2016 Waste Composition and Characterization Analysis

Presented to:

Larimer County

Submitted by:

SloanVAZQUEZMcAFEE
MUNICIPAL SOLID WASTE ADVISORS

3002 Dow Ave, Suite 116
Tustin, CA 92780
Office: 866.241.4533
info@sloanvazquez.com

November 16, 2016

This page intentionally left blank.

Table of Contents

Table of Tables

Table of Figures

1. EXECUTIVE SUMMARY

The Larimer County Solid Waste Department operates the Larimer County Landfill. The landfill is a 160-acre municipal solid waste (MSW) disposal facility situated on a 320-acre site. The landfill receives approximately 1,200 tons of solid waste per day. The landfill is funded solely by tipping fee revenue and competes in an open market with privately-owned landfills in neighboring counties. The landfill also hosts a material recovery facility (MRF) known as the “Recycling Center” where most of the materials come in as single stream materials. The MRF, which is owned by Larimer County and operated by Waste Management of Colorado, Inc., processes over 150 tons of recyclable materials each day.

In 2016, Larimer County retained Sloan Vazquez McAfee (SVM) to perform an updated, two-season waste composition study (2016 study). The sampling and analysis was conducted by the SVM team, a consulting firm focused exclusively on municipal solid waste planning and management services, specializing in waste characterizations, MRF project development and operational analysis, rate studies, financial feasibility studies, municipal contract analysis and residential and commercial collection operations. The firm’s principals have over 60 years of wide ranging expertise and experience in municipal waste management and recycling, and have conducted numerous waste composition studies at sites located throughout the United States. SVM maintains a specialized, streamlined organization that provides solid waste and recycling advisory services to both public and private sector solid waste and recycling enterprises.

The 2016 study seeks to achieve the following objectives:

- Provide a new waste characterization study
- Provide comparisons to the results of the 2007 Waste Study to evaluate trends
- Quantify the impact of existing recycling programs
- Identify opportunities to increase waste diversion
- Provide useful data to help guide Solid Waste Department with planning, policy development and resource allocation

The following report outlines the methodology used to conduct the study, the results of the study for each season individually and combined, a comparison of the 2007 and 2016 study data, and a summary of the findings, including the impact of recycling programs and opportunities to increase waste diversion

The intent of this solid waste composition analysis is to identify, quantify and characterize MSW material types received for disposal at the Larimer County Landfill. The methodology differentiates between four major categories of waste delivered to the landfill. The waste generation categories specifically identified and sampled as part of this composition and characterization study include residential, commercial, Construction and Demolition (C&D) materials and self-hauled waste.

As originally proposed, SVM committed to complete the physical sampling of 15 residential MSW and 20 commercial MSW samples per season. Additionally, 20 self-haul MSW samples were to be visually surveyed and composed. The original agreement called for a total of 110 samples to be analyzed during the two-season study. SVM performed an additional five self-haul and 20 added C&D samples per season, for a two-season total of 150 samples.

Based upon current and projected disposal at the Larimer County Landfill, it has been reasonably projected that the current site will reach its permitted capacity in approximately ten years. The County, and its partners, can position itself to guide the future of the waste stream and pursue innovations that offer economical solutions for both managing waste and generating resources. For example, in addition to the siting of a new landfill to meet the ongoing need for sanitary disposal capacity, the County may consider adding new technologies for the recovery of recyclable materials, or for the creation of feedstock for emerging renewable energy processes.

The amount of solid waste and source-separated recyclables that are generated within Larimer County are sufficient to provide the economies of scale to support a variety of solid waste management solutions, including the development and operation of a MRF to process and sell the County-generated source-separated recyclables; composting processes to manage the yard waste and wood waste materials; and, mixed-waste processing to recover post-consumer recyclables that do not find their way into the source-separation programs and generate valuable energy-producing feedstock.

Through the analysis of the study data, several immediate opportunities for the improvement of recycling and landfill diversion have emerged. Consider the following:

- Although the percentage of fiber in the residential and commercial waste streams has decreased since 2007, a significant amount of dry, recoverable fiber remains in the MSW. Policies to make recycling mandatory and community/educational outreach programs to encourage and improve participation rates will serve to increase the amount of material that is moved into the source-separated recycling services that are offered throughout the county.
- The percentage of non-ferrous metal (predominantly aluminum cans) that remains in the residential and commercial streams is significant. Though the weight of this material is insignificant, the value of it is not. If only 50% of the aluminum that remains in the commercial and residential streams was recycled, it would generate over $1M annually into the local economy.
- The percentage of clean wood in the Self-Haul and C&D waste streams may be readily recovered for use as compost feedstock, co-gen fuel, or repurposed for other uses. Recovering the clean wood has the potential to create jobs and extending the life of the landfill by removing this voluminous material.
- The percentage of ferrous metals in the self-haul and C&D streams is also significant. If only 50% of the ferrous was recovered from the C&D and Self-Haul streams, it would generate about $400,000 annually to the local economy.
- Because of the measured amounts of clean wood and ferrous metals, it may be possible for the county to attract a processor to economically recover the materials on-site.
- Increasing the frequency of recycling collection service almost always improves participation and recovery rates. The increase in the recovery of targeted recyclable materials achieved by

changing from Every-Other-Week collection to Weekly collection may offset the additional service costs via the combination of reduced disposal costs and increased commodity sales revenues.

- Representing over 12% of the residential waste-stream, yard-waste presents an immediate, and economical, opportunity for separate collection, composting, and diversion from landfill disposal. Using 400 pounds per cubic yard as the bulk-density conversion factor for the estimated 18,900 tons per year of yard-waste, approximately 50,000 cubic yards of landfill-space could be saved annually if 50% of the material was collected for composting.
- In addition to the immediate opportunities that may economically increase recycling and decrease landfill disposal, the study revealed a large percentage of organic wastes in each sampled stream. Though none are currently economically viable, there is tremendous interest and investment in the development of renewable energy processes that consume solid waste-derived feedstock for energy production. Closed landfill sites are excellent hosts for thermal and anaerobic digestion processes, as well as solar and wind energy production.

.

2. METHODOLOGY

The intent of the solid waste composition and characteristics analysis is to identify, quantify and characterize MSW material types received for disposal at the Larimer County Landfill. The methodology differentiates between four major categories of waste delivered to the landfill. The waste generation categories specifically identified and sampled as part of this composition and characterization study include residential, commercial, and C&D materials and self-hauled waste.

A. Material Streams

Each of these material types are directed to specific, separate areas of the landfill by Larimer County personnel. For the purposes of this study, the material streams were identified using the following criteria:

1. The area of the landfill to which the customer was directed to off-load the payload (SVM Area 1 – primarily compacted MSW, and SVM Area 2 – primarily Self-Haul and C&D)
2. Vehicle-Type
    a. Front Loader w/Compactor body (mostly commercial including multi-family, Area 1)
    b. Side Loader w/ Compactor body (mostly curb-serviced residential, Area 1)
    c. Rear Loader w/Compactor body (combination of single/multi-family residential and commercial, Area 1))
    d. Roll-Off Truck w/Compactor box (Commercial, Area 1)
    e. Roll-Off Truck w/Open-Top Roll-Off Box (commercial & residential, Areas 1&2)
    f. Roll-Off Truck w/ Open-Top Roll-Off Box (Self-identified as C&D, Area 2)
    g. End-Dumps (C&D, Area 2)
    h. Box-Trucks (Self-Haul, Area 2)
    i. Cars and Pick-Up Trucks (Self-Haul, Area 2)
    j. Trucks with Trailers (Self-Haul and C&D, Area 2)
3. Drivers were questioned regarding the primary jurisdiction of origin (city) and the primary material type, residential or commercial.
    a. Waste hauling companies generally distinguish commercial from residential customers based upon the type of storage container (dumpster/bin, or cart) used by the customer and the type of vehicle that the company uses to service the customer. For example:
        - Side-loader compactor trucks are almost exclusively used to service residential generators.
        - Front-loader compactor trucks are primarily used to service commercial waste generators. However, because most apartments, and other multi-family waste

generators use dumpsters for the storage of waste, they are regularly categorized by the hauler, and described by the driver, as commercial, not residential, generators.

- Rear-loader compactor trucks are flexible collection vehicles that can serve a wide array of waste generators; residential, commercial, rural, and bulky items. These vehicles are typically used where the route requires the service of carts, cans, bags, small dumpsters, and bulky item (sofas, etc.) collection with one vehicle.

b. All samples were randomly identified and categorized per the driver's statement regarding the primary generator-type (residential or commercial) of each load.

- Residential MSW – material collected primarily from residential premises (usually a side-loader, but sometimes front, or rear loader)
- Commercial MSW – material that is collected primarily from commercial generators including apartments and other multi-family customers. (front-loader, rear loader)
- Self-Haul – Loose materials collected by residents, or commercial hailers, that typically come from property clean-ups, landscaping, tree-removal, or small-scale remodeling projects. (cars, pick-up trucks, trucks with trailers, 8 to 20-yard roll-off boxes)
- C&D – Loose materials primarily collected by commercial enterprises that include; building site preparation debris (grading), room/building demolition, roofing tear-off materials, pavement/foundation removal, construction site clean-up. (roll-off trucks, end-dump trucks, large trucks with trailers)

B. Sampling Plan Summary

SVM performed the physical sampling of 15 residential MSW samples and 20 commercial MSW samples per season, and visually surveyed 20 self-haul MSW samples and 20 C&D samples per season, for a two-season total of 150 samples.

1. Waste Generation Sectors and Sample Selection

- Residential Waste – 15 samples per season, 3 to 4 samples per day, 200 lbs. (+-) per sample, 30 total samples during spring/fall 2016
- Commercial Waste - 20 samples per season, 4 to 5 samples per day, 200 lbs. (+-) per sample, 40 total samples during spring/fall 2016
- Self-Haul Waste - 20 samples per season, 4 to 5 samples per day, entire load visually surveyed, 40 total samples during spring/fall 2016
- C&D Waste - 20 samples per season, 4 to 5 samples per day, entire load visually surveyed, 40 total samples during spring/fall 2016

Table 2-1: Waste Generation Categories, Sample Numbers and Sort Type

Waste Generation Category	Total Number of Samples	Sort Type
Residential MSW	30	Hand Sort
Commercial MSW	40	Hand Sort
Industrial/C&D	40	Visual Survey
Self-Haul	40	Visual Survey
TOTAL SAMPLES	**150**	

C. Field Sampling and Sorting Methods

Residential and commercial MSW samples were identified and extracted using a track-loader equipped with a grapple bucket and operated by SVM personnel. The samples were delivered to the sorting area and placed separately on tarps. Then, they were placed upon a sorting table and sorted into 32-gallon cans and designated material categories. The sorted materials were then moved to the digital platform scale (.02 lb. increments) and weighed. The weights were manually entered into a Larimer County Waste Composition Study Field Form. The results were scanned and emailed to SVM offices daily for input into the company's custom-designed waste composition data management system.

Self-Haul and C&D MSW samples were identified and the entire loads were visually surveyed including the estimated cubic yards of material contained in each load. The volumetric percentages of each observed material-type were entered onto a Larimer County Field Form, scanned and emailed to SVM offices daily. There, SVM personnel performed a volume-to-weight conversion using an industry recognized conversion factor index. The results were then input into the data management system.

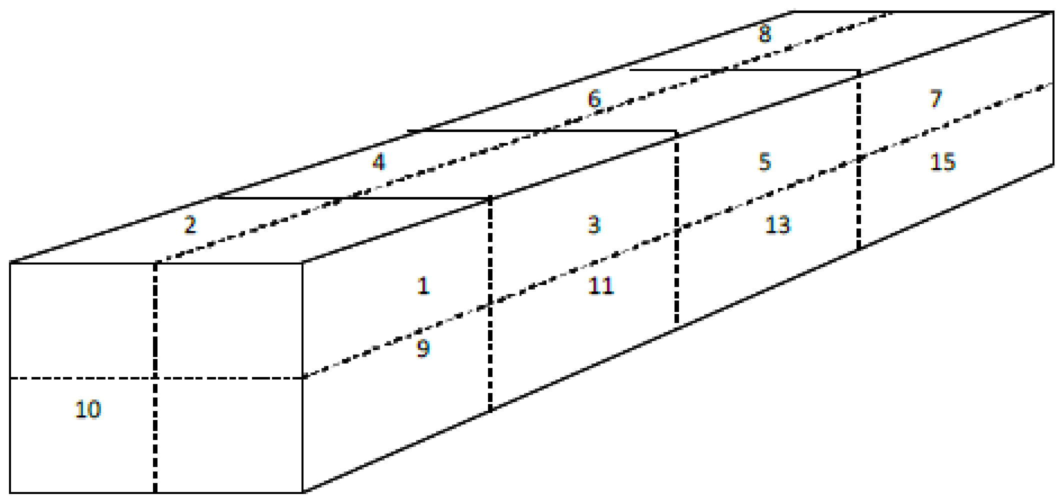
1. Load Selection

For the Spring Study, SVM generated a randomized customer number to identify the incoming loads and the cell within each load that would be extracted for sampling.

Because the County uses separate scale houses to manage the inbound payloads, it proved difficult to capture the selected loads using randomly selected customer/weight ticket numbers. Therefore, for the Fall Study, inbound loads were selected by rolling dice to select each load. For example, if the number "7" was rolled, the seventh vehicle arriving at the tipping-area after the dice-roll would be sampled. If a residential load was needed, and the seventh truck was a commercial load, the site manager captured the residential sample from the next residential load that arrived at the tipping area.

A “randomizer” program was used to select the precise cell within each load for extraction and categorization. The randomizer is an MS-Excel worksheet that uses a set of formulas to randomly select material for sorting. Each cell in the sixteen-cell table was assigned a random number. The first two cells were assigned an integer value based on their rank with the other cells. The number assigned to the first cell was the cell to be sampled, unless that cell was inaccessible. If accessible, the second cell was sampled.

Figure 2-1: Sixteen-Cell Grid



Note: Cells 12, 14, and 16 are below cells 4, 6 and 8, respectively.

2. Size of Physically Sorted and Visually Surveyed Samples

The physically sorted residential and commercial samples were approximately one-cubic yard and 200 lbs. (+-). Each visually surveyed sample comprised the entire load. Load sizes ranged from one-half cubic yard cars or small trucks to 60 cubic-yard end-dump trucks.

3. Seasonality

Seasonal variations in waste generation are relatively modest, apart from significant increases in the amount of post-consumer recyclables that manifest during major holidays and the seasonal impacts upon gardening/yard waste generation and construction activities. Yard waste and construction related waste fluctuations are registered in this Spring/Fall study.

D. Material Categories

The materials identified, extracted, sorted and weighed were divided into designated categories for each sample to establish the composition, or the various types of material, as well as the characterization, which is the shape and size of those materials. The types of items included in each material category are described below.

Dry Recoverable Fiber & OCC	All clean dry fiber, including cardboard (OCC), chip board (cereal/shoe box), office paper, junk mail, and shredded paper that is readily recoverable using current waste/recycling processing technology.
PET UBC's	PET plastic (#1) used beverage containers
HDPE	All readily identifiable HDPE, including UBC's, five-gallon pails, laundry baskets, trash cans, toys, et al
Film Plastic	All film plastic from t-shirt bags to large garbage bags and painters' tarps
Mixed Plastics	All readily identifiable plastics except PET, HDPE, and Film
Glass	Bottle and plate (window) glass
Aluminum UBC's	All aluminum beverage containers
Mixed Ferrous	Tin cans, steel (pots, pans, construction material, shelving, etc.)
Mixed Non-Ferrous	Aluminum windows and doors, folding lawn chairs, stainless steel fixtures, brass hardware, copper pipe, et al
Inerts	Dirt, rock, sand, brick, tile, ceramic, concrete, et al
Hazardous Waste	Pesticide, insecticide, paint, solvents, oil, cleaning solutions, et al
E-waste	All items that operate via AC current or battery
Textiles	Clothing, bedding, carpet, towels, rags, et al
Organics	Yard/garden waste, food waste, clean wood, painted/treated wood, wet contaminated fiber, rubber
Wet Contaminated Fiber	All fiber that has been soiled and is not marketable as a post-consumer fiber grade, and fiber that would disintegrate during the mechanical sorting process (screens and/or air classification) making it non-recoverable with fiber products.
Fines	Materials that fall through the 2" lattice on the sort table. Depending upon the source of the sample, the fines may be heavy in organic and inert materials, or in glass shards and small

	fiber (shred). The organic/inert fines are produced from unprocessed MSW or from “dirty” MRF operations. The glass/fiber fines are produced from “clean”, or single-stream recycling processing plants.
Other	These materials are not readily recoverable as any of the other commodity/products. They are generally represented by items that are comprised of more than one material and cannot be readily, economically separated and recovered.

E. Detailed Hand-Sort Protocol

A total of 30 samples of residential MSW and 40 samples of commercial MSW were hand-sorted. The step-by-step protocol for the hand sort is described below. Additionally, a pictorial presentation of the physical sorting process in provided as Exhibit B.

1. Conducted daily safety briefings, then reviewed methodology and sorting categories with the crew to ensure that all crewmembers understood the detailed material definitions before sampling began. The members of the crew were the same throughout the sampling process, and same crew members conducted the same activities during each day of the sampling. This consistency of team membership and assignment ensured reliability and uniformity of results throughout the process.

2. Obtained waste samples from the randomly selected cell, as identified by the Field Crew Manager. The samples consisted of approximately 150-200 pounds of waste that were removed and placed onto a 9’ X 12’ tarp. The larger items were recovered directly from the tarp and deposited into 30-gallon tubs. Once the larger materials were removed from the sample, the sorting table was moved into place and used for the recovery of smaller items and the allocation of fines.

3. Hand-sorted materials were placed into the prescribed categories. Sorting crew members specialized in specific material categories and placed the sorted materials into a designated plastic container while the Field Crew Manager monitored the sorting process to ensure proper classification. The Field Crew Manager verified the purity of each material classification as it was weighed, prior to recording data on the data sheet.

4. The composition weights were then recorded by the Field Crew Manager on the data sheet, depicted in the table below, the end of each day, the Field Crew Manager conducted a quality control review of the data recorded.

Figure 2-2: Sample Data Form

		WEIGHT #1	WEIGHT #2	WEIGHT #3	WEIGHT #4	WEIGHT #5
DRY, RECOVERABLE FIBER						
PET						
HDPE						
FILM PLASTICS						
MIXED PLASTICS						
GLASS						
ALUMINUM UBC's						
MIXED FERROUS						
MIXED NON-FERROUS						
INERTS						
HAZARDOUS WASTE						
E-WASTE						
TEXTILES						
Organics	YARD WASTE					
	FOOD WASTE					
	CLEAN WOOD					
	TREATED/PAINTED WOOD					
	WET/CONTAMINATED FIBER					
	RUBBER PRODUCTS					
	ALLOCATED ORGANICS					
FINES						
OTHER						

Examples of materials identified as "Fines" as part of the field work conducted at Orange County landfills included the following:

- organic materials, which were primarily yard and food waste
- inert materials, which were primarily rock, gravel, sand and dirt
- small shards of glass, and
- <2" fiber, which was primarily 3x5 card or Post-it® note sized and shredded paper.

The four types of material described above made up >95% of the identified fines. The remaining material identified as fines made up the remaining <5% included items such as ammunition, pens and pencils, medication bottles, batteries and bottle caps.

Material identified as “Other” during the Larimer County Landfill field work included the following items:

- Tar Roofing
- Window Blinds
- Cat Litter
- Tarps
- Sofa Bed
- Auto Body Parts
- Auto Interior Parts
- Foam Mattresses
- Office Cubicle Dividers
- Upholstered Furniture
- Diapers
- Asphalt Shingles
- Roof tile w/ grout and wire
- Office chairs
- Concrete filled tire
- Shoes
- Trophies
- Particle board cabinet w/vinyl & hardware
- Stucco w/ wire and tar paper

F. Detailed Visual Characterization Protocol

Visual waste characterization analysis was conducted for 40 samples of C&D waste and 40 samples of Self-Haul waste at the landfill. The visual sampling method is summarized in the following steps:

1. The volume of each sample (cubic yards) was estimated by a trained observer/classifier.
2. Using available solid waste volume-to-weight conversion tables, as informed by practical experience, the volume of each observed/classified sample was converted to weight.
3. The major classes of material were identified and noted. An estimator walked entirely around the load and noted all identified major material classes in the load, including paper, plastic, glass, metal, E-waste, yard waste, organics, C&D, hazardous waste and special wastes.
4. The volume for each major class of material was estimated, beginning with the largest major material class presented by volume. The process was repeated for the next most common major material class, and so on until each material class had been estimated. Finally, the totals for this step were calculated to ensure that they totaled 100%.
5. The volume for each specific sub-category within each of the major material classes was then estimated and recorded.
6. The data was then reconciled on the sampling form using input verification rules set up on the computer system to ensure the percentages totaled 100%.

A pictorial presentation of the self-haul and C&D survey process is provided in Exhibit B.

G. Data Analysis

Following the separation of each sample, all material was weighed and the weight was recorded on field forms and then populated into the database and reviewed for accuracy. Data input was checked twice by a two-person team for quality control to confirm that there were not any typos such as transposed numbers or misplaced decimal points. The equations used in these calculations are provided below.

1. Waste Sort Analytical Procedures

The waste characterization and quantity profiles for this study were developed through the following steps:

- Converted volumetric estimates of material categories to weight (for industrial and self-haul characterization estimates).
- Calculated the composition of all samples in the given sector, based on the sample weight.
- Calculated the confidence interval by first calculating the variance around the estimate, then calculating precision levels at 90%.
- Calculated overall weighted average by performing a weighted average across the waste types.

Converting Volumes to Weights

The composition calculations relied on the availability of individual material weights for each sample. For industrial and self-haul samples, volume estimates were converted to weights using accepted waste density conversion factors. Using the volume-to-weight conversion factors and the volume estimates obtained during the characterization of visual samples, individual material weights were calculated using the following formula:

$$c = m \times s \times v \times d$$

where:
m = percentage estimate of the material, as a portion of the material class (e.g., the extent to which yard waste constitutes all the organics in the sample)

s = percentage estimate of the material class, as a portion of all the material in the sample (e.g., the extent to which organics constitutes all the material in the sample)

v = total volume of the sample (in cubic yards)

d = density conversion of the material (in pounds/cubic yard)

c = the total weight of the specific material in the sample

Each material weight was scaled so that the sum of all material weights equals the actual total sample weight (or net weight of the load).

Composition Calculations

The composition estimates represent the ratio of the material categories' weight to the total waste for each noted sector. They were derived by summing each material's weight across all the selected records and dividing by the sum of the total weight of waste, as shown in the following equation:

$$\boldsymbol{r_j = \frac{\sum_i c_{if}}{\sum_i w_i}}$$

where:

c = weight of a particular material

w = sum of all material weights

for *i* = 1 to *n*

where *n* = number of selected samples

for *j* = 1 to *m*

where *m* = number of material categories

Confidence Interval

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 ration includes two random variables (the material and the total sample weights). The variance of the ratio estimator equation follows:

$$\hat{V}_{rj} = \left(\frac{1}{n}\right) \cdot \left(\frac{1}{\overline{w}^2}\right) \cdot \left(\frac{\sum_i \left(c_{ij} - r_j w_i\right)^2}{n-1}\right)$$

where:

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

Second, precision levels at the 90% confidence interval were calculated for a material's mean as follows:

$$r_j \pm \left(t \cdot \sqrt{\hat{V}_{rj}}\right)$$

where:

t = the value of the t-statistic (1.645) corresponding to a 90% confidence level.

Weighted Averages

The overall waste composition estimates were calculated by performing a weighted average across the five waste types. The weighted average for an overall composition estimate was performed as follows:

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

where:

p = the proportion of tonnage contributed by the noted sample group

r = ratio of material weight to total waste weight in the noted sample group for *j* = 1 to m

where: *m* = number of material categories

The variance of the weighted average is calculated

$$VarO_j = \left(p_1^2 * \widehat{V_{r_{J_1}}}\right) + \left(p_2^2 * \widehat{V_{r_{J_2}}}\right) + \left(p_3^2 * \widehat{V_{r_{J_3}}}\right) + \cdots$$

H. Implementation Dates and Personnel

The waste characterization work was conducted during May and October 2016. The SVM project team included a crew of six sorters, a loader operator, a field crew manager and a principal. The team was equipped with a sorting table, a work table, tarps, tubs, hand tools, a skid steer, a digital scale with a 2/10ths of one-pound increment, and personal protective equipment including high visibility vests, hard hats, dust masks, steel-toed boots, puncture resistant gloves and safety glasses. A storage box was secured at the site for placement of the equipment at end of each workday.

The sampling process was effectively facilitated by the cooperation and active support of the Larimer County Landfill management and field personnel. Their participation was critical to the timely, successful completion of the field sorting process. Personnel included the following:

- **Stephen Gillette – Solid Waste Director**
- **Eddie Enriquez – Assistant Director**
- **Steve Harem – Environmental Specialist**

3. SCALE DATA ANALYSIS

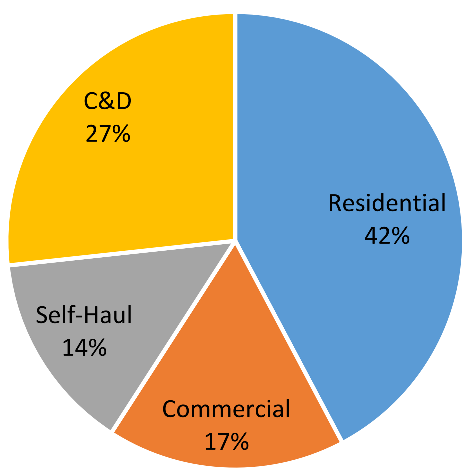
The analysis and allocation of tonnage by generator is based upon actual 2015 scale data. This data was not available during the 2007 study, requiring the use of one week of gate observation to estimate the annual allocations. The assignment of generator category to each scale ticket category was based upon four weeks of observing waste disposal at the Larimer County Landfill in 2016. SVM has analyzed the scale weight ticket identification of generator-type and allocated each ticket category to one of the four sectors. This approach combines actual tonnage and ticket data with observations of actual waste disposal to more accurately portray the material-types that are delivered by each of the four generators.

*Table 3-1: 2015 Tonnage Allocations by Generator**

Sector	2015 Tons Disposed	Percent of Total
Residential		42.2%
Commercial	60,269.1	16.9%
Self Haul	50,530.6	14.2%
C&D Debris	95,370.2	26.7%
Total	356,912	100.0%

*allocations do not include animals, Freon, RIP/Fill, sludge, tires or special waste. The total weight of the excluded materials was 70,835 tons for a combined total annual tonnage of 427,747 tons.

Figure 3-1: 2015 Tons by Generator



One designed feature of the County's current process for identification of customers and material types is driven by regulatory requirements for the assessment of governmental fees. The County's scale management system currently hosts a listing of defined customer types and waste categories. As such, in contrast to the 2007 waste composition study, the County is now able to produce an up-to-the-minute report that the defines the types of generators and the types of waste. With this powerful tool, the County can identify and collect data that will be important to municipal planners and waste-processing system developers, as well. To facilitate future planning for MSW management programs, SVM recommends a modification of the current scale house identification process to categorize the inbound payloads. Specifically, loads that are currently logged-in at the scale-house as “compacted” waste should be bifurcated into “residential” and “commercial” categories. Further, the County should engage its regular customers (e.g. Gallegos, WMI, Ram, et al) in order to refine the data to reflect the actual source of the waste (residential or commercial). Typically, waste haulers internally designate routes that service bins (dumpsters) as commercial routes. However, many bin-serviced routes consist primarily of MSW that is collected from multi-family premises. These wastes are often identified as “commercial”, by the hauler, even though the waste is generated by residential households. In order to more precisely identify wastes that are generated by residents and businesses, the County should devise and implement a procedure for identifying and categorizing residential and commercial wastes at the scale-house.

For solid waste management planning, it is not just the waste composition that is important, but the character (size and shape) of the material must be considered, as well. Therefore, it is important to accurately categorize the inbound loads by material-type (residential, commercial, C&D and Self-Haul) in addition to customer-type (commercial customer, self-haul/residential customer).

Important distinctions are drawn by the purveyors of waste processing technologies and waste processing system integrators as they consider the application of various technologies to waste and recycling processing, the production of feedstocks for alternative energy projects, composting, et al.

For instance, commercial and residential waste streams are largely composed of the same material types, albeit in various percentages, sizes, and shapes. Residential and commercial streams each contain:

1. OCC (cardboard), but the percentage of OCC is higher in commercial and the pieces are larger and more readily recoverable than the residential stream.
2. Ferrous Metals, but residential metals are mostly tin cans (steel), pots and pans, and an occasional bicycle frame. Commercial ferrous, on the other hand, is likely to be metal shelving, appliances, car wheels, and car-body parts. These are the same material types, but they require different handling and technology for processing, recovery and recycling.

These types of material character (shape/size) differences manifest across most material categories and directly impact the application of programs and technologies that may be applied to achieve recovery and recycling.

Likewise, the primary material types presented in the Self-Haul and C&D loads were almost identical, although manifested in different percentages, sizes, and shapes. C&D and Self-Haul materials each contain wood and inert-materials as their primary components. However, self-Haul wood is generally in whole pieces of dimensional lumber, sheets of plywood, wood fencing, and decking. C&D wood, on the other hand, is produced primarily from knock-down style demolition projects, or roof tear-off operations and is broken, or crushed, at the job-site, into smaller, splintered pieces.

Inert materials in C&D loads are generally identifiable as sidewalk or driveway removal projects, dirt-rock-brick-sand from construction sites, or roadway improvement/paving projects. Inerts from Self-Haul loads are typically comprised of tile and rock (granite, marble, etc.) from kitchen and bathroom remodeling, and cinder block-style materials that are used for residential landscape management, or fencing.

The widely variant character of these, and other, materials will require the application of distinct technologies for processing, recovery, and recycling to each of the distinct material types (residential, commercial, self-haul, C&D). As such, planning for the future management of Larimer County solid wastes, including the replacement of the current operating site with a new landfill and supporting waste processing technology, will require a complete understanding of the composition of the specific streams to be processed and disposed. For general interest, a composite composition of all wastes entering the landfill has been calculated. However, for planning purposes and the consideration of applicable processes and technologies to Larimer County's currently landfilled wastes, it is the composition of the separate waste streams that is most important. A composite composition of all wastes entering the landfill will have little value for planning future operations.

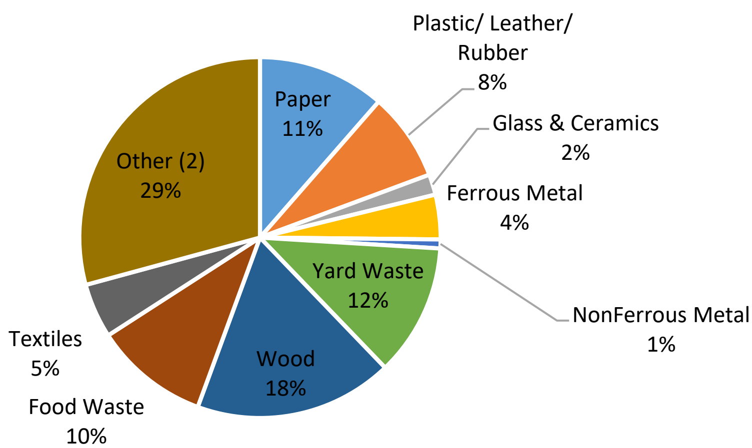
4. 2016 WASTE COMPOSITION STUDY RESULTS

The following section reviews the results from the 2016 waste composition study and compares the data with the findings from the 2007 Study. Additional breakdowns of the study data, as well as the results of the individual spring and fall season studies are provided in Sections 5, 6, 7 and 8.

A. Aggregate Waste Composition Results and Findings

The aggregate composition results (percent by weight) from the 2016 two-season waste composition study are shown Figure 4-1 below.

Figure 4-1: Aggregate Composition (Percent by Weight), All Wastes Delivered to Landfill



As shown in Table 4-1, when compared to the 2007 aggregate data the 2016 study revealed some notable differences in the overall composition of the material flowing into the Larimer County Landfill. For example, over the past decade the ratio of paper decreased significantly, while there were notable increases in the ratio of yard waste and wood waste.

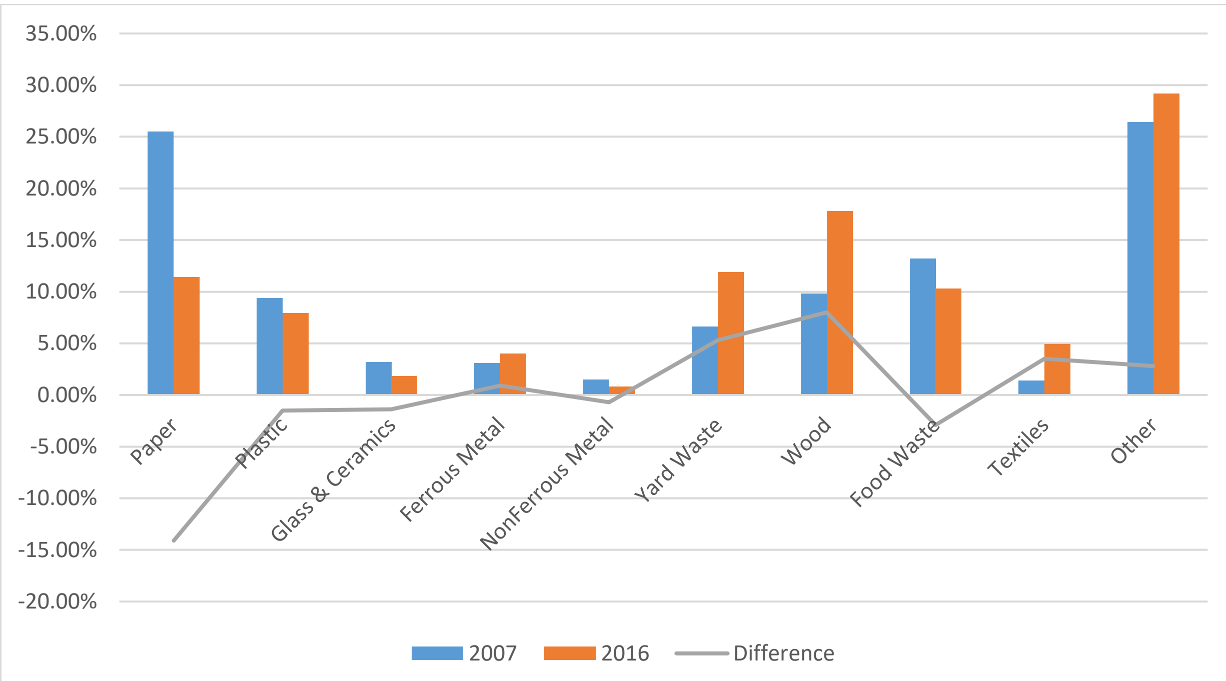
Table 4-1: Comparison of 2007 and 2016 Aggregate Composition (Percent by Weight)

Aggregate Waste Composition	2007	2016	Difference
Paper	25.5%	11.4%	-14.1%
Plastic	9.4%	7.9%	-1.5%
Glass	3.2%	1.8%	-1.4%
Ferrous Metal	3.1%	4.0%	0.9%
Non-Ferrous Metal	1.5%	0.8%	-0.7%
Yard Waste	6.6%	11.9%	5.3%
Wood	9.8%	17.8%	8.0%
Food Waste	13.2%	10.3%	-2.9%
Textiles	1.4%	4.9%	3.5%
Other	26.4%	29.2%	2.8%

Because glass, metals and textiles make up smaller percentages of the overall waste stream, the impact of the increase or decrease in the percentage of these materials, while informative, is not as impactful as the changes in the materials representing a larger overall volume by weight. Changes in the overall percentage of materials such as paper, yard waste, wood and food waste represent a more significant change in the waste stream. The amount of paper in the waste was went from 25.5% in 2007 to 11.4% in 2016. This decrease in paper – from one-quarter of the waste stream to just over one-tenth – is likely the result of participation in recycling, as is the reduction in aluminum beverage cans, plastic and glass found in the waste stream.

Figure 4-2 provides a graphical representation of the changes in waste composition between 2007 and 2016.

Figure 4-2: Comparison of 2007 and 2016 Aggregate Composition (Percent by Weight)



Although recycling programs are available to residential and commercial generators all across the county, a significant amount of targeted recyclables remain in the waste streams. To increase the recovery of these commodities, the jurisdictions should implement policies and programs designed to:

1. Increase participation in existing programs

   a. Increasing the frequency of recycling collection service almost always improves participation and recovery rates. The increase in the recovery of targeted recyclable materials achieved by changing from Every-Other-Week collection to Weekly collection may offset the additional service costs via the combination of reduced disposal costs and increased commodity sales revenues.

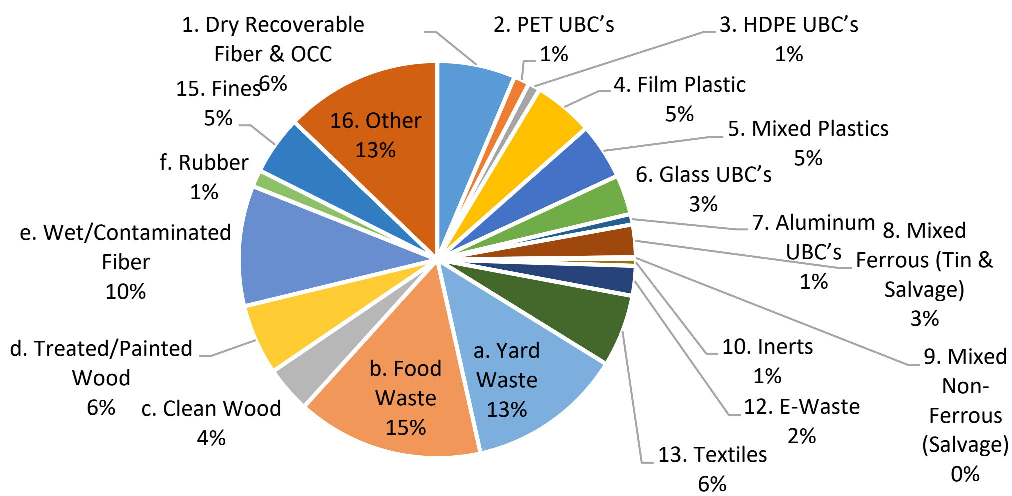
2. Improve the separation efficiency of those who do participate in the programs

3. Because organic materials represent between 35% to 60% of the respective streams, composting, animal feed, and alternative energy processes should be investigated

B. Residential Waste Composition Results and Findings

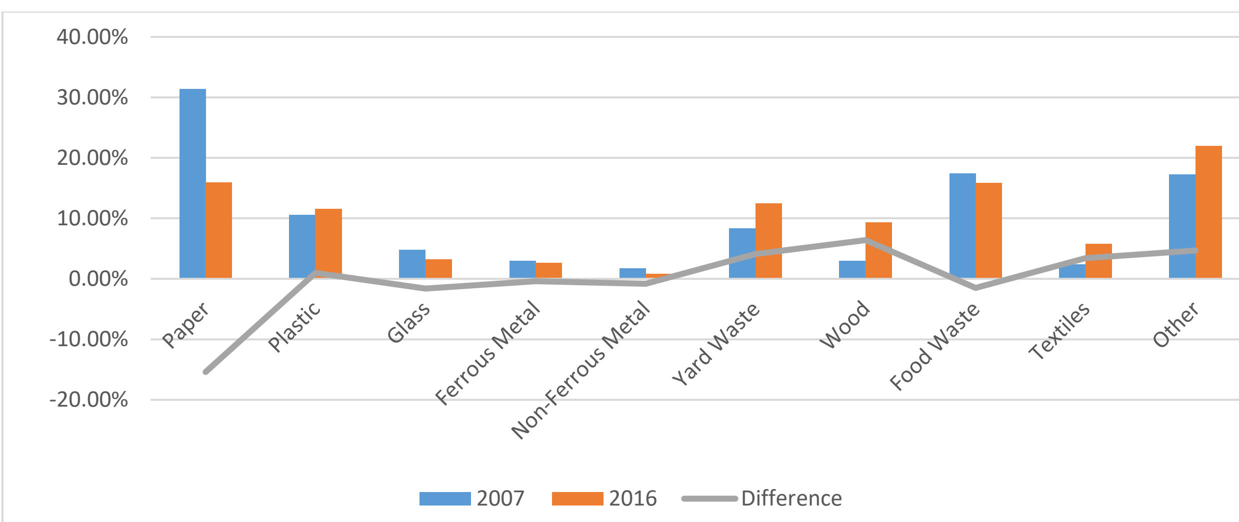
The 2016 residential waste composition results (percent by weight) from the 2016 two-season waste composition study are shown Figure 4-2 below.

Figure 4-3: 2016 Residential Waste Composition



The differences between the 2007 and 2016 residential waste composition results are shown in Figure 4-4.

Figure 4-4: 2007 and 2016 Residential Waste Composition Comparison



The decrease in the percentage of paper, glass, ferrous, and non-ferrous metals in the residential waste stream is likely attributable to:

1. Changes in public attitudes about waste and recycling
2. The proliferation and promotion of recycling collection and recycling drop-off programs in cities and communities throughout the county
3. The reduction in print media publications
4. The light-weighting of consumer products and packaging by manufacturers and retailers.

The increase in plastic percentage is likely attributable to moves in the packaging industry from ferrous, non-ferrous, and glass containers to plastic ones. Also, the increase is likely impacted by the surge in the production of single serve PETE and HDPE drink containers.

Additionally, between 2007 and 2016, the amount of yard-waste measured in the residential waste stream increased by approximately 50%. Several factors may have contributed to the increase, including:

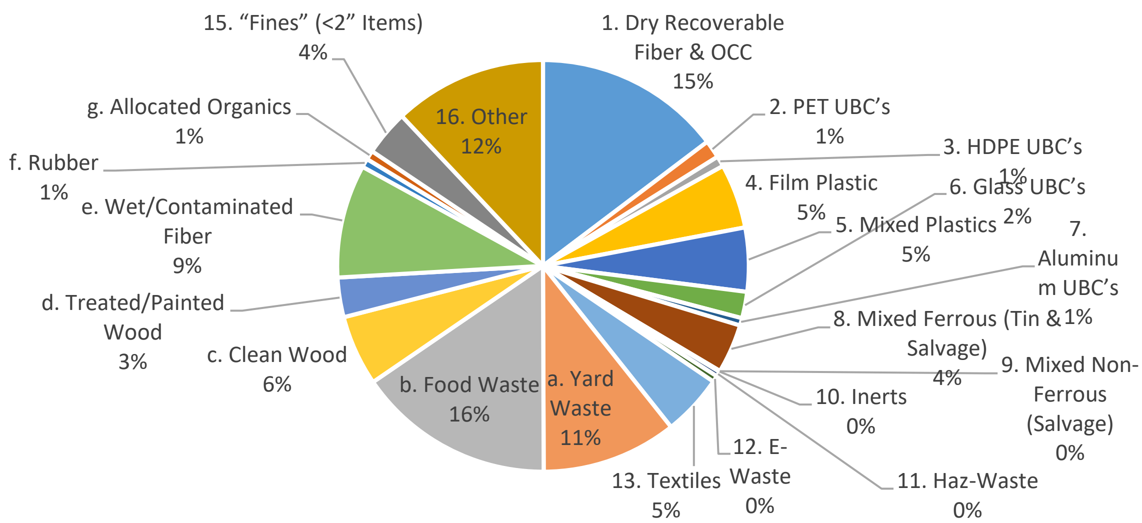
1. Changes in consumer landscaping preferences
2. Changes in municipal development requirements for set-backs and landscaping
3. Reduction in the percentage of other components in the waste stream due to municipal recycling collection programs and consumer preferences

Now representing over 12% of the residential waste-stream, yard-waste presents an immediate and economical, opportunity for separate collection, composting, and diversion from landfill disposal. Using 400 pounds per cubic yard as the bulk-density conversion factor for the estimated 18,900 tons per year of yard-waste, approximately 50,000 cubic yards of landfill-space could be saved annually if 50% of the material was collected for composting.

C. Commercial Waste Composition Results and Findings

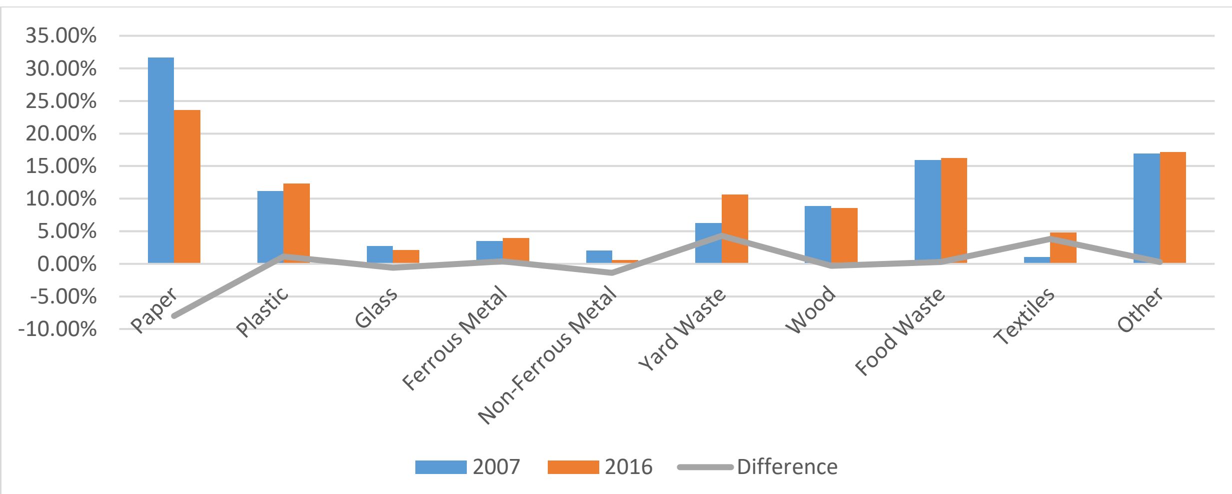
The 2016 commercial waste composition results (percent by weight) from the 2016 waste composition study are shown Figure 4-5 on the following page.

Figure 4-5: 2016 Commercial Waste Composition



The differences between the 2007 and 2016 commercial waste composition results are shown in Figure 4-6.

Figure 4-6: 2007 and 2016 Commercial Waste Composition Comparison



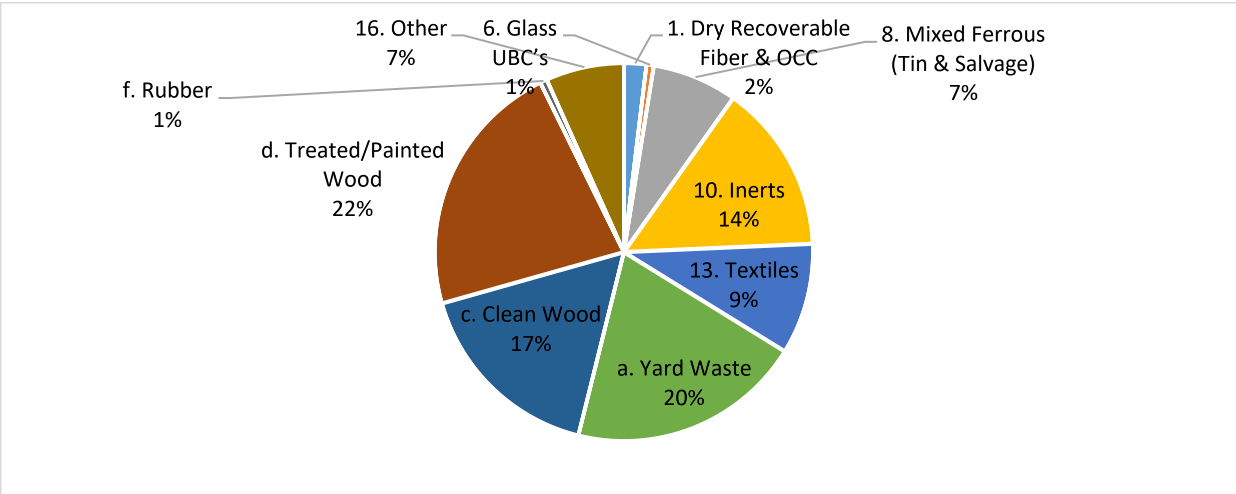
Reductions in the percentages of paper, glass, and non-ferrous metal in the commercial waste stream is likely attributable to the same factors that created the reductions cited in the residential MSW recommendations.

The increase in plastic percentage is likely attributable to moves in the packaging industry from ferrous, non-ferrous, and glass containers to plastic ones. Also, the increase is likely impacted by the proliferation of single serve PETE and HDPE drink containers.

D. Self-Haul and C&D Waste Composition Results and Findings

Figure 4-7 provides a graphical representation of the 2016 Self-Haul waste composition results (percent by weight).

Figure 4-7: 2016 Self-Haul Waste Composition



The 2016 results are compared with the 2007 data in the chart below:

Figure 4-8: 2007 and 2016 Self-Haul Waste Composition Comparison

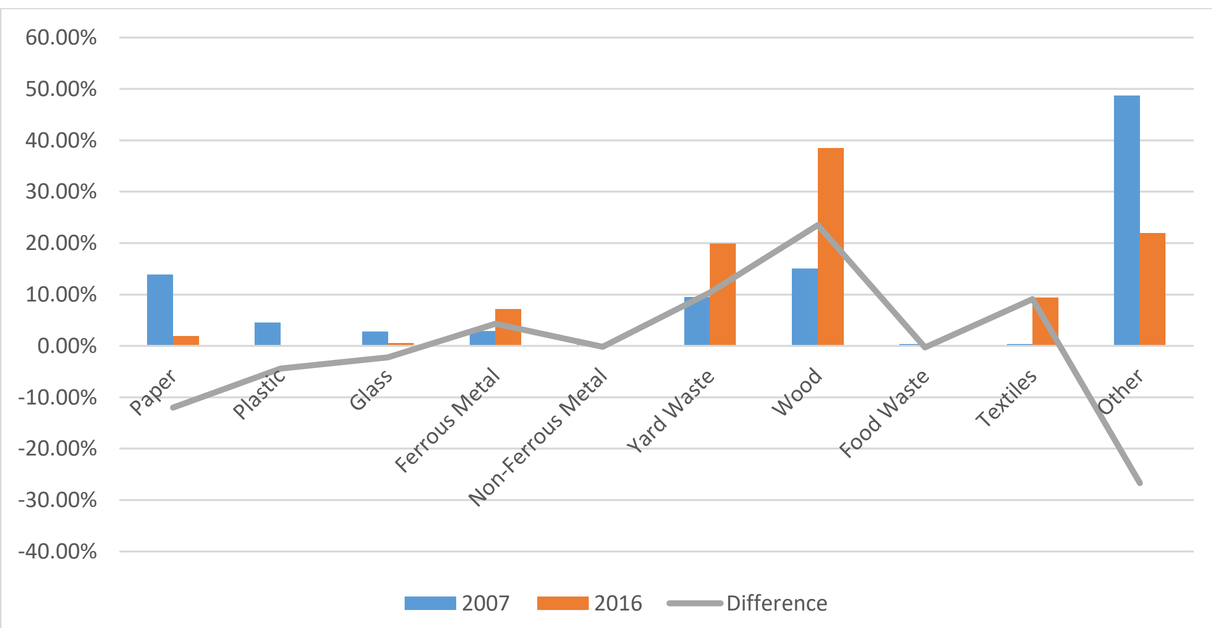
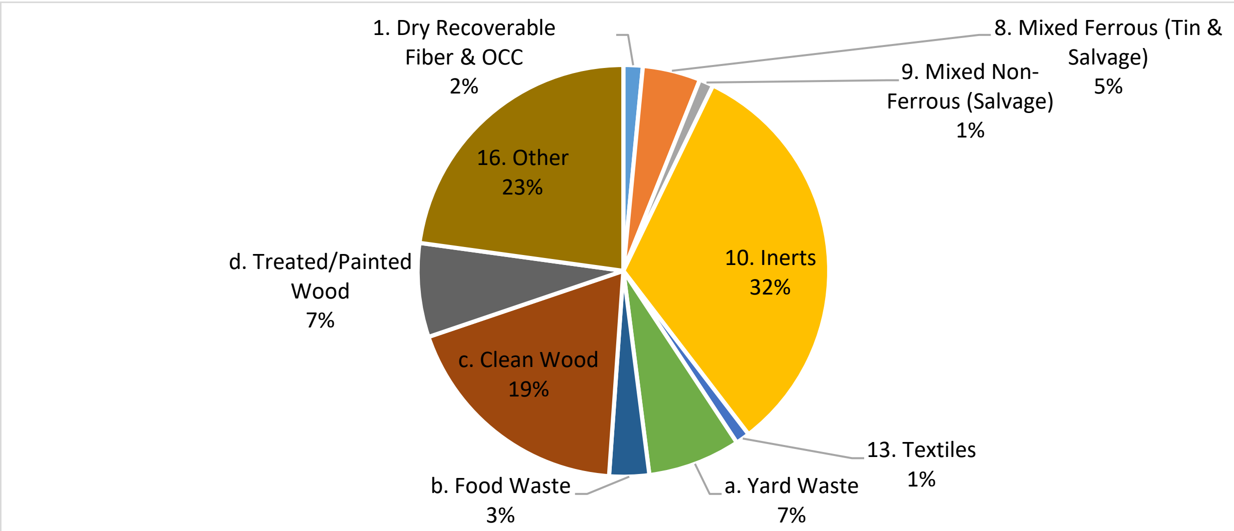


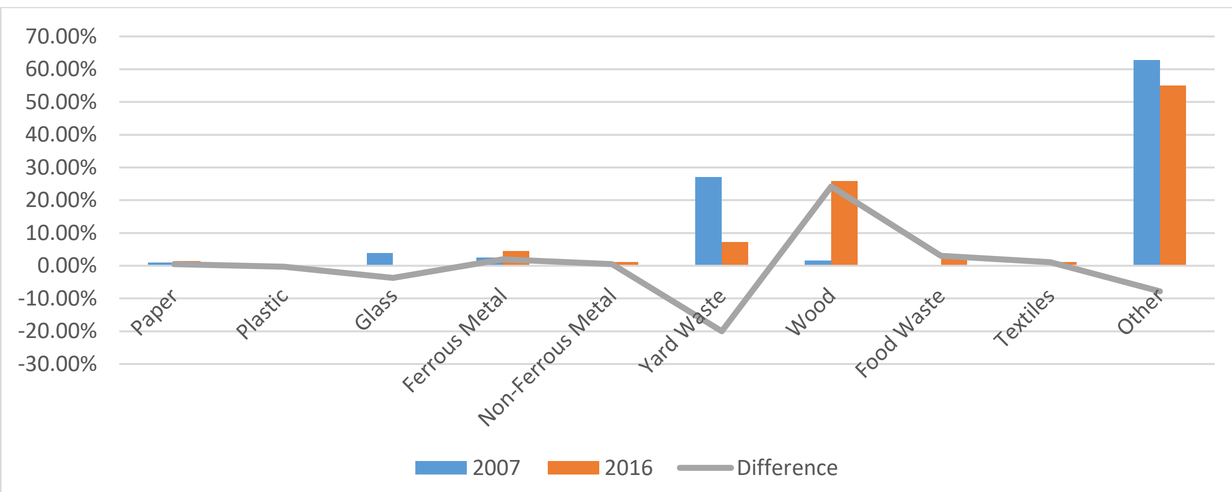
Figure 4-9 below shows the 2016 Self-Haul waste composition results (percent by weight).

Figure 4-9: 2016 C&D Waste Composition



The 2016 C&D waste composition study results are compared with the 2007 data in the chart below:

Figure 4-10: 2007 and 2016 C&D Waste Composition Comparison



Although the generation of wood waste is cyclical and driven largely by construction activity, the material can be readily separated by generators, or by hand at a landfill or transfer station. The significant increase in wood-waste from 2007 to 2016 is surely related to the dramatic turn in the construction activity from the housing/banking crisis of 2007 to the current economic expansion along the front-range. Wood generation will always ebb and flow with economic activity, but it will remain a relatively large percentage of the self-haul and C&D waste streams, and will be readily recyclable as a compost component, or as feed stock for renewable energy processes.

5. 2016 AGGREGATE WASTE COMPOSITION DATA

Table 5-1: Aggregate Waste Composition

MSW Aggregate	Generator				Composite
	Res	Com	Self Haul	C&D	
1. Dry Recoverable Fiber & OCC	2.7%	2.5%	0.3%	0.4%	5.8%
2. PET UBC's	0.5%	0.2%	0.0%	0.0%	0.7%
3. HDPE UBC's	0.4%	0.1%	0.0%	0.0%	0.5%
4. Film Plastic	2.0%	0.9%	0.0%	0.0%	2.9%
5. Mixed Plastics	1.9%	0.8%	0.0%	0.0%	2.8%
6. Glass	1.4%	0.3%	0.1%	0.0%	1.8%
7. Aluminum UBC's	0.4%	0.1%	0.0%	0.0%	0.5%
8. Mixed Ferrous (Tin & Salvage)	1.1%	0.7%	1.0%	1.2%	4.0%
9. Mixed Non-Ferrous (Salvage)	0.1%	0.0%	0.0%	0.3%	0.4%
10. Inerts	0.2%	0.0%	2.0%	8.6%	10.9%
11. Hazardous Waste	0.1%	0.1%	0.0%	0.0%	0.2%
12. E-Waste	1.0%	0.1%	0.0%	0.1%	1.2%
13. Textiles	2.5%	0.8%	1.3%	0.3%	4.9%
14. Organics	20.7%	7.6%	8.4%	9.8%	46.4%
a. Yard Waste	5.3%	1.8%	2.8%	1.9%	11.9%
b. Food Waste	6.4%	2.6%	0.0%	0.8%	9.8%
c. Clean Wood	1.6%	0.9%	2.4%	4.9%	9.8%
d. Treated/Painted Wood	2.4%	0.5%	3.1%	2.0%	8.0%
e. Wet/Contaminated Fiber	4.1%	1.5%	0.0%	0.0%	5.6%
f. Rubber	0.6%	0.1%	0.1%	0.1%	0.9%
g. Allocated Organics	0.4%	0.1%	0.0%	0.0%	0.5%
15. Fines (<2" Items)	2.0%	0.6%	0.0%	0.0%	2.6%
16. Other	5.3%	2.0%	0.9%	6.0%	14.4%

Table 5-2: 2016 Aggregate Residential Waste Composition

Residential MSW Aggregate (30 Samples, Hand Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber & OCC	6.3%	4.9%	4.9%	7.8%
2. PET UBC's	1.3%	1.0%	1.0%	1.5%
3. HDPE UBC's	1.0%	0.9%	0.7%	1.2%
4. Film Plastic	4.8%	3.4%	3.8%	5.8%
5. Mixed Plastics	4.5%	2.7%	3.7%	5.4%
6. Glass	3.2%	4.5%	1.8%	4.6%
7. Aluminum UBC's	0.8%	0.9%	0.6%	1.1%
8. Mixed Ferrous (Tin & Salvage)	2.6%	3.2%	1.7%	3.6%
9. Mixed Non-Ferrous (Salvage)	0.1%	0.3%	0.0%	0.2%
10. Inerts	0.6%	1.9%	0.0%	1.1%
11. Hazardous Waste	0.2%	1.1%	0.0%	0.5%
12. E-Waste	2.4%	8.3%	0.0%	4.9%
13. Textiles	5.8%	9.6%	2.9%	8.7%
14. Organics	48.9%	18.4%	43.4%	54.4%
a. Yard Waste	12.5%	17.8%	7.2%	17.9%
b. Food Waste	15.0%	12.8%	11.2%	18.9%
c. Clean Wood	3.7%	9.9%	0.8%	6.7%
d. Treated/Painted Wood	5.7%	11.9%	2.1%	9.2%
e. Wet/Contaminated Fiber	9.7%	7.3%	7.5%	11.9%
f. Rubber	1.4%	4.5%	0.0%	2.7%
g. Allocated Organics	0.9%	4.8%	0.0%	2.3%
15. Fines (<2" Items)	4.7%	5.2%	3.2%	6.3%
16. Other	12.7%	9.5%	9.8%	15.5%

Table 5-3: 2016 Aggregate Commercial Waste Composition

Commercial MSW Aggregate (40 Samples, Hand Sort)	Mean Composition	Standard Deviation	Lower	Upper
1A. Dry Recoverable Fiber	14.7%	16.6%	10.4%	19.0%
2. PET UBC's	1.4%	2.8%	0.7%	2.1%
3. HDPE UBC's	0.8%	1.0%	0.6%	1.1%
4. Film Plastic	5.1%	4.2%	4.0%	6.2%
5. Mixed Plastics	5.0%	5.9%	3.5%	6.6%
6. Glass	2.1%	3.4%	1.2%	3.0%
7. Aluminum UBC's	0.6%	0.7%	0.4%	0.8%
8. Mixed Ferrous (Tin & Salvage)	3.9%	8.4%	1.7%	6.0%
9. Mixed Non-Ferrous (Salvage)	0.0%	0.2%	0.0%	0.1%
10. Inerts	0.0%	0.3%	0.0%	0.1%
11. Hazardous Waste	0.4%	1.3%	0.1%	0.7%
12. E-Waste	0.5%	1.1%	0.2%	0.8%
13. Textiles	4.8%	9.6%	2.3%	7.3%
14. Organics	45.1%	21.7%	39.4%	50.7%
a. Yard Waste	10.6%	20.6%	5.3%	16.0%
b. Food Waste	15.5%	17.5%	11.0%	20.1%
c. Clean Wood	5.5%	14.3%	1.8%	9.2%
d. Treated/Painted Wood	3.1%	7.4%	1.2%	5.0%
e. Wet/Contaminated Fiber	8.9%	8.0%	6.8%	11.0%
f. Rubber	0.7%	2.6%	0.0%	1.4%
g. Allocated Organics	0.7%	4.6%	0.0%	1.9%
15. Fines (<2" Items)	3.6%	5.0%	2.3%	4.9%
16. Other	12.0%	12.8%	8.7%	15.4%

Table 5-4: 2016 Aggregate Self-Haul Waste Composition

Self Haul Aggregate (40 Samples, Visual Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber	1.9%	7.1%	0.0%	3.7%
2. PET UBC's	0.0%	0.0%	-	-
3. HDPE UBC's	0.0%	0.0%	-	-
4. Film Plastic	0.0%	0.1%	0.0%	0.1%
5. Mixed Plastics	0.1%	0.4%	0.1%	0.2%
6. Glass	0.6%	3.2%	0.0%	1.4%
7. Aluminum UBC's	0.0%	0.0%	-	-
8. Mixed Ferrous (Tin & Salvage)	7.2%	16.3%	3.0%	11.5%
9. Mixed Non-Ferrous (Salvage)	0.2%	0.6%	0.0%	0.3%
10. Inerts	14.4%	26.3%	7.5%	21.2%
11. Hazardous Waste	0.1%	0.3%	0.0%	0.1%
12. E-Waste	0.3%	1.2%	0.0%	0.6%
13. Textiles	9.4%	20.3%	4.2%	14.7%
14. Organics	59.1%	35.5%	49.8%	68.3%
a. Yard Waste	19.9%	34.8%	10.9%	29.0%
b. Food Waste	0.0%	0.0%		
c. Clean Wood	16.6%	27.0%	9.6%	23.7%
d. Treated/Painted Wood	21.9%	30.2%	14.1%	29.8%
e. Wet/Contaminated Fiber	0.0%	0.0%	-	-
f. Rubber	0.6%	2.1%	0.0%	1.2%
g. Allocated Organics	0.0%	0.0%	-	-
15. Fines (<2" Items)	0.0%	0.0%	-	-
16. Other	6.6%	16.3%	2.4%	10.9%

Table 5-5: 2016 Aggregate C&D Waste Composition

C&D Aggregate (40 Samples, Visual Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber & OCC	1.5%	5.2%	0.1%	2.8%
2. PET UBC's	0.0%	0.0%	0.0%	0.0%
3. HDPE UBC's	0.0%	0.0%	-	-
4. Film Plastic	0.0%	0.1%	0.0%	0.1%
5. Mixed Plastics	0.1%	0.2%	0.0%	0.1%
6. Glass	0.2%	1.0%	0.0%	0.4%
7. Aluminum UBC's	0.0%	0.0%	0.0%	0.0%
8. Mixed Ferrous (Tin & Salvage)	4.5%	15.4%	0.5%	8.5%
9. Mixed Non-Ferrous (Salvage)	1.1%	2.5%	0.4%	1.7%
10. Inerts	32.1%	44.7%	20.5%	43.7%
11. Hazardous Waste	0.0%	0.2%	0.0%	0.1%
12. E-Waste	0.3%	1.3%	0.0%	0.6%
13. Textiles	1.1%	3.2%	0.2%	1.9%
14. Organics	36.5%	40.7%	25.9%	47.1%
a. Yard Waste	7.2%	21.0%	1.8%	12.7%
b. Food Waste	3.1%	14.0%	0.0%	6.7%
c. Clean Wood	18.5%	31.1%	10.4%	26.6%
d. Treated/Painted Wood	7.3%	17.3%	2.8%	11.8%
e. Wet/Contaminated Fiber	0.0%	0.0%	-	-
f. Rubber	0.4%	2.2%	0.0%	1.0%
g. Allocated Organics	0.0%	0.0%	-	-
15. Fines (<2" Items)	0.0%	0.0%	-	-
16. Other	22.6%	37.9%	12.8%	32.5%

6. 2007 AND 2016 WASTE COMPOSITION COMPARISON DATA

Table 6-1: 2007 and 2016 Aggregate Waste Composition Comparison

Aggregate Material Group	2007	2016	Difference
Paper	25.5%	11.4%	-14.1%
Plastic	9.4%	7.9%	-1.5%
Glass	3.2%	1.8%	-1.4%
Ferrous Metal	3.1%	4.0%	0.9%
Non-Ferrous Metal	1.5%	0.8%	-0.7%
Yard Waste	6.6%	11.9%	5.3%
Wood	9.8%	17.8%	8.0%
Food Waste	13.2%	10.3%	-2.9%
Textiles	1.4%	4.9%	3.5%
Other	26.4%	29.2%	2.8%

Table 6-2: 2007 and 2016 Residential Waste Composition Comparison

Residential Material Group	2007	2016	Difference
Paper	31.4%	16.0%	-15.4%
Plastic	10.6%	11.6%	1.0%
Glass	4.8%	3.2%	-1.6%
Ferrous Metal	3.0%	2.6%	-0.4%
Non-Ferrous Metal	1.7%	0.9%	-0.8%
Yard Waste	8.4%	12.5%	4.1%
Wood	3.0%	9.4%	6.4%
Food Waste	17.4%	15.9%	-1.5%
Textiles	2.4%	5.8%	3.4%
Other	17.3%	22.0%	4.7%

Table 6-3: 2007 and 2016 Commercial Waste Composition Comparison

Commercial Material Group	2007	2016	Difference
Paper	31.6%	23.6%	-8.0%
Plastic	11.2%	12.3%	1.1%
Glass	2.7%	2.1%	-0.6%
Ferrous Metal	3.5%	3.9%	0.4%
Non-Ferrous Metal	2.0%	0.6%	-1.4%
Yard Waste	6.3%	10.6%	4.3%
Wood	8.9%	8.6%	-0.3%
Food Waste	15.9%	16.2%	0.3%
Textiles	1.0%	4.8%	3.8%
Other	16.9%	17.2%	0.3%

Table 6-4: 2007 and 2016 Self-Haul Waste Composition Comparison

Self Haul Material Group	2007	2016	Difference
Paper	13.9%	1.9%	-12.0%
Plastic	4.5%	0.1%	-4.4%
Glass	2.8%	0.6%	-2.2%
Ferrous Metal	2.9%	7.2%	4.3%
Non-Ferrous Metal	0.4%	0.2%	-0.2%
Yard Waste	9.5%	19.9%	10.4%
Wood	15.0	38.5%	23.5%
Food Waste	0.3%	0.0%	-0.3%
Textiles	0.3%	9.4%	9.1%
Other	48.7%	22.0%	-26.7%

Table 6-5: 2007 and 2016 C&D Waste Composition Comparison

C&D Material Group	2007	2016	Difference
Paper	1.0%	1.5%	0.5%
Plastic	0.4%	0.1%	-0.3%
Glass	3.9%	0.2%	-3.7%
Ferrous Metal	2.5%	4.5%	2.0%
Non-Ferrous Metal	0.6%	1.1%	0.5%
Yard Waste	27.2%	7.2%	-20.0%
Wood	1.6%	25.8%	24.2%
Food Waste	0.1%	3.1%	3.0%
Textiles	0.0%	1.1%	1.1%
Other	62.8%	55.0%	-7.8%

7. 2016 SPRING WASTE COMPOSITION BY GENERATOR DATA

Table 7-1: Spring 2016 Residential Waste Composition

Residential MSW (15 Samples, Hand Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber	**4.0%**	3.2%	2.6%	5.3%
2. PET UBC's	**1.0%**	0.6%	0.7%	1.3%
3. HDPE UBC's	**0.9%**	0.6%	0.6%	1.1%
4. Film Plastic	**4.7%**	1.9%	3.9%	5.5%
5. Mixed Plastics	**4.4%**	2.7%	3.2%	5.5%
6. Glass	**2.6%**	2.5%	1.5%	3.7%
7. Aluminum UBC's	**0.7%**	0.7%	0.4%	1.0%
8. Mixed Ferrous (Tin & Salvage)	**2.8%**	3.5%	1.4%	4.3%
9. Mixed Non-Ferrous (Salvage)	**0.2%**	0.4%	0.0%	0.3%
10. Inerts	**0.2%**	0.9%	0.0%	0.6%
11. Hazardous Waste	**0.0%**	0.0%	-	-
12. E-Waste	**0.8%**	1.8%	0.1%	1.6%
13. Textiles	**5.5%**	5.3%	3.2%	7.7%
14. Organics	**51.6%**	14.5%	45.5%	57.8%
a. Yard Waste	14.0%	17.0%	6.8%	21.2%
b. Food Waste	18.9%	13.4%	13.2%	24.6%
c. Clean Wood	3.4%	9.4%	0.0%	7.4%
d. Treated/Painted Wood	4.1%	6.0%	1.5%	6.7%
e. Wet/Contaminated Fiber	10.7%	7.2%	7.7%	13.7%
f. Rubber	0.6%	1.0%	0.2%	1.0%
g. Allocated Organics	0.0%	0.0%	-	-
15. Fines (<2" Items)	**4.7%**	5.7%	2.3%	7.1%
16. Other	**15.8%**	9.6%	11.7%	19.9%

Figure 7-1: Spring 2016 Residential Waste Composition

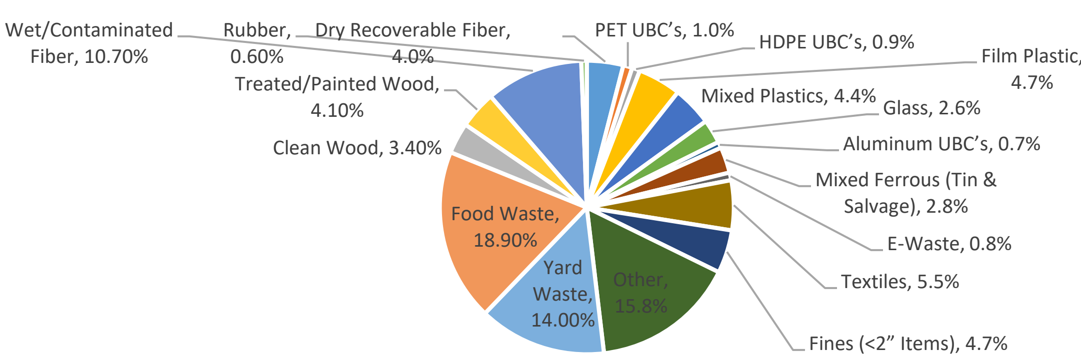


Table 7-2: Spring 2016 Commercial Waste Composition

Commercial MSW (20 Samples, Hand Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber	10.5%	10.0%	6.8%	14.1%
2. PET UBC's	1.3%	0.9%	1.0%	1.6%
3. HDPE	1.0%	0.8%	0.6%	1.3%
4. Film Plastic	6.7%	4.3%	5.1%	8.3%
5. Mixed Plastics	4.6%	4.2%	3.0%	6.1%
6. Glass	2.8%	3.1%	1.6%	3.9%
7. Aluminum UBC's	0.9%	0.8%	0.6%	1.1%
8. Mixed Ferrous (Tin & Salvage)	3.7%	7.2%	1.1%	6.4%
9. Mixed Non-Ferrous (Salvage)	0.0%	0.1%		
10. Inerts	0.1%	0.4%	0.0%	0.2%
11. Hazardous Waste	0.4%	1.4%	0.0%	0.9%
12. E-Waste	0.7%	1.4%	0.2%	1.2%
13. Textiles	3.5%	4.3%	1.9%	5.1%
14. Organics	43.2%	16.1%	37.3%	49.1%
a. Yard Waste	12.4%	17.9%	5.8%	19.0%
b. Food Waste	12.1%	11.3%	7.9%	16.2%
c. Clean Wood	2.6%	10.6%	0.0%	6.5%
d. Treated/Painted Wood	4.0%	8.9%	0.7%	7.3%
e. Wet/Contaminated Fiber	10.5%	9.2%	7.2%	13.9%
f. Rubber	0.1%	0.2%	0.0%	0.2%
g. Allocated Organics	1.4%	6.4%	0.0%	3.8%
15. Fines (<2" Items)	4.1%	5.7%	2.0%	6.2%
16. Other	16.7%	14.3%	11.4%	21.9%

Figure 7-2: Spring 2016 Commercial Waste Composition

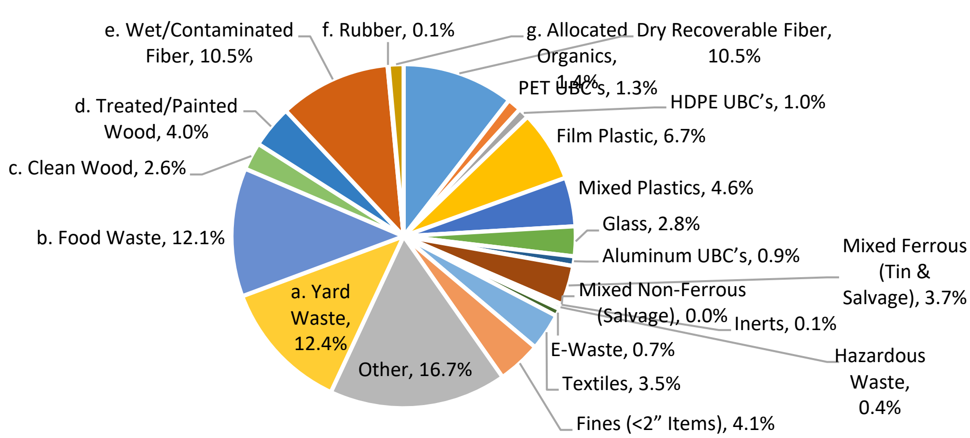


Table 7-3: Spring 2016 Self-Haul Waste Composition

Self Haul (20 Samples, Visual Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber	0.3%	0.5%	0.1%	0.4%
2. PET	0.0%	0.0%		
3. HDPE	0.0%	0.0%		
4. Film Plastic	0.0%	0.0%		
5. Mixed Plastics	0.1%	0.1%	0.0%	0.1%
6. Glass	1.2%	4.5%	0.0%	2.9%
7. Aluminum	0.0%	0.0%		
8. Mixed Ferrous (Tin & Salvage)	8.3%	16.7%	2.2%	14.4%
9. Mixed Non-Ferrous (Salvage)	0.1%	0.5%	0.0%	0.3%
10. Inerts	7.1%	16.4%	1.0%	13.1%
11. Hazardous Waste	0.0%	0.0%		
12. E-Waste	0.4%	1.5%	0.0%	1.0
13. Textiles	8.1%	16.9%	1.9%	14.3%
14. Organics	72.1%	26.0%	62.5%	81.6%
a. Yard Waste	14.6%	29.8%	3.6%	25.6%
b. Food Waste	0.0%	0.0%		
c. Clean Wood	26.0%	33.9%	13.5%	38.5%
d. Treated/Painted Wood	31.1%	33.9%	18.6%	43.6%
e. Wet/Contaminated Fiber	0.0%	0.0%		
f. Rubber	0.3%	1.5%	0.0%	0.9%
g. Allocated Organics	0.0%	0.0%		
15. Fines (<2" Items)	0.0%	0.0%		
16. Other	2.3%	3.8%	0.9%	3.7%

Figure 7-3: Spring 2016 Self-Haul Waste Composition

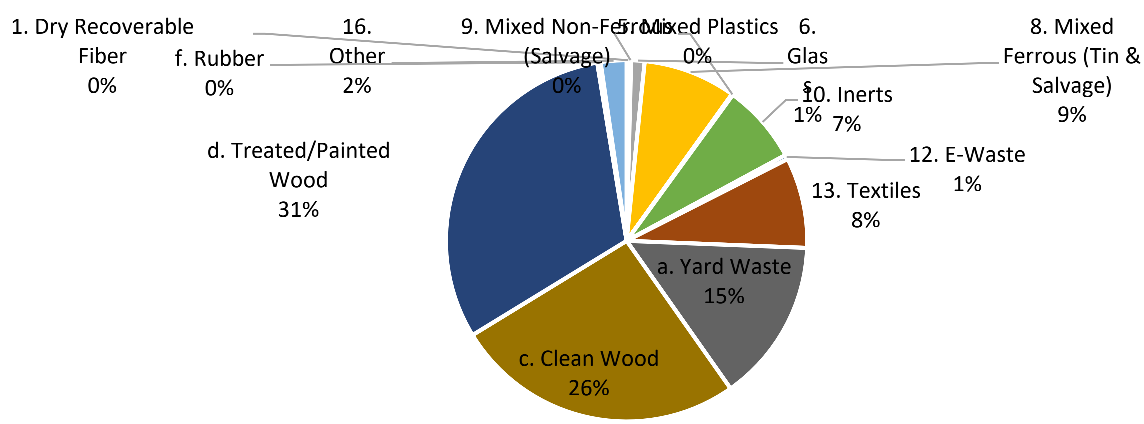
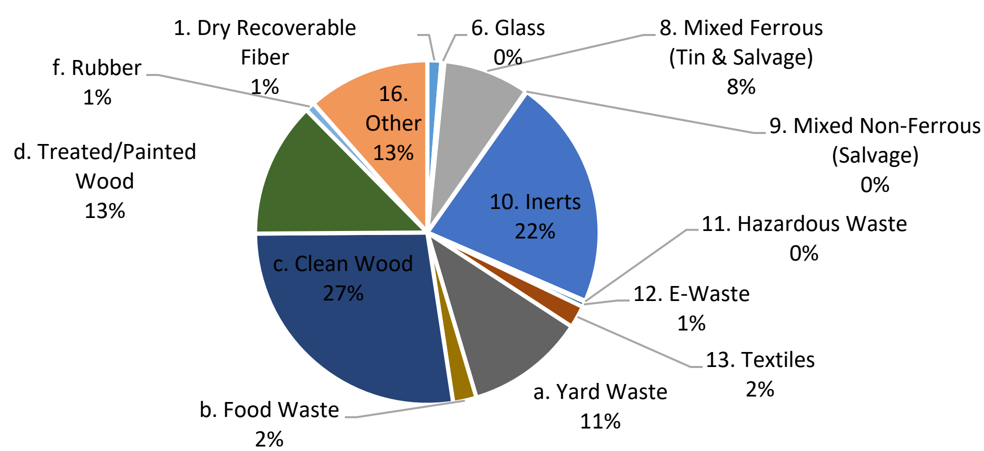


Table 7-4: Spring 2016 C&D Waste Composition

C&D (20 Samples, Visual Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber	1.3%	3.3%	0.1%	2.5%
2. PET	0.0%	0.0%		
3. HDPE	0.0%	0.0%		
4. Film Plastic	0.0%	0.0%		
5. Mixed Plastics	0.0%	0.1%	0.0%	0.1%
6. Glass	0.3%	1.5%	0.0%	0.9%
7. Aluminum	0.0%	0.0%		
8. Mixed Ferrous (Tin & Salvage)	8.1%	21.2%	0.3%	15.9%
9. Mixed Non-Ferrous (Salvage)	0.1%	0.3%	0.0%	0.2%
10. Inerts	21.7%	39.4%	7.2%	36.2%
11. Hazardous Waste	0.1%	0.3%	0.0%	0.2%
12. E-Waste	0.5%	1.8%	0.0%	1.2%
13. Textiles	2.1%	4.3%	0.5%	3.7%
14. Organics	54.3%	41.8%	38.9%	69.7%
a. Yard Waste	11.2%	26.5%	1.4%	20.9%
b. Food Waste	2.2%	9.9%	0.0%	5.8%
c. Clean Wood	27.3%	35.3%	14.4%	40.3%
d. Treated/Painted Wood	12.7%	23.0%	4.2%	21.2%
e. Wet/Contaminated Fiber	0.0%	0.0%		
f. Rubber	0.9%	3.1%	0.0%	2.0%
g. Allocated Organics	0.0%	0.0%		
15. Fines (<2" Items)	0.0%	0.0%		
16. Other	11.5%	27.4%	1.4%	21.5%

Figure 7-4: Spring 2016 C&D Waste Composition



8. 2016 FALL WASTE COMPOSITION BY GENERATOR DATA

Table 8-1: Fall 2016 Residential Waste Composition

Residential MSW Fall Sample (15 Samples, Hand Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber	8.6%	5.2%	6.4%	10.9%
2. PET UBC's	1.5%	1.2%	1.0%	2.0%
3. HDPE UBC's	1.1%	1.2%	0.6%	1.6%
4. Film Plastic	4.9%	4.6%	2.9%	6.8%
5. Mixed Plastics	4.7%	2.8%	3.5%	5.9%
6. Glass	3.8%	5.9%	1.3%	6.3%
7. Aluminum UBC's	1.0%	1.1%	0.6%	1.5%
8. Mixed Ferrous (Tin & Salvage)	2.4%	3.0%	1.1%	3.7%
9. Mixed Non-Ferrous (Salvage)	0.1%	0.3%	0.0%	0.2%
10. Inerts	0.9%	2.5%	0.0%	2.0%
11. Hazardous Waste	0.4%	1.5%	0.0%	1.0%
12. E-Waste	4.0%	11.6%	0.0%	8.9%
13. Textiles	6.2%	12.7%	0.8%	11.5%
14. Organics	46.2%	21.8%	37.0%	55.5%
a. Yard Waste	11.1%	19.1%	3.0%	19.2%
b. Food Waste	11.2%	11.2%	6.4%	16.0%
c. Clean Wood	4.1%	10.7%	0.0%	8.6%
d. Treated/Painted Wood	7.2%	15.9%	0.5%	14.0%
e. Wet/Contaminated Fiber	8.7%	7.5%	5.5%	11.9%
f. Rubber	2.1%	6.4%	0.0%	4.8%
g. Allocated Organics	1.7%	6.8%	0.0%	4.6%
15. Fines (<2" Items)	4.7%	4.9%	2.6%	6.8%
16. Other	9.5%	8.5%	5.9%	13.1%

Figure 8-1: Fall 2016 Residential Waste Composition

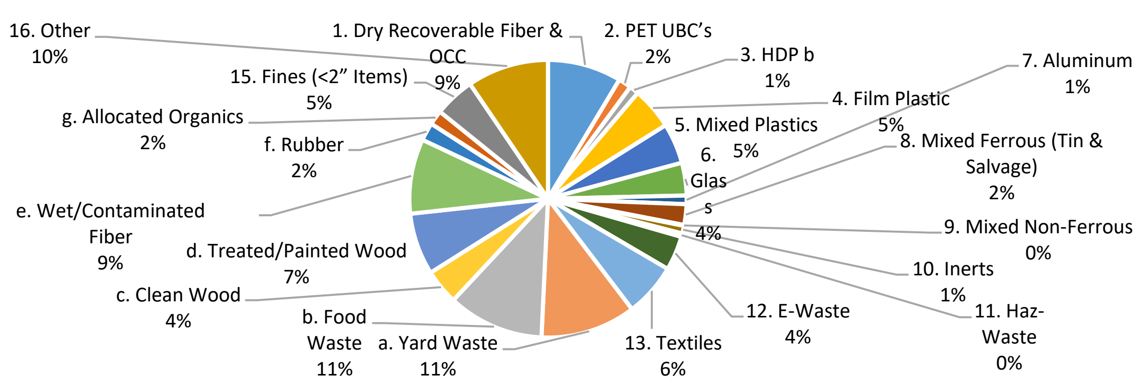


Table 8-2: Fall 2016 Commercial Waste Composition

Commercial MSW Fall Sort (20 Samples, Hand Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber & OCC	18.9%	20.6%	11.3%	26.5%
2. PET UBC's	1.5%	3.9%	0.1%	3.0%
3. HDP b	0.7%	1.2%	0.3%	1.1%
4. Film Plastic	3.5%	3.5%	2.2%	4.7%
5. Mixed Plastics	5.5%	7.3%	2.8%	8.1%
6. Glass	1.4%	3.6%	0.1%	2.7%
7. Aluminum UBC's	0.3%	0.4%	0.2%	0.5%
8. Mixed Ferrous (Tin & Salvage)	4.0%	9.6%	0.5%	7.5%
9. Mixed Non-Ferrous (Salvage)	0.0%	0.2%	0.0%	0.1%
10. Inerts	0.0%	0.0%	-	-
11. Hazardous Waste	0.4%	1.2%	0.0%	0.8%
12. E-Waste	0.3%	0.8%	0.0%	0.6%
13. Textiles	6.1%	13.0%	1.3%	10.9%
14. Organics	47.0%	26.5%	37.3%	56.7%
a. Yard Waste	8.8%	23.3%	0.3%	17.4%
b. Food Waste	19.0%	21.8%	10.9%	27.0%
c. Clean Wood	8.4%	16.9%	2.2%	14.7%
d. Treated/Painted Wood	2.2%	5.7%	0.1%	4.3%
e. Wet/Contaminated Fiber	7.3%	6.5%	4.9%	9.7%
f. Rubber	1.3%	3.6%	0.0%	2.6%
g. Allocated Organics	0.0%	0.0%	-	-
15. Fines (<2" Items)	3.1%	4.3%	1.5%	4.7%
16. Other	7.4%	9.3%	4.0%	10.8%

Figure 8-2: Fall 2016 Commercial Waste Composition

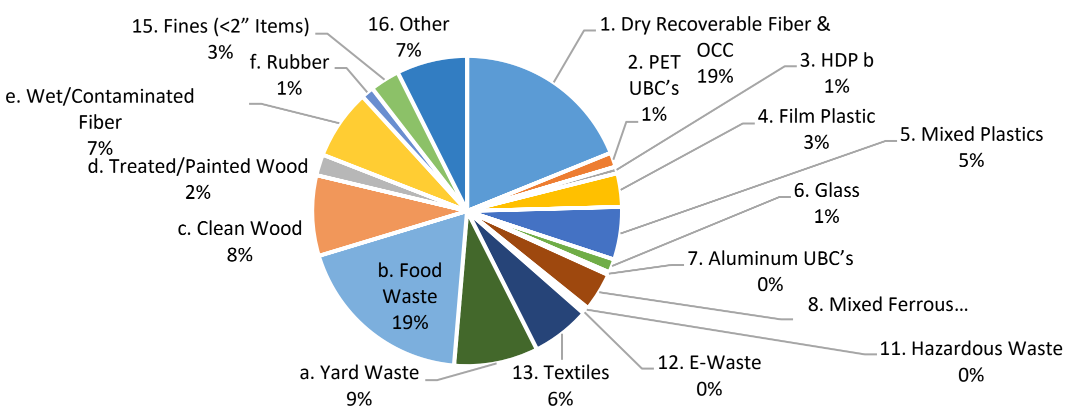


Table 8-3: Fall 2016 Self-Haul Waste Composition

Self Haul Fall Season (20 Samples, Visual Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber & OCC	3.5%	9.9%	0.0%	7.1%
2. PET UBC's	0.0%	0.0%	0.0%	0.0%
3. HDPE UBC's	0.0%	0.0%	0.0%	0.0%
4. Film Plastic	0.1%	0.2%	0.0%	0.1%
5. Mixed Plastics	0.2%	0.5%	0.0%	0.4%
6. Glass	0.0%	0.0%	-	-
7. Aluminum UBC's	0.0%	0.0%	0.0%	0.0%
8. Mixed Ferrous (Tin & Salvage)	6.2%	16.2%	0.2%	12.1%
9. Mixed Non-Ferrous (Salvage)	0.2%	0.7%	0.0%	0.5%
10. Inerts	21.7%	32.2%	9.8%	33.5%
11. Hazardous Waste	0.1%	0.5%	0.0%	0.3%
12. E-Waste	0.2%	0.9%	0.0%	0.5%
13. Textiles	10.8%	23.7%	2.1%	19.5%
14. Organics	46.1%	39.4%	31.6%	60.6%
a. Yard Waste	25.3%	39.2%	10.9%	39.7%
b. Food Waste	0.0%	0.0%	-	-
c. Clean Wood	7.2%	12.8%	2.5%	12.0%
d. Treated/Painted Wood	12.7%	23.3%	4.2%	21.3%
e. Wet/Contaminated Fiber	0.0%	0.0%	-	-
f. Rubber	0.9%	2.6%	0.0%	1.8%
g. Allocated Organics	0.0%	0.0%	-	-
15. Fines (<2" Items)	0.0%	0.0%	-	-
16. Other	11.0%	22.2%	2.8%	19.2%

Figure 8-3: Fall 2016 Self-Haul Waste Composition

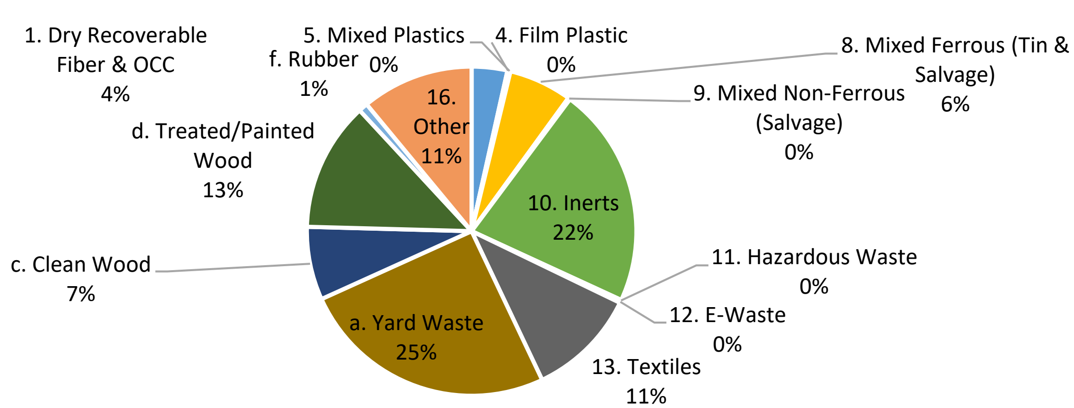
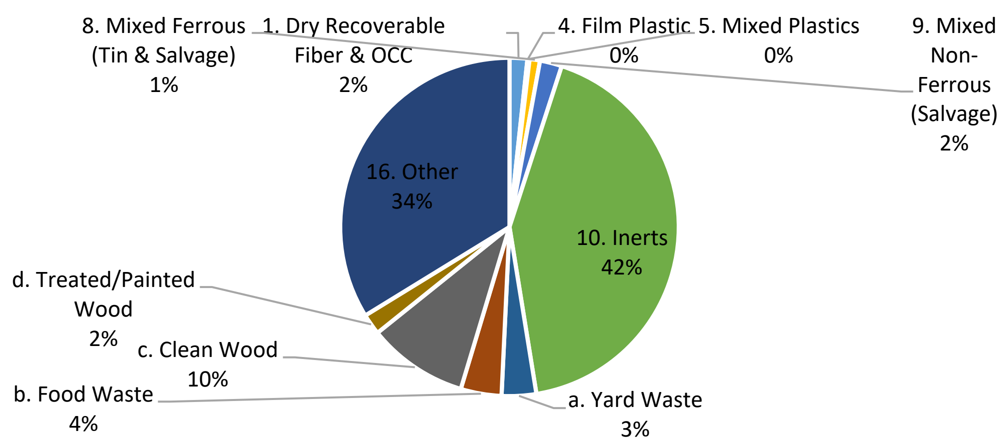


Table 8-4: Fall 2016 C&D Waste Composition

C&D Fall Season (20 Samples, Hand Sort)	Mean Composition	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber & OCC	1.7%	6.7%	0.0%	4.1%
2. PET UBC's	0.0%	0.0%	-	-
3. HDPE UBC's	0.0%	0.0%	-	-
4. Film Plastic	0.1%	0.2%	0.0%	0.1%
5. Mixed Plastics	0.1%	0.3%	0.0%	0.2%
6. Glass	0.0%	0.0%	-	-
7. Aluminum UBC's	0.0%	0.0%	0.0%	0.0%
8. Mixed Ferrous (Tin & Salvage)	1.0%	2.9%	0.0%	2.0%
9. Mixed Non-Ferrous (Salvage)	2.1%	3.2%	0.9%	3.3%
10. Inerts	42.5%	48.2%	24.7%	60.2%
11. Hazardous Waste	0.0%	0.0%	-	-
12. E-Waste	0.0%	0.0%	-	-
13. Textiles	0.0%	0.0%	-	-
14. Organics	18.7%	31.5%	7.2%	30.3%
a. Yard Waste	3.3%	13.1%	0.0%	8.1%
b. Food Waste	3.9%	17.5%	0.0%	10.3%
c. Clean Wood	9.6%	24.0%	0.7%	18.4%
d. Treated/Painted Wood	2.0%	5.1%	0.1%	3.8%
e. Wet/Contaminated Fiber	0.0%	0.0%	-	-
f. Rubber	0.0%	0.0%	-	-
g. Allocated Organics	0.0%	0.0%	-	-
15. Fines (<2" Items)	0.0%	0.0%	-	-
16. Other	33.8%	44.0%	17.6%	50.0%

Figure 8-4: Fall 2016 C&D Waste Composition



9. ATTACHMENT A: SAMPLE DATA

Larimer County 2016 Waste Composition Study

Residential Samples	Spring 1	Spring 2	Spring 3	Spring 4	Spring 5	Spring 6	Spring 7	Spring 8	Spring 9	Spring 10	Spring 11	Spring 12	Spring 13	Spring 14	Spring 15	Fall 1	Fall 2	Fall 3	Fall 4	Fall 5	Fall 6	Fall 7	Fall 8	Fall 9	Fall 10	Fall 11	Fall 12	Fall 13	Fall 14	Fall 15	Mean Composition	Standard Deviation	Number of Samples	Lower	Upper
1. Dry Recoverable Fiber & OCC	6.3%	10.0%	3.8%	5.2%	5.7%	8.5%	1.4%	0.0%	6.9%	0.0%	3.0%	0.9%	0.0%	4.7%	3.4%	0.0%	0.0%	12.8%	8.4%	14.2%	3.3%	14.4%	4.1%	9.6%	14.2%	10.4%	5.2%	7.0%	15.6%	10.5%	6.3%	4.9%	30.00	4.9%	7.8%
2. PET UBC's	1.7%	1.6%	0.7%	2.2%	1.0%	0.7%	0.3%	0.2%	1.0%	0.0%	0.3%	1.3%	1.2%	1.4%	1.3%	0.0%	0.0%	1.9%	1.6%	2.8%	0.5%	0.8%	0.0%	3.5%	2.5%	2.7%	3.0%	1.0%	1.3%	1.3%	1.3%	1.0%	30.00	1.0%	1.5%
3. HDPE UBC's	1.5%	1.8%	1.7%	0.9%	0.8%	2.0%	0.2%	0.4%	0.6%	0.0%	0.9%	0.2%	1.0%	0.8%	0.3%	0.0%	0.0%	0.2%	0.5%	0.6%	0.2%	0.4%	0.0%	1.4%	0.8%	1.6%	1.0%	2.5%	3.1%	3.7%	1.0%	0.9%	30.00	0.7%	1.2%
4. Film Plastic	5.1%	4.5%	4.9%	7.4%	4.3%	7.8%	1.3%	4.4%	6.2%	4.1%	2.8%	3.6%	2.9%	3.8%	7.9%	0.0%	0.0%	3.0%	7.3%	9.8%	4.2%	14.4%	0.0%	5.3%	13.6%	4.9%	1.3%	3.6%	2.9%	3.3%	4.8%	3.4%	30.00	3.8%	5.8%
5. Mixed Plastics	6.8%	4.4%	4.5%	3.3%	4.2%	2.4%	5.3%	2.9%	2.1%	0.0%	9.6%	1.9%	4.3%	3.9%	9.7%	0.0%	4.2%	6.2%	4.2%	9.1%	8.5%	4.5%	3.9%	5.3%	6.8%	8.4%	1.5%	5.0%	3.3%	0.0%	4.5%	2.7%	30.00	3.7%	5.4%
6. Glass UBC's	0.0%	9.3%	4.5%	4.0%	2.2%	0.0%	0.0%	0.0%	0.6%	2.1%	4.9%	3.8%	3.5%	1.9%	2.6%	0.0%	0.0%	21.5%	0.1%	1.8%	0.7%	0.4%	3.8%	4.6%	0.6%	4.8%	4.0%	12.8%	1.0%	0.5%	3.2%	4.5%	30.00	1.8%	4.6%
7. Aluminum UBC's	0.9%	1.5%	0.4%	2.7%	1.1%	0.0%	0.3%	0.1%	0.3%	0.0%	0.4%	0.4%	0.4%	0.7%	0.9%	0.0%	0.0%	1.1%	2.4%	1.6%	0.3%	0.7%	0.0%	1.9%	0.4%	1.1%	3.9%	0.6%	1.3%	0.0%	0.8%	0.9%	30.00	0.6%	1.1%
8. Mixed Ferrous (Tin & Salvage)	12.3%	1.8%	0.3%	0.3%	1.6%	0.5%	4.2%	0.0%	1.1%	0.0%	3.1%	8.4%	1.4%	2.6%	4.9%	0.0%	0.0%	1.1%	2.2%	0.6%	0.0%	0.5%	10.8%	2.9%	0.0%	3.0%	2.2%	3.9%	7.3%	1.4%	2.6%	3.2%	30.00	1.7%	3.6%
9. Mixed Non-Ferrous (Salvage)	0.0%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%	30.00	0.0%	0.2%
10. Inerts	0.0%	0.0%	0.0%	0.0%	3.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.5%	0.0%	0.0%	0.0%	0.0%	0.0%	8.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	1.9%	30.00	0.0%	1.1%
11. Haz-Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	5.8%	0.0%	0.2%	1.1%	30.00	0.0%	0.5%
12. E-Waste	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	5.6%	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	45.7%	0.9%	3.1%	1.4%	0.0%	0.0%	3.3%	0.0%	0.0%	2.5%	0.0%	2.5%	0.0%	0.0%	2.4%	8.3%	30.00	0.0%	4.9%
13. Textiles	9.7%	5.6%	1.6%	17.5%	10.3%	0.0%	11.6%	1.3%	0.6%	3.0%	9.6%	7.7%	0.0%	1.2%	2.3%	0.0%	0.0%	4.8%	10.6%	2.4%	3.5%	0.1%	50.4%	1.5%	0.0%	5.5%	5.0%	8.2%	0.5%	0.0%	5.8%	9.6%	30.00	2.9%	8.7%
14. Organics	49.9%	19.0%	70.0%	46.0%	50.2%	67.5%	64.8%	67.2%	68.3%	58.8%	43.4%	48.3%	44.7%	35.3%	41.4%	100.0%	50.1%	17.8%	28.9%	43.7%	66.9%	37.1%	23.6%	34.3%	56.2%	26.3%	61.4%	31.7%	46.2%	68.9%	48.9%	18.4%	30.00	43.4%	54.4%
a. Yard Waste	8.5%	0.0%	15.8%	17.8%	1.1%	52.1%	0.6%	0.0%	46.7%	4.8%	2.1%	22.2%	29.8%	1.4%	6.9%	0.0%	19.6%	1.5%	5.6%	1.6%	29.6%	1.2%	0.0%	0.0%	31.4%	0.0%	5.4%	0.9%	1.5%	68.0%	12.5%	17.8%	30.00	7.2%	17.9%
b. Food Waste	25.5%	2.5%	22.8%	9.7%	16.3%	11.3%	0.0%	47.5%	11.3%	36.3%	25.7%	26.1%	0.0%	25.2%	22.9%	0.0%	0.0%	12.9%	9.2%	22.0%	7.6%	22.6%	0.0%	12.2%	6.2%	8.2%	42.0%	13.6%	11.6%	0.0%	15.0%	12.8%	30.00	11.2%	18.9%
c. Clean Wood	0.0%	0.0%	1.6%	2.1%	4.7%	0.4%	36.9%	0.0%	0.0%	1.2%	3.9%	0.0%	0.0%	0.0%	0.0%	40.0%	4.3%	0.0%	1.0%	0.0%	15.4%	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	3.7%	9.9%	30.00	0.8%	6.7%
d. Treated/Painted Wood	3.0%	7.8%	0.0%	0.0%	13.8%	0.0%	20.9%	3.0%	0.8%	0.0%	0.0%	0.0%	4.7%	4.8%	2.5%	60.0%	0.0%	3.4%	2.8%	0.0%	0.0%	0.0%	23.6%	4.9%	0.0%	0.0%	2.4%	10.4%	0.0%	0.9%	5.7%	11.9%	30.00	2.1%	9.2%
e. Wet/Contaminated Fiber	12.9%	8.8%	29.4%	16.0%	14.2%	3.6%	4.2%	16.7%	9.5%	14.5%	8.5%	0.0%	10.1%	3.2%	9.0%	0.0%	0.0%	0.0%	9.7%	19.9%	8.6%	13.3%	0.0%	17.0%	18.5%	17.3%	11.6%	6.0%	8.6%	0.0%	9.7%	7.3%	30.00	7.5%	11.9%
f. Rubber	0.0%	0.0%	0.4%	0.4%	0.0%	0.0%	2.2%	0.0%	0.0%	1.9%	3.2%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.5%	0.2%	5.7%	0.0%	0.0%	0.2%	0.1%	0.1%	0.0%	0.7%	24.5%	0.0%	1.4%	4.5%	30.00	0.0%	2.7%
g. Allocated Organics	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	26.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	4.8%	30.00	0.0%	2.3%
15. Fines	0.0%	7.3%	0.0%	2.8%	7.5%	5.8%	2.3%	0.0%	2.7%	3.9%	2.2%	0.0%	9.0%	22.2%	5.5%	0.0%	0.0%	7.7%	2.4%	6.4%	8.3%	2.7%	0.0%	12.4%	0.0%	13.7%	0.0%	8.3%	9.4%	0.0%	4.7%	5.2%	30.00	3.2%	6.3%
16. Other	4.5%	33.2%	6.2%	7.7%	7.5%	4.9%	8.1%	17.9%	9.6%	22.0%	19.7%	23.4%	31.7%	21.5%	19.3%	0.0%	0.0%	15.3%	27.4%	5.5%	3.6%	24.2%	0.0%	9.0%	4.9%	15.2%	11.6%	12.8%	2.4%	10.5%	12.7%	9.5%	30.00	9.8%	15.5%
																																Confidence Interval			90%

Larimer County 2016 Waste Composition Study

Commercial Samples	Spring 1	Spring 2	Spring 3	Spring 4	Spring 5	Spring 6	Spring 7	Spring 8	Spring 9	Spring 10	Spring 11	Spring 12	Spring 13	Spring 14	Spring 15	Spring 16	Spring 17	Spring 18	Spring 19	Spring 20
1. Dry Recoverable Fiber & OCC	0.8%	20.0%	12.0%	10.9%	20.8%	2.7%	4.0%	9.8%	2.8%	9.6%	23.3%	4.8%	2.0%	7.7%	5.4%	42.4%	9.3%	0.0%	9.1%	12.2%
2. PET UBC's	1.7%	2.1%	0.4%	0.4%	1.7%	1.8%	1.3%	1.9%	0.1%	0.5%	2.1%	0.4%	0.7%	3.4%	2.3%	1.0%	0.7%	0.4%	2.0%	0.7%
3. HDPE UBC's	1.8%	0.0%	1.0%	0.0%	1.5%	0.6%	0.5%	1.3%	2.5%	1.3%	0.7%	0.1%	0.3%	0.5%	3.2%	0.6%	0.2%	0.7%	1.0%	1.2%
4. Film Plastic	14.7%	10.3%	15.3%	8.2%	5.1%	6.2%	5.5%	6.9%	6.5%	1.0%	14.6%	4.2%	0.5%	3.2%	3.1%	7.2%	4.8%	2.4%	5.9%	8.0%
5. Mixed Plastics	2.8%	16.4%	6.2%	10.9%	4.0%	3.1%	2.6%	13.5%	4.8%	3.8%	0.0%	3.1%	4.2%	2.9%	0.6%	1.6%	3.6%	2.0%	4.1%	1.2%
6. Glass UBC's	0.5%	1.3%	3.4%	0.0%	6.5%	1.9%	7.1%	7.9%	10.9%	4.7%	1.0%	0.9%	0.0%	0.9%	0.6%	2.8%	1.1%	0.0%	1.5%	2.3%
7. Aluminum UBC's	0.8%	0.0%	1.0%	0.1%	2.5%	1.5%	1.3%	1.4%	0.4%	0.8%	0.5%	0.3%	0.1%	1.5%	2.5%	0.0%	0.7%	0.0%	1.1%	0.7%
8. Mixed Ferrous (Tin & Salvage)	0.6%	2.0%	0.4%	0.0%	6.3%	2.9%	0.6%	4.3%	5.2%	1.1%	0.0%	2.8%	0.1%	1.7%	0.0%	0.6%	6.6%	5.6%	0.8%	32.7%
9. Mixed Non-Ferrous (Salvage)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%
10. Inerts	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
11. Haz-Waste	3.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	5.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
12. E-Waste	0.0%	2.4%	0.0%	0.0%	0.0%	2.9%	3.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%	1.1%	0.0%	0.0%
13. Textiles	0.0%	3.2%	4.2%	0.0%	0.0%	8.8%	1.3%	2.6%	0.1%	1.3%	0.0%	1.3%	5.0%	15.7%	2.9%	10.5%	6.7%	0.0%	0.0%	6.9%
14. Organics	58.0%	38.8%	45.2%	69.5%	34.5%	58.5%	37.6%	31.6%	43.7%	64.9%	53.2%	31.9%	66.3%	39.5%	55.7%	11.0%	30.6%	49.4%	23.1%	20.8%
a. Yard W+A18:AJ23aste	0.0%	7.4%	32.4%	21.8%	3.6%	23.7%	3.5%	19.3%	0.0%	59.0%	0.0%	0.0%	54.4%	2.7%	4.9%	0.0%	14.2%	0.0%	0.0%	1.9%
b. Food Waste	20.4%	2.8%	6.2%	0.0%	19.6%	8.7%	14.6%	3.2%	23.7%	3.8%	47.3%	25.2%	4.4%	20.8%	8.6%	6.2%	7.1%	5.8%	10.1%	3.0%
c. Clean Wood	0.0%	0.3%	0.0%	47.7%	0.0%	0.0%	0.0%	3.7%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
d. Treated/Painted Wood	4.0%	0.0%	0.7%	0.0%	1.0%	9.3%	3.9%	0.0%	0.0%	0.0%	5.9%	1.9%	5.2%	1.8%	1.6%	2.1%	2.2%	40.5%	0.0%	0.0%
e. Wet/Contaminated Fiber	33.5%	28.4%	5.9%	0.0%	9.7%	16.8%	15.6%	5.3%	19.0%	2.2%	0.0%	4.8%	2.3%	14.2%	11.8%	2.7%	7.1%	3.1%	12.6%	15.9%
f. Rubber	0.1%	0.0%	0.0%	0.0%	0.6%	0.0%	0.1%	0.2%	0.5%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.3%	0.0%
g. Allocated Organics	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	28.8%	0.0%	0.0%	0.0%	0.0%	0.0%
15. Fines	1.3%	2.8%	2.0%	0.0%	4.8%	1.7%	0.0%	0.0%	3.5%	9.6%	4.7%	4.7%	0.0%	0.0%	5.5%	4.9%	25.8%	3.8%	3.4%	3.0%
16. Other	14.0%	0.7%	8.9%	0.0%	12.4%	7.4%	33.0%	18.8%	13.9%	1.3%	0.0%	45.4%	20.8%	23.0%	18.1%	17.4%	4.9%	34.7%	48.1%	10.2%

Commercial Samples	Fall 1	Fall 2	Fall 3	Fall 4	Fall 5	Fall 6	Fall 7	Fall 8	Fall 9	Fall 10	Fall 11	Fall 12	Fall 13	Fall 14	Fall 15	Fall 16	Fall 17	Fall 18	Fall 19	Fall 20	Mean Composition	Standard Deviation	Number of Samples	Lower	Upper
1. Dry Recoverable Fiber & OCC	4.1%	0.0%	5.0%	5.9%	4.1%	36.8%	17.5%	0.0%	9.7%	14.6%	12.8%	0.0%	20.6%	61.3%	57.1%	28.9%	66.0%	8.3%	13.0%	12.9%	14.7%	16.6%	40.00	10.4%	19.0%
2. PET UBC's	0.6%	0.0%	17.9%	1.3%	0.0%	1.1%	0.0%	0.0%	1.1%	0.6%	1.3%	0.0%	1.7%	0.0%	0.8%	0.7%	0.2%	1.4%	0.0%	1.7%	1.4%	2.8%	40.00	0.7%	2.1%
3. HDPE UBC's	0.1%	0.0%	0.3%	0.9%	0.0%	5.0%	0.0%	0.0%	0.9%	0.0%	0.6%	0.0%	0.7%	0.7%	2.9%	0.2%	0.4%	0.8%	0.1%	0.6%	0.8%	1.0%	40.00	0.6%	1.1%
4. Film Plastic	3.3%	0.0%	3.3%	1.3%	0.0%	6.0%	4.9%	0.0%	2.6%	2.7%	7.4%	0.0%	3.2%	0.0%	7.5%	6.1%	2.3%	2.1%	14.0%	2.5%	5.1%	4.2%	40.00	4.0%	6.2%
5. Mixed Plastics	30.9%	0.0%	2.9%	0.5%	3.5%	3.2%	0.0%	0.0%	3.2%	3.2%	3.9%	0.0%	8.8%	14.0%	1.5%	5.4%	3.6%	8.6%	2.3%	13.9%	5.0%	5.9%	40.00	3.5%	6.6%
6. Glass UBC's	1.5%	0.0%	0.7%	0.7%	0.0%	0.5%	0.0%	0.0%	4.7%	0.3%	1.7%	0.0%	15.9%	0.0%	0.0%	0.2%	0.0%	0.3%	0.0%	1.0%	2.1%	3.4%	40.00	1.2%	3.0%
7. Aluminum UBC's	0.3%	0.0%	0.9%	0.2%	0.0%	0.8%	0.0%	0.0%	0.0%	0.2%	1.0%	0.0%	0.7%	0.0%	0.9%	0.6%	0.1%	0.3%	0.0%	0.5%	0.6%	0.7%	40.00	0.4%	0.8%
8. Mixed Ferrous (Tin & Salvage)	2.2%	0.0%	0.4%	2.0%	0.0%	0.0%	1.5%	0.0%	0.9%	0.8%	1.3%	43.1%	12.5%	0.0%	2.8%	2.8%	3.4%	1.2%	1.9%	3.0%	3.9%	8.4%	40.00	1.7%	6.0%
9. Mixed Non-Ferrous (Salvage)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	40.00	0.0%	0.1%
10. Inerts	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	40.00	0.0%	0.1%
11. Haz-Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	4.9%	0.0%	2.0%	0.0%	0.4%	1.3%	40.00	0.1%	0.7%
12. E-Waste	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	0.0%	0.0%	0.0%	0.0%	2.3%	0.5%	1.1%	40.00	0.2%	0.8%
13. Textiles	0.7%	0.0%	0.0%	0.1%	0.0%	0.1%	5.9%	47.5%	2.3%	0.2%	0.3%	37.2%	14.0%	0.0%	1.4%	0.7%	4.9%	0.6%	1.2%	4.8%	4.8%	9.6%	40.00	2.3%	7.3%
14. Organics	51.4%	100.0%	37.7%	66.7%	82.7%	44.7%	52.0%	31.1%	62.9%	75.2%	48.5%	0.0%	14.6%	24.1%	14.9%	39.4%	9.2%	75.2%	64.3%	45.2%	45.1%	21.7%	40.00	39.4%	50.7%
a. Yard W+A18:AJ23aste	0.0%	100.0%	0.5%	0.0%	2.5%	0.0%	9.6%	0.0%	33.9%	0.0%	0.6%	0.0%	4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.5%	10.6%	20.6%	40.00	5.3%	16.0%
b. Food Waste	37.4%	0.0%	29.6%	65.8%	67.8%	33.2%	0.0%	0.0%	13.0%	2.1%	33.4%	0.0%	0.0%	0.0%	6.2%	27.3%	0.0%	32.5%	27.8%	3.0%	15.5%	17.5%	40.00	11.0%	20.1%
c. Clean Wood	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	32.3%	31.1%	0.0%	63.9%	0.0%	0.0%	0.0%	0.0%	2.8%	0.0%	0.0%	20.9%	17.9%	0.0%	5.5%	14.3%	40.00	1.8%	9.2%
d. Treated/Painted Wood	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.7%	24.1%	2.6%	3.5%	9.2%	0.0%	0.0%	0.0%	3.1%	7.4%	40.00	1.2%	5.0%
e. Wet/Contaminated Fiber	14.0%	0.0%	7.6%	0.9%	12.4%	10.9%	10.1%	0.0%	1.8%	9.2%	14.0%	0.0%	5.7%	0.0%	3.2%	8.1%	0.0%	21.1%	18.0%	8.2%	8.9%	8.0%	40.00	6.8%	11.0%
f. Rubber	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	14.2%	0.2%	0.4%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.7%	0.6%	8.6%	0.7%	2.6%	40.00	0.0%	1.4%
g. Allocated Organics	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	4.6%	40.00	0.0%	1.9%
15. Fines	2.8%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.0%	6.3%	1.2%	12.8%	0.0%	3.3%	0.0%	5.1%	13.9%	3.6%	1.0%	0.8%	9.1%	3.6%	5.0%	40.00	2.3%	4.9%
16. Other	2.1%	0.0%	30.8%	20.0%	9.7%	0.5%	18.3%	21.3%	5.4%	1.0%	8.3%	19.7%	3.9%	0.0%	1.9%	0.2%	1.5%	0.5%	0.4%	2.5%	12.0%	12.8%	40.00	8.7%	15.4%
																					Confidence Interval				90%

Exhibit A

Larimer County 2016 Waste Composition Study

Self-Haul Samples	Spring 1	Spring 2	Spring 3	Spring 4	Spring 5	Spring 6	Spring 7	Spring 8	Spring 9	Spring 10	Spring 11	Spring 12	Spring 13	Spring 14	Spring 15	Spring 16	Spring 17	Sprin g 18	Spring 19	Spring 20
1. Dry Recoverable Fiber & OCC	0.0%	0.0%	0.9%	0.2%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	1.1%	0.0%	1.6%	0.0%	0.0%	0.3%	0.3%
2. PET UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3. HDPE UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4. Film Plastic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5. Mixed Plastics	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.2%	0.2%	0.4%	0.2%	0.0%	0.0%	0.4%	0.0%	0.2%	0.0%
6. Glass UBC's	0.0%	0.0%	0.0%	19.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%	0.0%
7. Aluminum UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8. Mixed Ferrous (Tin & Salvage)	0.0%	0.0%	0.0%	0.0%	10.9%	0.0%	0.0%	0.0%	0.0%	2.6%	21.4%	0.0%	32.1%	0.0%	0.9%	31.7%	63.4%	0.0%	3.3%	0.0%
9. Mixed Non-Ferrous (Salvage)	0.0%	0.0%	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10. Inerts	0.0%	0.0%	51.7%	14.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	51.9%	0.0%	0.0%	0.0%	22.8%	0.0%
11. Haz-Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
12. E-Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%
13. Textiles	0.0%	0.0%	0.0%	0.0%	20.5%	0.0%	0.0%	0.0%	66.5%	4.0%	0.6%	36.0%	0.0%	22.8%	0.0%	0.0%	7.6%	0.0%	3.3%	0.7%
14. Organics	98.7%	100%	45.2%	65.7%	68.0%	100%	100%	93.4%	21.7%	88.9%	77.5%	61.6%	67.5%	68.3%	39.0%	66.7%	19.0%	100%	61.0%	99.0%
a. Yard Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%	0.0%	15.8%	39.5%	69.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	67.1%
b. Food Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
c. Clean Wood	49.3%	100%	6.5%	0.0%	0.0%	100%	0.0%	4.9%	5.9%	49.4%	8.0%	56.0%	67.5%	0.0%	0.0%	0.0%	0.0%	0.0%	40.7%	31.9%
d. Treated/Painted Wood	49.3%	0.0%	38.8%	65.7%	61.2%	0.0%	0.0%	88.5%	0.0%	0.0%	0.0%	5.6%	0.0%	68.3%	39.0%	66.7%	19.0%	100%	20.3%	0.0%
e. Wet/Contaminated Fiber	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
f. Rubber	0.0%	0.0%	0.0%	0.0%	6.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
g. Allocated Organics	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15. Fines	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
16. Other	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	11.8%	3.3%	0.0%	2.2%	0.0%	7.6%	8.2%	0.0%	9.5%	0.0%	1.6%	0.0%

Self-Haul Samples	Fall 1	Fall 2	Fall 3	Fall 4	Fall 5	Fall 6	Fall 7	Fall 8	Fall 9	Fall 10	Fall 11	Fall 12	Fall 13	Fall 14	Fall 15	Fall 16	Fall 17	Fall 18	Fall 19	Fall 20	Mean Composition	Standard Deviation	Number of Samples	Lower	Upper
1. Dry Recoverable Fiber & OCC	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	2.7%	0.0%	31.4%	0.0%	33.5%	0.0%	1.1%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	1.9%	7.1%	40.00	0.0%	3.7%
2. PET UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	0.0%	0.0%
3. HDPE UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	0.0%	0.0%
4. Film Plastic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.1%	40.00	0.0%	0.1%
5. Mixed Plastics	0.0%	0.0%	0.0%	2.1%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.1%	0.4%	40.00	0.1%	0.2%
6. Glass UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	3.2%	40.00	0.0%	1.4%
7. Aluminum UBC's	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	0.0%	0.0%
8. Mixed Ferrous (Tin & Salvage)	1.1%	2.0%	0.0%	18.9%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.6%	2.7%	70.3%	0.0%	0.0%	0.0%	0.0%	0.0%	19.4%	7.2%	16.3%	40.00	3.0%	11.5%
9. Mixed Non-Ferrous (Salvage)	0.0%	0.0%	0.0%	0.0%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.6%	40.00	0.0%	0.3%
10. Inerts	98.8%	0.0%	0.0%	18.9%	0.0%	0.0%	0.0%	32.4%	0.0%	0.0%	63.2%	33.5%	0.0%	26.4%	0.0%	17.4%	0.0%	99.6%	0.0%	43.5%	14.4%	26.3%	40.00	7.5%	21.2%
11. Haz-Waste	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%	40.00	0.0%	0.1%
12. E-Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	1.2%	40.00	0.0%	0.6%
13. Textiles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	32.5%	0.0%	34.4%	0.0%	6.7%	0.0%	0.0%	0.0%	0.0%	87.8%	0.0%	54.4%	0.0%	9.4%	20.3%	40.00	4.2%	14.7%
14. Organics	0.0%	98.0%	100%	60.0%	0.0%	100%	100%	32.4%	68.8%	34.2%	36.8%	0.0%	70.0%	0.0%	85.7%	82.6%	8.1%	0.0%	9.0%	36.3%	59.1%	35.5%	40.00	49.8%	68.3%
a. Yard Waste	0.0%	98.0%	100%	50.5%	0.0%	84.2%	100%	32.4%	0.0%	0.0%	0.0%	0.0%	40.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	19.9%	34.8%	40.00	10.9%	29.0%
b. Food Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	-	-
c. Clean Wood	0.0%	0.0%	0.0%	4.7%	0.0%	0.0%	0.0%	0.0%	22.2%	34.2%	5.3%	0.0%	10.0%	0.0%	32.1%	0.0%	0.0%	0.0%	0.0%	36.3%	16.6%	27.0%	40.00	9.6%	23.7%
d. Treated/Painted Wood	0.0%	0.0%	0.0%	4.7%	0.0%	15.8%	0.0%	0.0%	46.7%	0.0%	31.6%	0.0%	20.0%	0.0%	53.6%	82.6%	0.0%	0.0%	0.0%	0.0%	21.9%	30.2%	40.00	14.1%	29.8%
e. Wet/Contaminated Fiber	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	-	-
f. Rubber	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.1%	0.0%	9.0%	0.0%	0.6%	2.1%	40.00	0.0%	1.2%
g. Allocated Organics	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	-	-
15. Fines	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	-	-
16. Other	0.0%	0.0%	0.0%	0.0%	92.1%	0.0%	0.0%	0.0%	31.1%	0.0%	0.0%	16.7%	23.3%	2.2%	14.3%	0.0%	4.1%	0.0%	36.1%	0.0%	6.6%	16.3%	40.00	2.4%	10.9%
																					Confidence Interval				90%

Larimer County 2016 Waste Composition Study

C&D Samples	Spring 1	Spring 2	Spring 3	Spring 4	Spring 5	Spring 6	Spring 7	Spring 8	Spring 9	Spring 10	Spring 11	Spring 12	Spring 13	Spring 14	Spring 15	Spring 16	Spring 17	Spring 18	Spring 19	Spring 20
1. Dry Recoverable Fiber & OCC	0.3%	9.4%	0.2%	0.0%	0.7%	0.0%	1.7%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.2%	0.0%	0.7%	12.0%	0.0%	0.0%	0.0%
2. PET UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3. HDPE UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4. Film Plastic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5. Mixed Plastics	0.1%	0.1%	0.0%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%
6. Glass UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.5%	0.0%	0.0%	0.0%
7. Aluminum UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8. Mixed Ferrous (Tin & Salvage)	1.4%	0.0%	3.5%	0.0%	0.0%	90.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	3.1%	0.0%	13.4%	11.7%	0.0%	0.0%	37.7%
9. Mixed Non-Ferrous (Salvage)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10. Inerts	0.0%	0.0%	63.3%	0.0%	0.0%	0.0%	0.0%	100%	100%	0.0%	0.0%	0.0%	97.6%	74.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
11. Haz-Waste	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
12. E-Waste	0.0%	7.5%	0.0%	3.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
13. Textiles	0.0%	0.0%	0.0%	0.0%	0.8%	1.9%	4.0%	0.0%	0.0%	15.3%	0.0%	0.0%	1.1%	0.0%	0.0%	10.5%	8.6%	0.0%	0.0%	0.0%
14. Organics	96.9%	83.1%	31.6%	27.6%	98.3%	7.9%	94.3%	0.0%	0.0%	83.1%	100%	96.6%	1.4%	18.5%	100%	75.4%	53.8%	100%	0.0%	17.0%
a. Yard Waste	0.0%	0.0%	0.0%	17.2%	0.0%	0.0%	1.3%	0.0%	0.0%	31.7%	6.6%	0.0%	0.0%	0.0%	66.7%	0.0%	0.0%	100%	0.0%	0.0%
b. Food Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	44.1%	0.0%	0.0%	0.0%
c. Clean Wood	96.9%	83.1%	15.8%	0.0%	88.0%	6.4%	29.2%	0.0%	0.0%	47.6%	0.0%	91.5%	0.0%	9.2%	33.3%	40.2%	0.0%	0.0%	0.0%	5.7%
d. Treated/Painted Wood	0.0%	0.0%	15.8%	10.3%	10.3%	1.6%	50.3%	0.0%	0.0%	0.0%	93.4%	5.1%	1.4%	9.2%	0.0%	35.2%	9.7%	0.0%	0.0%	11.3%
e. Wet/Contaminated Fiber	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
f. Rubber	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	13.4%	0.0%	0.0%	3.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
g. Allocated Organics	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15. Fines	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
16. Other	0.0%	0.0%	1.4%	69.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	0.0%	3.1%	0.0%	0.0%	7.1%	0.0%	100%	45.3%

C&D Samples	Fall 1	Fall 2	Fall 3	Fall 4	Fall 5	Fall 6	Fall 7	Fall 8	Fall 9	Fall 10	Fall 11	Fall 12	Fall 13	Fall 14	Fall 15	Fall 16	Fall 17	Fall 18	Fall 19	Fall 20	Mean Composition	Standard Deviation	Number of Samples	Lower	Upper
1. Dry Recoverable Fiber & OCC	0.7%	0.0%	0.2%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	29.9%	0.0%	0.0%	0.0%	0.4%	1.5%	5.2%	40.00	0.1%	2.8%
2. PET UBC's	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	0.0%	0.0%
3. HDPE UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	0.0%	0.0%
4. Film Plastic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.7%	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%	40.00	0.0%	0.1%
5. Mixed Plastics	0.0%	0.0%	0.2%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.2%	0.0%	0.4%	0.0%	0.1%	0.2%	40.00	0.0%	0.1%
6. Glass UBC's	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	1.0%	40.00	0.0%	0.4%
7. Aluminum UBC's	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	40.00	0.0%	0.0%
8. Mixed Ferrous (Tin & Salvage)	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.9%	0.0%	0.0%	12.0%	0.0%	0.0%	0.0%	0.0%	4.5%	15.4%	40.00	0.5%	8.5%
9. Mixed Non-Ferrous (Salvage)	3.0%	0.0%	3.9%	6.5%	0.0%	0.0%	0.0%	5.0%	4.9%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	12.0%	0.0%	0.0%	5.0%	0.0%	1.1%	2.5%	40.00	0.4%	1.7%
10. Inerts	0.0%	99.2%	49.4%	11.8%	100%	100%	98.7%	0.0%	0.0%	100%	96.4%	100%	0.0%	0.0%	94.1%	0.0%	0.0%	0.0%	0.0%	0.0%	32.1%	44.7%	40.00	20.5%	43.7%
11. Haz-Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	40.00	0.0%	0.1%
12. E-Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	1.3%	40.00	0.0%	0.6%
13. Textiles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	3.2%	40.00	0.2%	1.9%
14. Organics	0.0%	0.3%	36.3%	78.5%	0.0%	0.0%	1.3%	0.0%	7.3%	0.0%	3.6%	0.0%	2.9%	3.0%	3.9%	44.8%	78.1%	100%	14.9%	0.0%	36.5%	40.7%	40.00	25.9%	47.1%
a. Yard Waste	0.0%	0.1%	0.0%	58.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.6%	0.0%	0.0%	0.0%	3.9%	0.0%	0.0%	0.0%	0.0%	0.0%	7.2%	21.0%	40.00	1.8%	12.7%
b. Food Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	78.1%	0.0%	0.0%	0.0%	3.1%	14.0%	40.00	0.0%	6.7%
c. Clean Wood	0.0%	0.0%	18.2%	19.6%	0.0%	0.0%	1.3%	0.0%	7.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	44.8%	0.0%	100%	0.0%	0.0%	18.5%	31.1%	40.00	10.4%	26.6%
d. Treated/Painted Wood	0.0%	0.2%	18.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	3.0%	0.0%	0.0%	0.0%	0.0%	14.9%	0.0%	7.3%	17.3%	40.00	2.8%	11.8%
e. Wet/Contaminated Fiber	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	-	-
f. Rubber	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	2.2%	40.00	0.0%	1.0%
g. Allocated Organics	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	-	-
15. Fines	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.00	-	-
16. Other	92.2%	0.5%	9.9%	0.0%	0.0%	0.0%	0.0%	95.0%	87.8%	0.0%	0.0%	0.0%	93.0%	94.9%	2.0%	0.0%	21.7%	0.0%	79.5%	99.5%	22.6%	37.9%	40.00	12.8%	32.5%
																					Confidence Interval				90%

Exhibit A

10. ATTACHMENT B: PICTORIAL PRESENTATION

Larimer County Landfill Field Sampling Process Pictorial

The following photos depict the field sampling process conducted at Larimer Landfill during the waste composition study.

The Sloan Vazquez McAfee (SVM) loader operator extracts a cell, which was selected through a random sampling process, from a commercial MSW load.

The extracted sample is placed on a tarp that is adjacent to the sorting table.

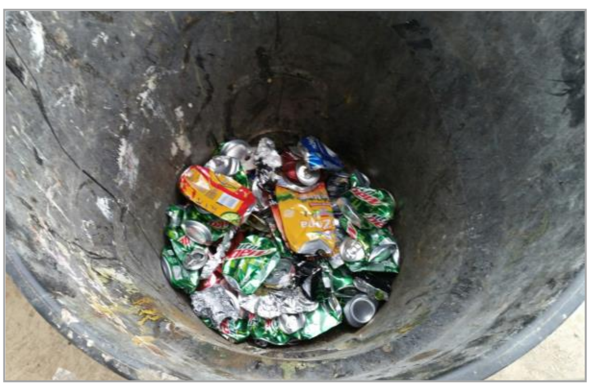
The sorting table is centered on a plywood “island” that is constructed for stability and sorter safety. 32 gallon cans were used for sorting the designated MSW materials into categories.

The sorting area could host up to seven individual samples on tarps that were staked to the ground surrounding the sorting table.

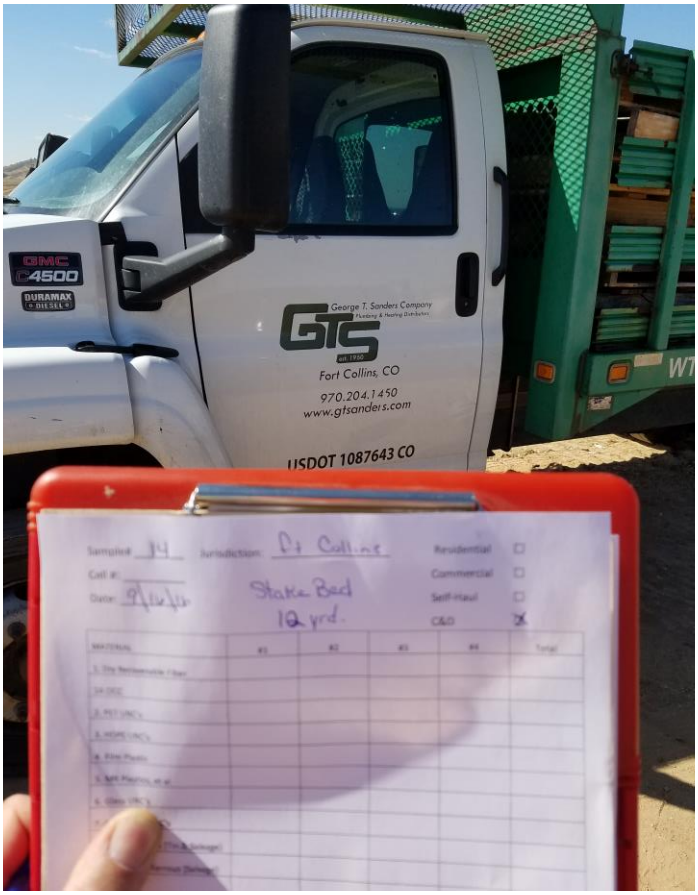
Trained sorters identify the various materials and deposit them into designated 32-gallon cans for weighing and recording. The photos on the following page show the designated materials sorted into respective containers and ready for weighing and recording.


FILM PLASTICS


BUILT TO LAST

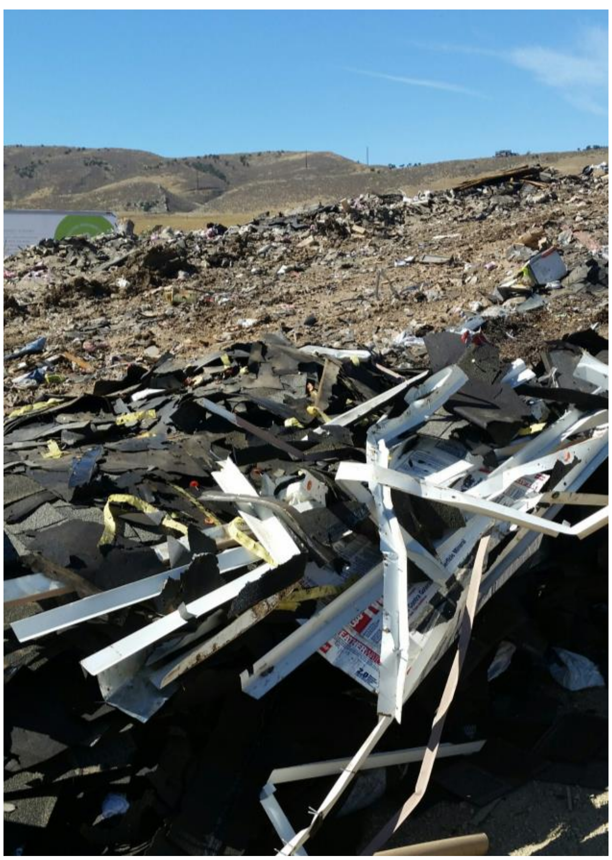


Larimer County Waste Composition Photos



Material categorized as “C&D” delivered to the Self-Haul area in a stake-bed truck. This is demolition material that came from a commercial tenant improvement project.

A roofing contractor delivers a roof tear-off that is comprised of composite shingles, felt paper, and aluminum flashing.

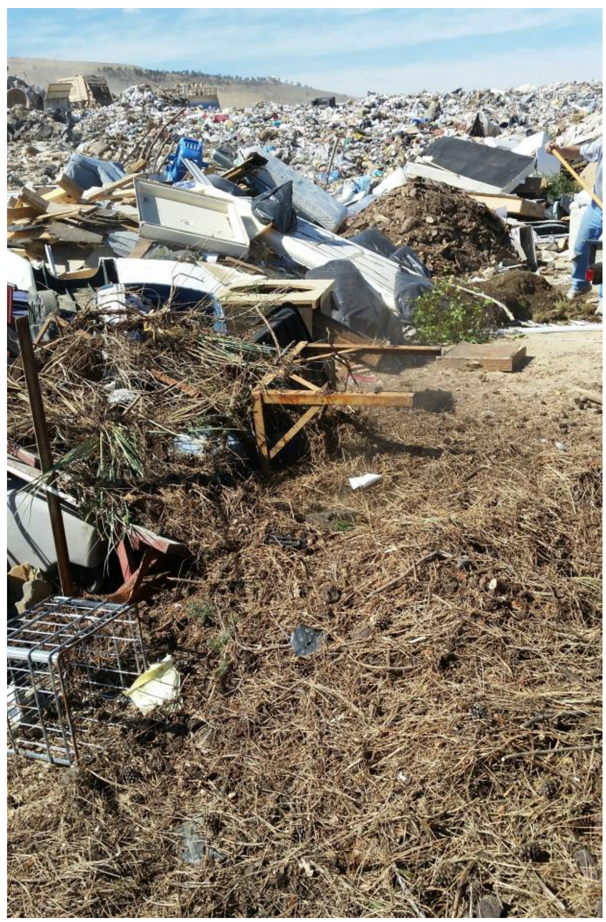


A Self-Hauler delivers a load that is 96% drywall.

A commercial contractor delivers a prime example of materials identified as C&D. The payload appears to be primarily generated by a knock-down type of demolition process whereby most of the materials; wood, drywall, and fiberglass insulation are broken into small pieces.

These photos represent a significant number of self-haul loads that are primarily composed of a single-material type; in this case, yard waste

.



Sometimes, smaller loads are delivered to the self-haul area that are obviously generated by construction/demolition activities.