

2014 Disposal-Facility-Based Characterization of Solid Waste in California



California Department of Resources Recycling and Recovery

October 6, 2015

Contractor's Report
Produced Under Contract By:
Cascadia Consulting Group



STATE OF CALIFORNIA

Edmund G. Brown Jr.
Governor

Matt Rodriquez
Secretary, California Environmental Protection Agency

DEPARTMENT OF RESOURCES RECYCLING AND RECOVERY

Scott Smithline
Director

Department of Resources Recycling and Recovery
Public Affairs Office
1001 I Street (MS 22-B)
P.O. Box 4025
Sacramento, CA 95812-4025
www.calrecycle.ca.gov/Publications/
1-800-RECYCLE (California only) or (916) 341-6300

Publication # DRRR-2015-1546



To conserve resources and reduce waste, CalRecycle reports are produced in electronic format only.

If printing copies of this document, please consider use of recycled paper containing 100 percent postconsumer fiber and, where possible, please print images on both sides of the paper.

Copyright © 2015 by the California Department of Resources Recycling and Recovery (CalRecycle). All rights reserved. This publication, or parts thereof, may not be reproduced in any form without permission.

Prepared as part of contract number DRR-12059 (total contract amount: \$1,911,500.46, includes other services not related to this report).

The California Department of Resources Recycling and Recovery (CalRecycle) does not discriminate on the basis of disability in access to its programs. CalRecycle publications are available in accessible formats upon request by calling the Public Affairs Office at (916) 341-6300. Persons with hearing impairments can reach CalRecycle through the California Relay Service, 1-800-735-2929.

Disclaimer: This report was produced under contract by Cascadia Consulting Group. The statements and conclusions contained in this report are those of the contractor and not necessarily those of the Department of Resources Recycling and Recovery (CalRecycle), its employees, or the State of California and should not be cited or quoted as official Department policy or direction.

The state makes no warranty, expressed or implied, and assumes no liability for the information contained in the succeeding text. Any mention of commercial products or processes shall not be construed as an endorsement of such products or processes.

Executive Summary

Introduction and Objectives

Through periodic studies, CalRecycle tracks California's ever-changing waste stream while gathering new information on materials of concern as they are identified. With up-to-date information on the types and amounts of materials disposed in the state's waste stream, CalRecycle can better determine where changes are needed to achieve California's 75 percent recycling goal. These data are essential for solid waste management planning, assessment of waste diversion activities, market development for recovered materials, and charting progress toward climate impact goals. Data generated from these studies are critical for several reasons:

- An accurate appraisal of recyclable materials in the disposed waste stream can help ensure that diversion goals are both reasonably set and effectively reached and that recyclable materials are being directed to their highest and best uses.
- Reducing the amount of bulky and biodegradable organic materials in the disposed waste stream is an effective way of reducing greenhouse gas emissions while extending the life of landfills. Characterization studies assess the amount of organics still being landfilled.
- The volume and type of household hazardous waste, electronic waste, and other types of special waste are constantly fluctuating with the changing list of goods on the market. The impact of these wastes on the natural environment is of constant concern. Staying abreast of these materials and current ways of handling them is of the utmost importance for a healthy California.

CalRecycle contracted with Cascadia Consulting Group to characterize and quantify the statewide disposed waste stream in 2014. This study followed standards and protocols similar to those used in the statewide waste characterization studies conducted in 2008 and 2004. The first statewide study was done in 1999 and used a different methodology. As with the 2004 and 2008 studies, the 2014 study estimates the quantity and composition of the commercial, residential, and self-hauled waste streams in California and aggregates this data to estimate the overall composition.

This report presents the findings of the 2014 Statewide Waste Characterization Study.

A concurrent study assessed the commercial waste and recycling streams through generator-based sampling. The results of that study are reported in an accompanying report titled "2014 Generator-Based Characterization of Commercial Sector Disposal and Diversion in California."

Study Methodology

A stratified random sampling methodology was used to sample waste from numerous subgroups (strata) to develop a waste composition profile for each stratum. Strata considered in this study included the geographical region, the waste sector (franchised

residential, franchised commercial, or self-hauled), and the waste subsector (single-family residential, multi-family residential, residential self-hauled, and commercial self-hauled). The strata were then “added together” in a way that reflects each stratum’s relative contribution to the overall waste stream, thus producing overall waste composition information.

The state was divided into five regions defined by similarities in demographic, climatic, geographic, and economic characteristics. Data regarding waste composition were gathered from 754 waste samples that our field crew sorted at 26 solid waste facilities (landfills and transfer stations) during four seasons. Whenever possible, a randomized process was used to select participating solid waste facilities, dates for fieldwork, vehicles carrying waste, and samples from loads. Approximately equal numbers of waste samples from each waste sector were obtained from each region of the state.

The sampled waste was sorted into 82 *material types*. However, the detailed composition tables in the main body of the report are presented using the 62 Standard Material Types from CalRecycle’s Uniform Waste Disposal Characterization Method. The expanded list of 82 *material types* used for sorting allows additional detail on materials of interest, yet is designed to be “folded up” into the standard list used for presenting results in this study. All *material types* were chosen and defined such that they can be compared to the *material types* used during California’s 2008 Statewide Waste Characterization Study. These materials are described in more detail in Appendix B: List and Definitions of Material Types. Tables containing waste composition data using the expanded 82 *material types* list are found in Appendix D: Expanded Statewide Waste Characterization Tables.

As part of the study, drivers at participating solid waste facilities were surveyed to determine the waste-generating sector and the net weight of each load, among other data. Results from these surveys were used to estimate the portion of California’s disposed waste derived from each waste sector and subsector. Surveys were conducted on the same days at the same sites that waste was sampled, with an additional 15 survey-only days at additional sites, split across the four study seasons. All vehicles, except for transfer trucks, bringing disposed waste to the study facilities were surveyed, for a total of 7,245 surveys completed over the study period.

Results

The data gathered during the sampling efforts were compiled and statistical analyses were performed to extrapolate the findings to statewide estimates. This report includes detailed findings for the following areas:

- Disposed waste composition and tonnage for the state’s overall waste stream and the commercial, residential, and self-hauled sectors.
- Disposed waste composition and tonnage for the state’s single-family residential waste, multi-family residential waste, commercial self-hauled waste, and residential self-hauled waste subsectors.

Special Note Regarding Sector Percentages

Sites participating in the composition study were selected at random from all eligible sites throughout the state. This site selection method ensured that the samples selected were representative of the materials disposed throughout the state. This method also should have ensured that vehicle survey data collected at each site accurately represented the proportion of waste disposed by each sector, subsector, and activity. However, during the data analysis, an unexpected anomaly was detected. Compared to previous studies, there was a steep increase in the portion of the waste stream attributable to the residential sector, with a comparable steep decrease in both the commercial and self-hauled sectors. A region-by-region analysis showed that the Southern Region had a massive change in its residential/commercial split when compared to previous studies. Since that region accounted for more than 60 percent of the state's disposed waste, even small changes there create substantial changes in the statewide results.

At the time of publication, CalRecycle staff are continuing to obtain more data from the Southern Region to determine if the sector percentages obtained are “real” or an artifact of changes in how waste is managed that affects our survey results. In the interim, we are publishing two sets of composition data for each of the sectors and subsectors. One set of data will reflect the use of the 2014 calculated sector percentages applied to 2014 waste composition data. The second set of data applies the sector percentages obtained in the 2008 Statewide Waste Characterization Study to the 2014 waste composition data. This provides a side-by-side comparison using the two different sector percentages. In reality, the true value may lie somewhere in between. The side-by-side data is presented for sector tonnages and detailed composition tables only. All other tables and figures show only the 2014 results as reported from field data observations, considered to be initial results. If CalRecycle staff obtain additional data that invalidate the sector splits calculated in the 2014 results, we will publish an addendum to this report.

A more in-depth explanation and analysis of this issue may be found in the section titled Special Note Regarding Vehicle Surveys and Quantifying Waste in Appendix A: Detailed Methodology in the [complete 2014 report](#).

Findings

Table ES-1 depicts each sector's estimated contribution to the overall waste stream, showing results from using both 2014 vehicle surveys and 2008 vehicle surveys.

Figure ES-1 through Figure ES-4 present the material composition by **Material Class** for the overall waste stream and for each of the three studied waste sectors. Table ES-2 presents the 10 most prevalent *material types* in the overall disposed waste stream. Figure ES-1 through Figure ES-4 and Table ES-2 present results using 2014 sector percentages applied to 2014 composition results. Finally, Table ES-3 provides a detailed breakdown of the composition of the overall waste stream by *material type* showing both compositions and quantities using 2014 sector percentages and 2008 sector percentages applied to 2014 composition percentages.

Table ES-1: Estimated Contribution of Each Sector to California's Overall Disposed Waste Stream

Sector	Calculated Using 2014 Sector Percentages		Calculated Using 2008 Sector Percentages	
	Est. % of Disposed Waste	Est. Tons Disposed Statewide	Est. % of Disposed Waste	Est. Tons Disposed Statewide
Franchised Commercial*	38.6%	11,909,937	49.6%	15,301,492
Franchised Residential*	47.0%	14,516,212	30.0%	9,254,001
<i>Single-family residential</i>	35.4%	10,924,313	21.6%	6,662,188
<i>Multi-family residential</i>	11.6%	3,591,900	8.4%	2,591,814
Self-Hauled	14.4%	4,438,130	20.4%	6,308,785
<i>Commercial self-hauled</i>	11.3%	3,486,297	17.1%	5,285,747
<i>Residential self-hauled</i>	3.1%	951,833	3.3%	1,023,039
Totals	100.0%	30,864,279	100.0%	30,864,279

Numbers may not total exactly due to rounding. Source: 2014 vehicle survey findings and 2008 vehicle survey findings applied to individual facility records and CalRecycle Disposal Reporting System 2013 tonnage figures. See *Special Note Regarding Sector Percentages* on page 3 of the [2014 report](#) for a further explanation of the sector percentage issues.

*Includes waste collected by both private and public entities that provide service to residential and business customers.

Figure ES-1: Material Classes in California's Overall Disposed Waste Stream

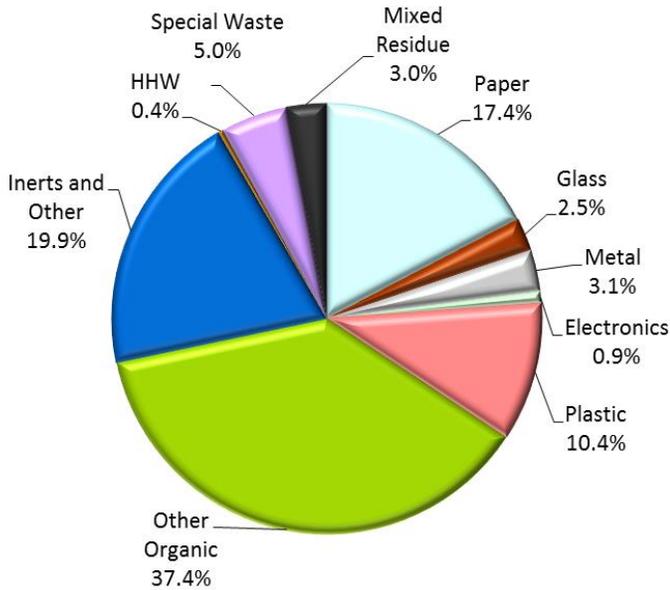


Figure ES-2: Material Classes in the Franchised Commercial Disposed Waste Stream

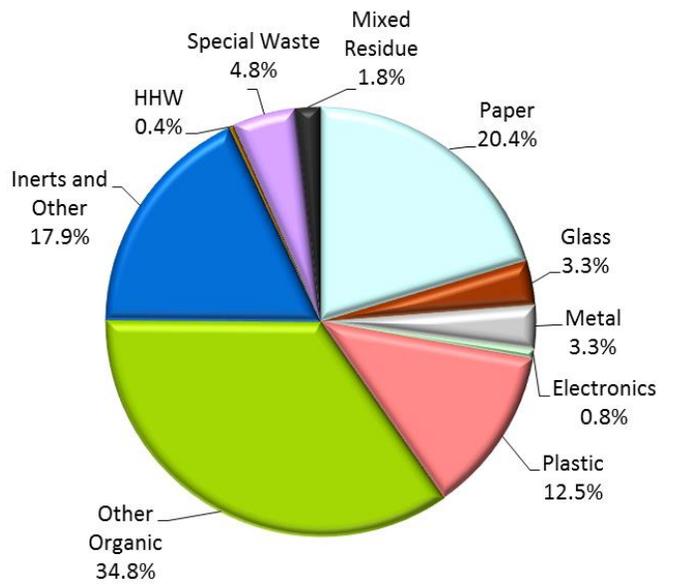


Figure ES-3: Material Classes in the Franchised Residential Disposed Waste Stream

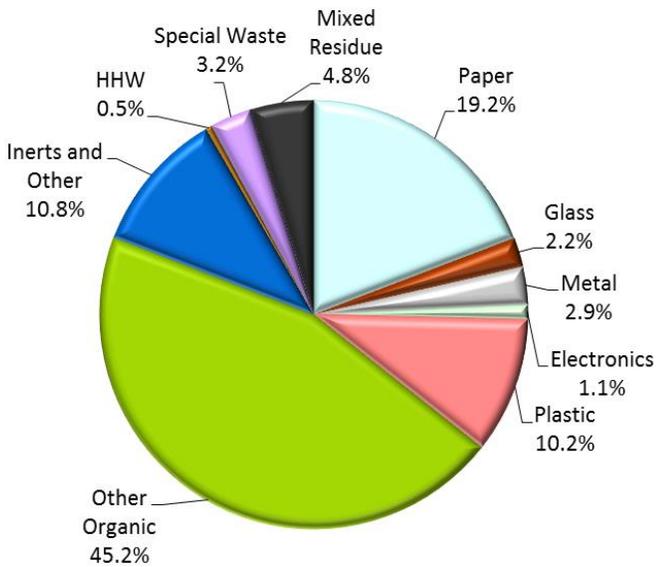
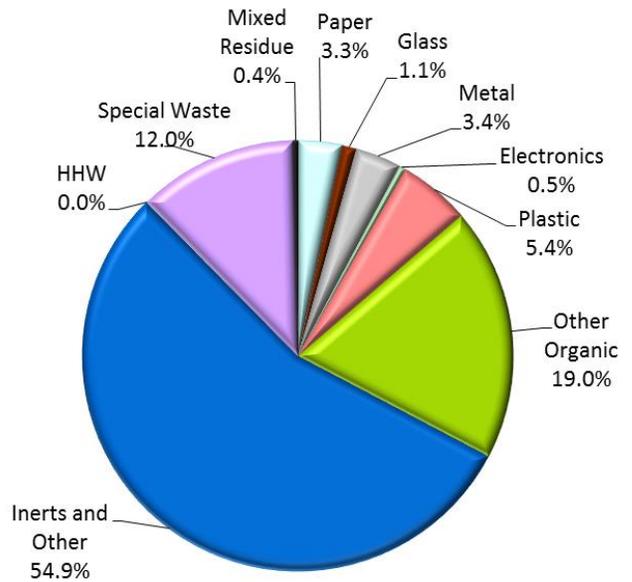


Figure ES-4: Material Classes in the Self-Hauled Disposed Waste Stream



Numbers may not total exactly due to rounding.

The above pie charts were constructed using sector percentage data obtained from the 2014 vehicle surveys applied to 2014 composition results. See *Special Note Regarding Sector Percentages* on page 3 of the [2014 report](#) for a further explanation of the sector percentage issues. See Table ES-3 for a listing of *material types* in each **Material Class**.

Table ES-2: Ten Most Prevalent Material Types in California’s Overall Disposed Waste Stream

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food	18.1%	18.1%	5,591,179
Lumber	11.9%	30.0%	3,676,710
Remainder/Composite Paper	7.5%	37.6%	2,325,048
Bulky Items	4.4%	42.0%	1,365,340
Remainder/Composite Organic	4.3%	46.3%	1,323,465
Textiles	4.0%	50.3%	1,234,711
Other Miscellaneous Paper	3.9%	54.2%	1,215,919
Leaves and Grass	3.8%	58.0%	1,172,925
Uncoated Corrugated Cardboard	3.1%	61.1%	964,942
Prunings and Trimmings	3.1%	64.3%	962,262
Total	64.3%		19,832,501

The above table was constructed using sector percentage data obtained from the 2014 vehicle surveys applied to 2014 composition results. See *Special Note Regarding Sector Percentages* on page 3 of the [2014 report](#) for a further explanation of the sector percentage issues. Any differences between cumulative percent figures and the sum of estimated percent figures are due to rounding. Note that the material type *remainder/composite paper* includes such items as waxed corrugated cardboard, aseptic packages, paper towels, and photographs. *Remainder/composite organic* includes leather items, cork, garden hoses, carpet padding, and diapers. See Appendix B: List and Definitions of Material Types for definitions of the different material types

Table ES-3: Composition of California's Overall Disposed Waste Stream by Material Type

Material	Est. Using 2014 Sector Percentages			Est. Using 2008 Sector Percentages		
	Estimated Percent	+ / -	Estimated Tons	Estimated Percent	+ / -	Estimated Tons
Paper	17.4%		5,367,734	16.8%		5,176,996
Uncoated Corrugated Cardboard	3.1%	0.6%	964,942	3.7%	0.8%	1,152,480
Paper Bags	0.2%	0.0%	70,627	0.2%	0.0%	62,259
Newspaper	1.2%	0.4%	372,966	0.9%	0.3%	285,517
White Ledger Paper	0.4%	0.1%	121,637	0.4%	0.2%	132,219
Other Office Paper	0.3%	0.1%	103,845	0.3%	0.1%	89,177
Magazines and Catalogs	0.6%	0.1%	178,166	0.5%	0.1%	158,407
Phone Books and Directories	0.0%	0.0%	14,583	0.0%	0.0%	13,590
Other Miscellaneous Paper	3.9%	0.4%	1,215,919	3.8%	0.5%	1,164,676
Remainder/Composite Paper	7.5%	0.6%	2,325,048	6.9%	0.6%	2,118,672
Glass	2.5%		764,162	2.5%		770,530
Clear Glass Bottles and Containers	0.9%	0.1%	263,439	0.7%	0.1%	225,563
Green Glass Bottles and Containers	0.2%	0.1%	71,382	0.2%	0.1%	57,935
Brown Glass Bottles and Containers	0.4%	0.1%	111,432	0.3%	0.1%	104,175
Other Glass Colored Bottles and Containers	0.0%	0.0%	12,185	0.0%	0.0%	11,843
Flat Glass	0.1%	0.1%	42,481	0.2%	0.2%	56,510
Remainder/Composite Glass	0.9%	1.0%	263,243	1.0%	1.3%	314,504
Metal	3.1%		957,027	3.1%		964,502
Tin/Steel Cans	0.7%	0.1%	204,449	0.6%	0.2%	186,422
Major Appliances	0.2%	0.2%	50,251	0.1%	0.1%	29,000
Used Oil Filters	0.0%	0.0%	1,255	0.0%	0.0%	1,098
Other Ferrous	0.8%	0.2%	248,593	0.9%	0.3%	267,932
Aluminum Cans	0.2%	0.0%	47,233	0.1%	0.0%	42,696
Other Non-Ferrous	0.5%	0.2%	157,478	0.6%	0.3%	181,009
Remainder/Composite Metal	0.8%	0.2%	247,768	0.8%	0.3%	256,344
Electronics	0.9%		273,878	0.7%		230,498
Brown Goods	0.3%	0.2%	84,415	0.2%	0.1%	75,142
Computer-related Electronics	0.1%	0.1%	45,648	0.1%	0.1%	41,339
Other Small Consumer Electronics	0.2%	0.1%	68,932	0.2%	0.1%	54,457
Video Display Devices	0.2%	0.1%	74,883	0.2%	0.1%	59,560
Plastic	10.4%		3,215,943	10.4%		3,203,542
PETE Containers	0.6%	0.1%	197,202	0.6%	0.1%	179,529
HDPE Containers	0.5%	0.1%	139,189	0.4%	0.1%	136,693
Miscellaneous Plastic Containers	0.6%	0.1%	173,738	0.5%	0.1%	165,343
Plastic Trash Bags	1.2%	0.1%	383,130	1.2%	0.2%	379,315
Plastic Grocery and Other Merchandise Bags	0.5%	0.1%	157,395	0.4%	0.0%	128,298
Non-Bag Commercial and Industrial Packaging Film	0.3%	0.1%	83,192	0.3%	0.1%	102,661
Film Products	0.2%	0.3%	73,394	0.4%	0.5%	118,895
Other Film	1.8%	0.2%	543,476	1.7%	0.2%	523,211
Durable Plastic Items	2.2%	0.5%	682,812	2.2%	0.5%	671,213
Remainder/Composite Plastic	2.5%	0.3%	782,415	2.6%	0.5%	798,384

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding. More detailed composition tables can be found in Appendix D: Expanded Statewide Waste Characterization Tables

The above table presents the 2014 sector percentages applied to the 2014 waste composition data and, for comparison, the sector percentages obtained in the 2008 Statewide Waste Characterization Study applied to the 2014 waste composition data. See *Special Note Regarding Sector Percentages* on page 3 of the [2014 report](#) for a further explanation of the sector percentage issues.

Table ES-3 (continued): Composition of California's Overall Disposed Waste Stream by Material Type

Material	Est. Using 2014 Sector Percentages			Est. Using 2008 Sector Percentages		
	Estimated Percent	+ / -	Estimated Tons	Estimated Percent	+ / -	Estimated Tons
Other Organic	37.4%		11,558,054	34.4%		10,614,389
Food	18.1%	1.6%	5,591,179	16.5%	1.8%	5,083,364
Leaves and Grass	3.8%	1.2%	1,172,925	3.4%	1.3%	1,048,621
Prunings and Trimmings	3.1%	1.0%	962,262	2.8%	1.0%	868,512
Branches and Stumps	1.7%	0.9%	528,493	1.8%	1.0%	544,872
Manures	0.6%	0.6%	174,808	0.7%	0.7%	214,875
Textiles	4.0%	0.7%	1,234,711	3.6%	0.7%	1,114,224
Carpet	1.8%	0.6%	570,212	2.0%	0.7%	605,950
Remainder/Composite Organic	4.3%	0.5%	1,323,465	3.7%	0.5%	1,133,971
Inerts and Other	19.9%		6,132,838	23.5%		7,265,537
Concrete	1.2%	0.4%	373,185	1.3%	0.5%	415,287
Asphalt Paving	0.2%	0.3%	70,269	0.4%	0.7%	130,364
Asphalt Roofing	0.7%	0.4%	223,236	0.8%	0.6%	251,150
Lumber	11.9%	1.8%	3,676,710	13.7%	2.0%	4,229,070
Gypsum Board	1.1%	0.4%	327,002	1.3%	0.5%	401,684
Rock, Soil and Fines	2.4%	0.7%	750,357	2.9%	1.0%	896,129
Remainder/Composite Inerts and Other	2.3%	0.7%	712,079	3.1%	1.1%	941,853
Household Hazardous Waste (HHW)	0.4%		109,568	0.3%		78,461
Paint	0.2%	0.1%	48,951	0.1%	0.1%	31,414
Vehicle & Equipment Fluids	0.0%	0.0%	219	0.0%	0.0%	88
Used Oil	0.0%	0.0%	1,410	0.0%	0.0%	939
Batteries	0.0%	0.0%	11,887	0.0%	0.0%	10,894
Remainder/Composite Household Hazardous	0.2%	0.1%	47,102	0.1%	0.1%	35,125
Special Waste	5.0%		1,558,079	5.8%		1,803,511
Ash	0.1%	0.0%	16,138	0.1%	0.1%	17,409
Treated Medical Waste	0.1%	0.2%	34,909	0.1%	0.1%	30,645
Bulky Items	4.4%	1.3%	1,365,340	5.1%	1.4%	1,574,149
Tires	0.1%	0.1%	39,393	0.1%	0.1%	39,308
Remainder/Composite Special Waste	0.3%	0.3%	102,299	0.5%	0.4%	142,000
Mixed Residue	3.0%		926,996	2.5%		756,314
Totals	100.0%		30,864,279	100.0%		30,864,279
Sample Count	754			754		

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

More detailed composition tables can be found in Appendix D: Expanded Statewide Waste Characterization Tables

The above table presents the 2014 sector percentages applied to the 2014 waste composition data and, for comparison, the sector percentages obtained in the 2008 Statewide Waste Characterization Study applied to the 2014 waste composition data. See *Special Note Regarding Sector Percentages* on page 3 of the [2014 report](#) for a further explanation of the sector percentage issues.

Key Findings

- Based on 2014 sector percentages, the franchised residential sector (single-family plus multi-family) generates 47 percent and the franchised commercial sector generates 39 percent of the disposed waste stream statewide. The self-hauled sector generates the remaining 14 percent.
- Organic materials such as food scraps, yard waste, and lumber continue to be a large part of the waste disposed in California landfills. The largest **Material Class** is **Other Organic**, which accounts for more than one-third of the statewide disposed waste stream (37 percent using 2014 sector percentages and 34 percent using 2008 sector percentages). This class of materials includes food waste, yard waste, carpet, and textiles. *Food* is the most prevalent *material type* in the entire disposed waste stream (more than 16 percent using either 2014 or 2008 sector percentages).
- The next largest **Material Class** is **Inerts and Other** at almost 20 percent of all disposal using 2014 sector percentages and 24 percent using 2008 sector percentages. More than half of this class is *lumber* (the second-largest *material type* disposed overall); other material types in this class include *concrete*, *gypsum board*, and *rock soil and fines*.
- Taken together, materials suitable for composting, mulch, anaerobic digestion, or other organics recovery strategies account for about 40 percent of California's disposed waste stream. This includes food, vegetative materials, clean wood materials, and compostable paper. Table 33 and Table 34 summarize the sources of these materials.
- **Paper** is the third-largest **Material Class**, at approximately 17 percent of disposed waste using either 2014 or 2008 sector percentages. *Other miscellaneous paper* is the most prevalent recyclable material, using either 2014 or 2008 sector percentages.

Comparison with 2008 Statewide Waste Characterization Study

The following comparisons apply to the results estimated using the 2014 sector percentages applied to the 2014 composition data.

- The 2014 study was conducted during an extraordinary time for California: The state was slowly recovering from the most significant economic downturn in decades and is also experiencing one of the worst droughts in its history.
- The proportions of the waste stream contributed by the franchised commercial and franchised residential sectors have changed noticeably. Franchised commercial disposal decreased from 50 percent to 39 percent while franchised residential disposal increased from 30 percent to 47 percent.

- The largest change in the overall waste stream composition was a decrease from 29 percent to 20 percent in the **Inerts and Other** class. Disposal of nearly every **Inerts and Other** material decreased between the two studies.
- In the franchised commercial sector, disposal of **Paper, Metal, and Inerts and Other** each decreased. **Inerts and Other** decreased by approximately 10 percentage points.
- Overall per capita disposal decreased from 1.06 to 0.81 tons per person per year (calculated by dividing tons of all disposed municipal solid waste by total population). Residential per capita disposal increased from 0.32 to 0.38 tons per resident per year (calculated by dividing all disposed franchised residential waste by total population).