crates	
	Composite/ Other wood	
Gypsum		
	Clean Gypsum	
	Painted Gypsum	
Fiberglass Insulation		
Rock/concrete/bricks		
Asphaltic Roofing		
Ceramics		
Sand/soil/dirt/grit/fines		
Composite/other C&D		
PVC		

Pharmaceuticals

CFLs

Metals

aluminum drink containers	
aluminum foil/containers	
other aluminum	
food and beverage	
other ferrous metals	
other non-ferrous scrap	
empty paint & aerosol cans	
empty propane & other tank	
composite/other metals	

Bulk

Carpet/ Upholstery	
Furniture	
Mattresses	

Other Products

Tires		
Rubber		
Textiles and leather		
Apparel		
Electrical Appliances		
Computer Related Electronics		
	monitors	
Personal Portable Electronics		

HHW

Automotive Products/Fluids	
Paints and Solvent	
Pesticides, Herbicides, Fungicides	
Household cleaners	
Lead Acid Batteries	
Other Batteries	
Other HHM	
Mercury Containing Products	
Cathode Ray Tubes	

Sharps

Fines/ Super mix

Date:	Paper	Newspaper				Organic	yard waste				Other Products	Tires			
Time:		OCC					Food					Rubber			
Hauler:		High Grade					Animal By-products					Textiles & leather			
Truck #:		Mixed Recyclable					Composite/ o organic					Apparel			
Driver:		Composite	junk mail				Total	0.00		0		Electrical Appliances			
Truck Type:			polycoated				Disposable Diapers	0.00				Comp Related Elect			
Truck Vol:			metal coated			Metals	aluminum drink cont					Portable Elect			
Source:			aseptic				aluminum foil/cont					Total	0.00		0
Collection Type: SH / COM		Composable/Soiled					other aluminum				HHW	Auto Products/Fluids			
Substream: RES COM INST		Boxboard					food and beverage					Paints & Solvent			
Load Wt (lb):		Miscellaneous					other ferrous metals					Pesticides, Herbicides, Fungicides			
Sample Wt (lb):		Other					other non-ferrous scrap					Household cleners			
Start Time:		Total	0.00		0		empty paint & aerosol					Lead Acid Batts			
End Time:	Plastic	#1 PET bottles					empty propane & o. tar					Other Batteries			
Ticket:			Clear				composite/o. metals					Other HHM			
			Colored				Total	0.00		0		Hg Containing Product			
General Observations:		#2 HDPE				Glass	Clear					Cathode Ray Tubes			
			Clear				Blue					Total	0.00		0
			Colored				Brown				Bulk	Carpet/ Upholst			
		#3-#7					Green					Furniture			
		Other rigid plastic					Flat					Mattresses			
			#2,4, and 5				composite/o mixed cullet					Total	0.00		0
			#1,3,6, and 7 nonfood EPS				Total	0.00		0					
			food service			C&D	Clean Wood								
		Film					Gypsum								
			clean shop				Fiberglass Insulation								
			other clean				Rock/concrete/bricks					Pharmaceuticals			
			other dirty				Asphaltic Roofing					CFLs			
		Plastic products					Ceramics					Sharps			
		Composite					PVC					Residuals			
		Other					Composite/other C&D					Fines/ Super mix			
		Total	0.00		0		Total	0.00		0		Other (See Notes)			

Notes:	Material origin (specific geographic origin)?
	Were any out-of-the-ordinary items picked up?
	Any observations within the load?
	Low recycling community?

Completed	Protocol
☐	1) Presort a) waste scanned b) waste placed on table
☐	2) Scan for the following items: a) sharps (needles and razors) b) HHW c) infectous waste
☐	3) Sorting steps a) ginergly pick items b) avoid grabbing handfuls c) sort for specific sub-categories

Appendix F: Overall Results

See the attached compact disc for overall detailed results from the waste composition studies, file name: “Compiled.Results.”

Appendix G: Statistical Analysis

ESTIMATING WASTE COMPOSITION

Waste composition estimates were calculated using one of two methods, the choice of which depended on the way composition data was collected. When waste samples were selected from vehicles that were chosen through a randomized process as they arrived at disposal facilities, it was appropriate to treat each sample as being equivalent to its peers within the same sampling stratum. Our statistical method for estimating the composition of single-family residential, commercial, and self-hauled waste relied on a method that gave equal weighting or "importance" to each sample within a given stratum. Confidence intervals (error ranges) were calculated based on assumptions of normality in the composition estimates.

On the other hand, when waste samples were collected at the sites where the waste was generated (for example, collected at individual apartment buildings) it became necessary to introduce a means of accounting for the relative magnitude of each generator site in the estimation process. The statistical method in this case used the estimated amount of waste generated at each site as a weighting factor to assign relative "importance" to that site in the composition calculations.

In the descriptions of calculation methods, the following variables are used frequently.

1. i denotes an individual sample
2. j denotes the material type
3. c_j is the weight of the material type j in a sample
4. w is the weight of an entire sample
5. r_j is the composition estimate for material j (r stands for ratio)
6. 7. s denotes a particular sector or subsector of the waste stream
8. n denotes the number of samples in the particular group that is being analyzed at that step

ESTIMATING COMPOSITION BASED ON SAMPLES FROM VEHICLES

The following method was used to estimate the composition of waste belonging to the single family residential, commercial, commercial self-hauled, and residential self-hauled sectors.

For a given stratum (that is, for the samples belonging to the same waste sector within the same region), the composition estimate denoted by rj represents the ratio of the components' weight to the total weight of all the samples in the stratum. It was derived by summing each component's weight across all of the selected samples belonging to a given stratum and dividing by the sum of the total weight of waste for all of the samples in that stratum, as shown in the following equation:

$$r_j = \frac{\sum_i c_{ij}}{\sum_i w_i}$$

where:

c = weight of particular component
w = sum of all component weights
for i = 1 to n, where n = number of selected samples

for j = 1 to m, where m = number of components

For example, the following simplified scenario involves three samples. For the purposes of this example, only the weights of the component carpet are shown.

$$r_{carpet} = \sum \frac{5+3+4}{80+70+90} = 0.05$$

To find the composition estimate for the component carpet, the weights for that material are added for all selected samples and divided by the total sample weights of those samples. The resulting composition is 0.05, or 5 percent. In other words, 5 percent of the sampled material, by weight, is carpet. This finding is then projected onto the stratum being examined in this step of the analysis.

The confidence interval for this estimate was derived in two steps. First, the variance around the estimate was calculated, accounting for the fact that the ratio included two random variables (the component and total sample weights). The variance of the ratio estimator equation follows:

$$Var(r_j) \approx \left(\frac{1}{n}\right)\left(\frac{1}{w^2}\right)\left(\frac{\sum_i \left(c_{ij} - r_j w_i\right)^2}{n-1}\right)$$

where

$$\overline{w} = \frac{\sum_i w_i}{n}$$

(For more information regarding Equation 2, please refer to Sampling Techniques, 3rd Edition by William G. Cochran [John Wiley & Sons, Inc., 1977].)

Second, precision levels at the 90 percent confidence level were calculated for a component's mean as follows:

$$r_j \pm \left(z\sqrt{Var\left(r_j\right)}\right)$$

where z = the value of the z-statistic (1.645) corresponding to a 90 percent confidence level.

Composition results for strata were then combined, using a weighted averaging method, to estimate the composition of larger portions of the waste stream. The relative tonnages associated with each stratum served as the weighting factors. The calculation was performed as follows:

$$O_j = \left(p_1 * r_{j1}\right) + \left(p_2 * r_{j2}\right) + \left(p_3 * r_{j3}\right) + \ldots$$

where:

p = the proportion of tonnage contributed by the noted waste stratum (that is, the weighting factor)

r = ratio of component weight to total waste weight in the noted waste stratum (that is, the composition percent for the given material component)

for j = 1 to m, where m = number of material components

For example, the above equation is illustrated here using three samples.

	Sample 1	Sample 2	Sample 3
Ratio (r) of carpet			
Tonnage			
Proportion of tonnage (p)			

To estimate the portion of larger portions of the waste stream, the composition results for the three strata are combined as follows.

$$O_{carpet} = (0.143*0.05)+(0.571*0.10)+(0.286*0.10) = 0.092 = 9.2\%$$

Therefore, 9.2 percent of this examined portion of the waste stream is carpet.

ESTIMATING COMPOSITION OF ENTIRE STATEWIDE DISPOSED WASTE STREAM

Composition results for all waste sectors were combined, using a weighted averaging method, to estimate the composition of the entire statewide disposed waste stream. The relative tonnages associated with each sector served as the weighting factors. The calculation was performed as follows:

$$O_j = (p_1 * r_{j1})+(p_2 * r_{j2})+(p_3 * r_{j3})+\ldots$$

where:

p = the proportion of tonnage contributed by the noted waste sector (that is, the weighting factor)

r = ratio of component weight to total waste weight in the noted waste sector (that is, the composition percent for the given material component)

for j = 1 to m, where m = number of material components

The following scenario illustrates the above equation. This example involves the component carpet in three waste sectors.

$$O_{carpet} = (0.50*0.05)+(0.25*0.10)+(0.25*0.15) = 0.0875$$

So, it is estimated that 0.0875 or 8.75% of the entire waste stream is composed of carpet.

Appendix H: Alachua County 2007 MSW collection and recycling data

See the attached compact disc for overall the 2007 MSW collection and recycling data reported to the Florida Department of Environmental Protection, file name: “AC.FDEP.Report.2007.”

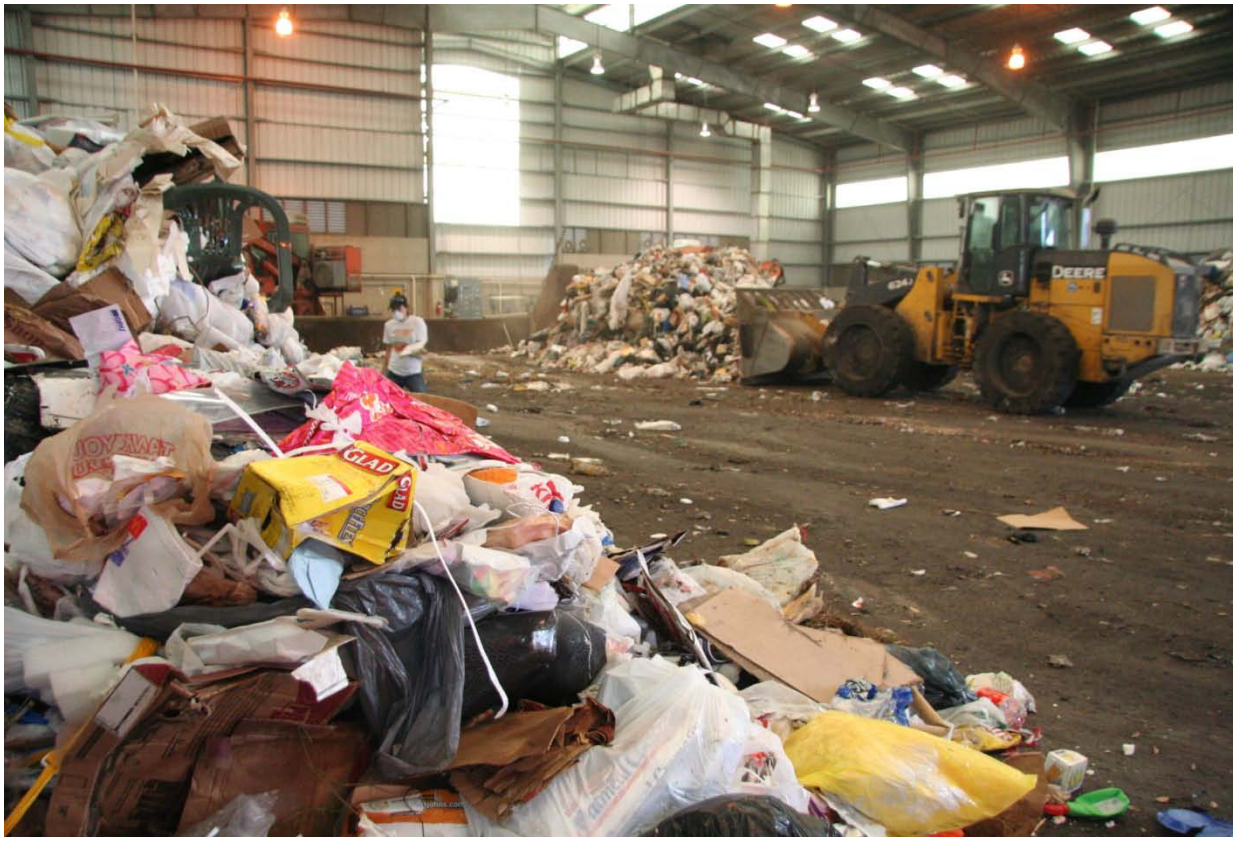
Appendix I: Photo compilation

Above: A local hauler trucks arrives at the transfer station with a load.

Below: Municipal Solid Waste in the Transfer Station.

Above: Household hazardous material in MSW.

Below: Recyclable materials present in MSW.



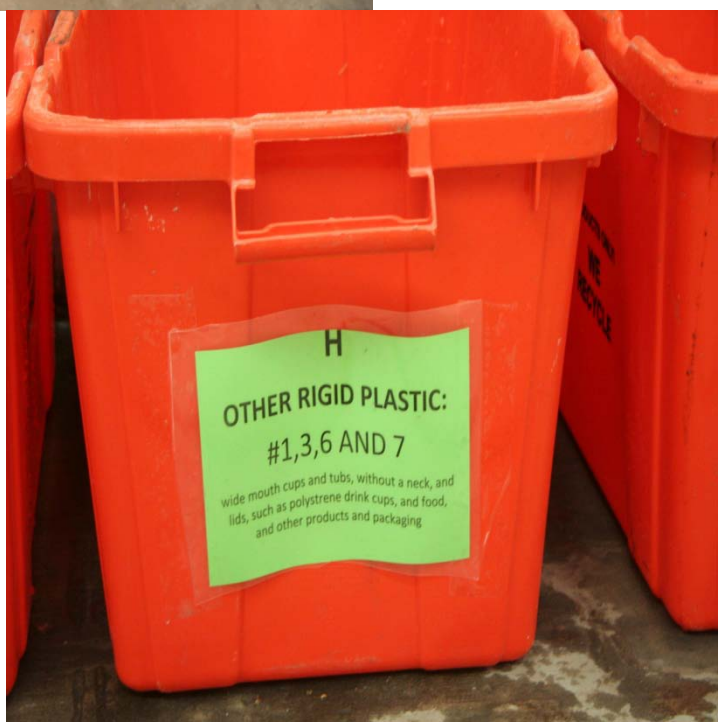
Above & Below: Waste composition being observed while a bulldozer pushes a ready load over the precipice into a transfer trailer below.

Right: Grapple arm loading a transfer trailer down below with transfer station waste to be hauled to New River Landfill.

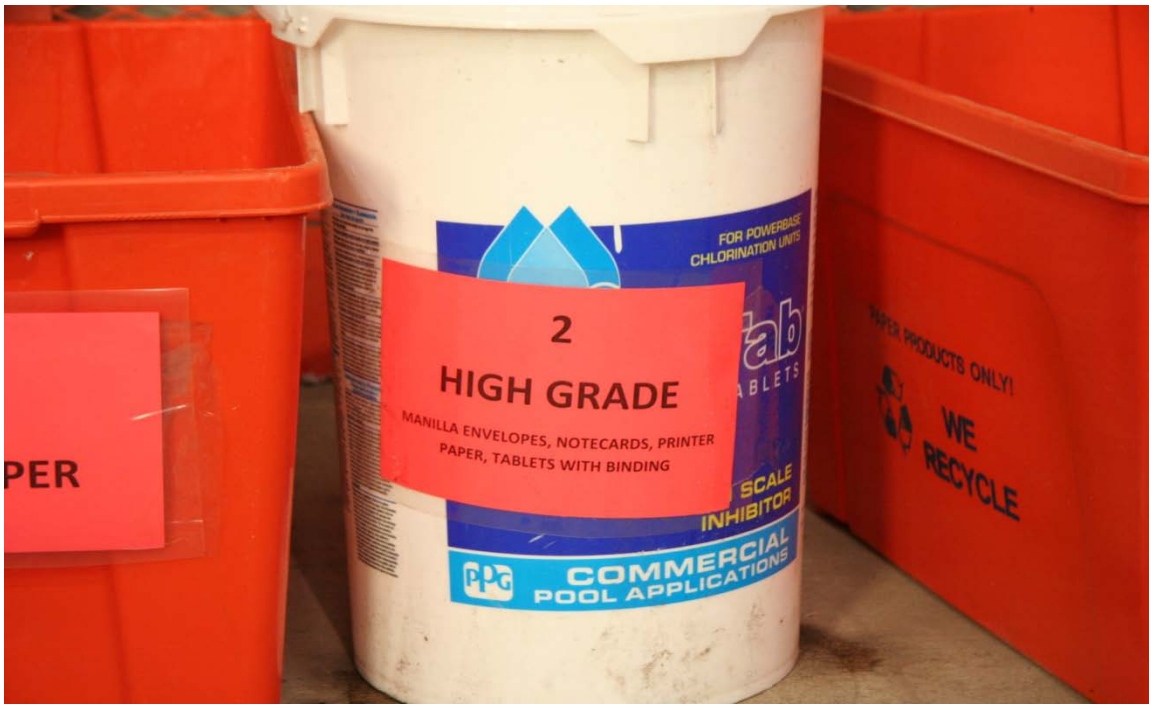
Below: The loaded transfer trailer, a roughly 100 cubic yard capacity truck, taking off. The waste will be covered.

Right: The waste sort table prior to use. Notice the top screen (2”x2” holes) and the bottom screen (1”x1” holes). Labeled bins surround the sort table for reception of sorted waste.

Left: A labeled bin for sorted waste. This bin was for other rigid plastic, a category of waste not currently recycled by Alachua County.



Above & Below: More labeled containers.



Left: Sorters working to pick out certain waste stream components.

Right: Subcatagorized paper bins filled from sorting progress.

Above: Overhead view of sort operation during Phase II. Bins are being taken to be weighed after a load sort.

Left: Sorted waste being weighed, mass being recorded on the sort sheet.

Right: Residuals/Fines that have fallen through the sort table's 2 and 1 inch slots. These will be gathered up and weighed after all other components from the load have been weighed.