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All Materials Recycling Study: Total Solid Waste

Prepared for the
DELAWARE SOLID WASTE AUTHORITY

FINAL REPORT

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INTRODUCTION

The Delaware Solid Waste Authority (DSWA) has been documenting materials recovery activity throughout the State for over two decades. In 2005 DSWA contracted with DSM Environmental Services, Inc. (DSM) to conduct a comprehensive "on-the-ground" survey of Delaware recycling activity to quantify non-residential recycling in Delaware. This effort, detailed in the June 2006 report "*State of Delaware Assessment of Commercial and Industrial Recycling Activity*" (commonly referred to as the "Bridge Report) provided the most complete inventory of non-hazardous solid waste materials recovery to date, and calculated a series of recycling rates for Delaware based on all types of materials recovery activities.

The methodology developed through this effort was refined and the materials inventory narrowed to document only municipal solid waste (MSW) recycling activities subsequent to the 2006 report. This allowed the *Recycling Public Advisory Council,* on which DSWA sits, to report a municipal solid waste (MSW) recycling rate for Delaware each year. Data from both these efforts – the 2006 Report and the subsequent Annual MSW Recycling Reports – were used to develop the 2010 *Statewide Solid Waste Management Plan, Moving toward Zero Waste* (Plan). The Plan was adopted on April 22, 2010, establishing goals to maximize recycling and diversion of materials.

DSM began an effort in 2014 to update all recycling data referenced in the Plan to measure progress toward achieving the diversion goals made since adoption of the Plan. Over the past year DSM has collected information on all types of solid waste materials management activity, including recycling, diversion for energy recovery and other beneficial uses, and disposal. This report presents the findings of these efforts, including calculating a new recycling rate for all materials recovery, or Total Solid Waste, which has become the term to differentiate MSW recycling activity and the MSW Recycling Rate from this effort.

These data can also be combined with the results from solid waste characterization at DSWA facilities to present current recovery rates by material type and to determine where the greatest opportunities may lie for further materials diversion or alternative management strategies.

BASE YEARS

Data used in the Plan was primarily from calendar year (CY) 2008, with some C&D data dating back to 2005 and 2006. DSM began to collect data on non-MSW materials recycled during the CY 2013 MSW Recycling survey. DSM then updated all CY 2013 data with CY 2014 data as available, and attempted to use CY 2014 data for all material categories. In some cases CY 2013 data was used because the reporter did not typically report and therefore DSM did not ask that they report twice.

METHODOLOGY

DSM reviewed all material categories referenced in the Plan, and included in the June 2006 "Bridge" Report, to determine which material categories should be included, and whether any should no longer be included, and the reason(s) why. For example, DSM recognized that slag recovery would no longer be accounted for with the departure of a major steel producer from Delaware.

DSM also followed the same methodology as in the original 2006 Bridge Report and subsequent reporting used for the Plan.

The methodology of included and excluded waste types, accounting for imported and exported wastes, and the survey method to identify and document waste management activities is described below.

INCLUDED WASTE TYPES

The assessment concentrated on solid wastes only. No gaseous or liquid wastes are included, although solid residuals from the treatment of liquid and gaseous wastes are included to the extent that the materials are beneficially reused or recycled, and can be quantified (as described below).

Both infectious wastes and Sub-title C (of RCRA) hazardous wastes are excluded, although DSM did attempt to include conditionally exempt waste streams, or "universal wastes" such as:

- Waste oil;
- Oil filters;
- Dry cell batteries (i.e. non-lead acid batteries);
- Lead acid batteries;
- Electronic devices such as cell phones, computer monitors, hard drives and related components; and,
- Mercury containing wastes such as fluorescent tubes and electronic switches (to the degree that they can be quantified at the processing stage) as well as CRT screens.

POTENTIAL FOR OFF-SITE DISPOSAL

Only those materials which would be disposed off-site if they were not beneficially reused or recycled, and therefore could potentially be delivered to a DSWA landfill, are included in the assessment. Examples include:

- Dairy manure, which is typically applied on adjacent agricultural fields for its nutrient value, is excluded, but excess poultry litter or in some cases horse manure, which is generated in such large quantities that all of it cannot be applied on adjacent agricultural fields without increasing nutrient releases to ground and surface waters, is included.[1] [2]

- Wood chips and stumps that are disposed on site are excluded while wood waste, including trees and stumps, that must be removed from the site is included in cases where it is mulched or further processed for resale.[3]

- Plastic wastes reused on-site in a manufacturing process are excluded, but plastic wastes sent off-site for reclamation are included.

[1] *Only that portion of poultry litter which is accounted for under the Nutrient Management programs and therefore not applied to adjacent agricultural lands or within 10 miles of generation is included.*
[2] *In most cases horse manure would be managed on-site and not be included, but horse manure generated in very large quantities that would need to be taken off-site for disposal but instead is managed through composting is included.*
[3] *Tree waste managed by tree companies that do not process their own material is included but those that process and then sell their material or that manage the material in some other way that does not include use of a mulch or compost site are excluded.*

- Pallets that are reused on-site are excluded, but pallets that are shipped off-site for reuse or rebuilding are included.

IMPORT AND EXPORT

In all cases the assessment ***excludes*** solid wastes that are being imported into Delaware for either recycling or disposal. Construction and demolition (C&D) wastes that are generated in Pennsylvania or New Jersey but delivered to the Revolution Recovery facility or to any asphalt or concrete processing plant in Delaware are excluded. And, petroleum contaminated soils imported from New Jersey (or other states) for thermal treatment at the Clean Earth facility in Wilmington, and scrap steel generated outside of Delaware but delivered to any scrap dealer or processor in Delaware are excluded.

Similarly, the study ***includes*** quantities of material generated in Delaware but exported for disposal or for recycling. For example, solid waste that is hauled out of state for disposal (to the degree it can be tracked and quantified) as well as recycled materials (e.g., paper and cardboard) backhauled or transported from large generators in Delaware directly to out-of-state warehouses or recyclers are included (e.g., grocery stores that backhaul cardboard to an out-of-state distribution facility for processing, or printing facilities that generate large amounts of scrap paper that broker directly to an out-of-state facility).

SURVEY METHOD

DSM also updated the current and original contact databases used to solicit data and reports on recycling activity. While the annual MSW recycling activity reporting has resulted in the updating of contact names, telephones and e-mails addresses, the construction industry and industrial facilities have not been regularly reporting, and therefore the contacts were not current. In addition, DSM recognized that some large corporations or facilities may have left the state and some new ones may have relocated in Delaware. To address this, DSM researched economic data and developed a list of the largest employers in the State. All of the largest employers not already in the database were added to the database.

Finally, DSM researched member organizations including: the Delaware Contractors' Association; Associated Builders and Contractors of Delaware; Delaware Grounds Maintenance Association; the Delaware Landscapers Association; and, the Delaware Manufacturer's Association to identify missing companies and find contact names.

Over 300 contacts were initially targeted; of which MSW recycling only (where there was no material reported that might not be considered MSW) encompassed about 175 of these contacts. Because some of the MSW recycling contacts have become accustomed to reporting on only a portion of their materials (e.g., scrap metal recyclers reporting on appliances and aluminum cans and not on other types of ferrous and nonferrous metals recycling), some facilities had to be re-contacted after they submitted their annual report so that DSM could request more detailed data on their materials recycling activities.

For construction and demolition waste recycling, DSM contacted many businesses for the first time to ensure that asphalt, concrete and other construction materials recycling that did not flow through licensed haulers and/or did not use the new Revolution Recovery facility were accounted for.

DSM performed outreach using both internet mailing and direct telephone calls. In most cases, DSM contacted those companies that were first time contacts by telephone to introduce the broader survey and the need for data.

DSM also worked with DNREC to create letters of introduction to the expanded survey and referenced the new State recycling reporting requirement which does not specify which types of materials are covered.

DSM modified the MSW recycling survey form for reporting and did blanket and individual e-mails to all contacts. DSM made the forms available on the DSM website, and included the opportunity for manual and electronic reporting using *Adobe Forms Central* for the electronic reporting.

For the larger businesses, and in those cases where the business was a first time reporter, and their data important to the total material accounted for, DSM offered to make an on-site visit to explain the project, the use of the data and the specific data and supporting information that was necessary to report. Ultimately most data were collected by telephone and e-mail and then submitted to DSM electronically.

In all cases, DSM requested data on materials recovery by weight and specific material type and asked for the end use of the material. Confirmation of the end use was necessary to ensure material was not double counted and that the management activity would be classified as some type of beneficial use and not disposal.

In some cases, material conversion factors (densities by cubic yard or other unit) were used because weights were not available. For these conversions, if the generator could not supply a reliable materials density or weight per unit, US EPA, or state material densities were used and referenced in the dataset. Oregon was one state referenced.

DATA MANAGEMENT

DSM entered all data into an expanded data model that groups generators or businesses by main material types. The following generator categories were used to group data:

- ***Recycling Businesses*** – This is a broad category describing organizations that operate for the primary purpose of recovering and ultimately marketing materials processed. This includes materials recovery facilities, paper brokers and packers, document shredding (destruction) businesses, scrap metal and electronic recyclers, and tire recyclers. Most of these businesses already report annually for the MSW recycling report.

- ***Green and Wood Waste*** –A substantial effort was made to expand this contact list and confirm this data set as part of the Yard Waste Study (see separate report – Delaware Yard Waste Study, October 2015). This list includes all end users of yard waste, trees and branches, land-clearing debris and clean wood waste that is mulched.

- ***Retailers and Wholesalers*** – This includes grocers and department stores, including Walmart's and Best Buys as well as chains such as Wawa's and PepBoys. This also includes distributors and other wholesalers who may backhaul pallets, cardboard, shrink wrap or other packaging materials. Almost all of this material is covered in the Annual MSW Recycling Reports.

- ***Banks and Institutions*** – This includes banks which have a large presence in Delaware and therefore may have contracts for paper recycling and document destruction outside of those that report directly, as well as hospitals and educational institutions.

- ***Solid Waste Haulers*** – Almost all haulers of MSW also offer recycling services and for this report, DSM asked that they report on all types of material they collected including single stream, cardboard, any separate paper, yard waste, construction wastes (for recycling) and any other materials diverted from disposal.

- ***Handlers of Universal Waste*** – This includes companies such as Safety Kleen, and competitors that collect waste oil, solvents, and/or mercury containing devices such as ballasts.

- ***Manufacturers*** – All manufacturers suspected to generate large quantities of recyclable materials were asked to report for this year.

- ***Agricultural Waste Generators*** – This category includes chicken processing wastes, as well as manures and other materials sent for off-site composting or nutrient management.

- ***Construction and Demolition Firms*** – This category includes large construction, demolition and site preparation/earth moving companies, as well as those that operate processing facilities for C&D materials, such as asphalt plants, concrete crushers and processors, and C&D sorting operations.

- ***Utilities*** – Utility companies that operate generating facilities in Delaware were researched and data on fly and bottom ash management solicited.

- ***Wastewater Treatment Facilities –*** Management of biosolids for beneficial use such as land application or composting were researched, and both municipal and regional wastewater treatment facilities as well as industrial facilities bio-solids were accounted for.[4]

MATERIAL CATEGORIES

Materials were then entered into material categories as described below in Table 1. Table 1 also provides information as to whether materials are included in the Annual RPAC MSW Recycling Report. Check marks in the last three columns "EPA's MSW", "Industrial" and "C&D" identify which waste (or recycling) stream the material is most likely to be generated from. In the case where a material is classified as both "EPA's MSW", and therefore included in the RPAC Report, and as "Industrial" (e.g. industrial process waste) or "C&D" (e.g. construction and demolition waste), and therefore excluded from EPA's MSW, the items excluded are noted in the descriptor column to the right.

For example, all OCC (old corrugated containers) is included in the MSW Recycling Rate, except for OCC generated during construction and renovation activities, which are considered construction and demolition (C&D) waste and not included as EPA's MSW. Another example is tree waste which is included as part of the MSW Recycling Rate

[4] *DNREC has not provided detailed data on the source of permitted activities but instead provided data in aggregate making it difficult for DSM to verify that all bio-solids that are being beneficially reused are counted, and that no double counting has occurred.*

except when it is managed with other C&D materials. In addition, any tires, wood or other materials (such as plastics) that are used for fuel are excluded in the MSW Recycling Rate.

TABLE 1 *– Material Categories and Definitions Included in Reporting on MSW Recycling and on All Other Materials Recycling/Diversion*

	Material Category	*Definition*	*Excluded from MSW*	Delaware Generators of Recycled Materials		
				MSW	*Industrial*	*C&D*
PAPER AND NONPAPER PACKAGING MATERIALS	**PAPER AND PAPER PACKAGING**					
	ONP (old newspapers)	All newspapers and glossy inserts, and all items made from newsprint, such as free advertising guides, election guides, plain news packing paper, stapled college schedules of classes, and tax instruction booklets.	*Print overruns*	√	√	
	OCC (old corrugated containers)	Corrugated boxes (including cardboard containers, computer packaging cartons, and sheets and pieces of boxes and cartons) and Kraft paper bags include paper grocery bags, un-soiled fast food bags, and department store bags) and heavyweight sheets of Kraft packing paper.	*Corrugated containers in C&D loads*	√		√
	Mixed Paper (1)	All types of paper including magazines and catalogs, phone books and directories, junk mail, chipboard and all other recyclable paper packaging, and high-grade paper (such as uncolored and or lightly colored bond, rag, printer/copier or stationary grade paper) of which most is reported by document destruction companies or health care or financial institutions.	*Print overruns and over issue publications*	√	√	
	NON PAPER PACKAGING					
	Aluminum Cans and Food Containers	Food or beverage containers made mainly of aluminum including aluminum soda or beer cans, and some pet food cans. This subtype does not include bimetal containers with steel sides and aluminum ends.		√		
	Mixed Glass (bottles)	Clear, green, amber or other colored glass beverage and food containers. Examples include whole or broken soda, beer, wine and liquor bottles, fruit juice bottles, peanut butter, mayonnaise and other food containers and jars.		√		
	Ferrous/Bimetal Cans	Rigid containers made mainly of steel and other ferrous metals and may be used to store food, beverages, and a variety of other household and consumer products including empty spray paint and other aerosol containers, and bimetal containers with steel sides and aluminum ends.		√		
	Plastic Bottles and Containers	Bottles, Jars, Containers and Tubs including clear or colored PETE (polyethylene terephthalate), natural and colored HDPE (high-density polyethylene) and all other plastic (3-7) bottles, jars and containers that have the potential to be recycled. This includes soft drink and water bottles, some liquor bottles, cooking oil bottles, milk and juice containers, laundry, detergent and shampoo bottles, food jars and containers, yogurt and take out containers, and large jugs (well drained) used for vehicle and equipment fluids. This also includes clamshell, thermoform and press mold plastic packaging that has the potential for recycling.		√		
	Shrink Wrap/ Recoverable Film (2)	Film that can be recycled, and has not been greatly contaminated by other materials during its use. Examples include clean, recyclable plastic film, such as bread, grocery, newspaper, and dry cleaner plastic film bags, film packaging or wrapping, and stretch wraps used for shipping and containerizing pallets.	*Pre-consumer plastic waste.*	√	√	√
	Plastic Retail Bags	Plastic retail and grocery sacks collected through retail collection sites.		√		
	Mixed Plastics/Other Plastics	Plastic products such as coat hangers, plastic toys and furniture, other non-durable plastics and non-food plastic packaging as well as mixed plastic packaging reported.	*Pre-consumer plastic waste.*	√	√	
	Pallets, mulched and other	Unpainted wood pallets, crates, and packaging made of lumber/engineered wood.	*Rebuilt or reused pallets. Only pallets ground for mulch are included. Use in fuel is excluded.*	√	√	√
	Single Stream or Mixed Recyclables	Recyclables reported as collected as a single stream or mixture of different categories of recyclables.		√		

TABLE 1 *– Material Categories and Definitions (continued)*

	Material Category	*Definition*	*Excluded from MSW*	Delaware Generators of Recycled Materials		
				MSW	*Industrial*	*C&D*
SPECIAL WASTES	**VEHICLE WASTE**					
	Oil Filters	Oil filters from vehicles.		√		
	Lead Acid batteries	Lead-acid batteries from passenger cars, trucks, and motorcycles and small equipment when reported separately.	*Batteries from large equipment, boats, heavy duty trucks and tractors, and from industrial applications.*	√	√	
	Tires	Tires from trucks, automobiles, motorcycles, heavy equipment, and bicycles. For tires on rims, an attempt to estimate the portion that is rubber tire vs. the ferrous rim should be made.	*Bus and heavy farm and construction equipment tires; tire derived fuel.*	√	√	
	OTHER SPECIAL WASTES					
	Carpet	Any material consisting mainly of carpet or carpet padding including flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material as well as plastic, foam, felt, and other materials used under carpet to provide insulation and padding.		√		√
	Mattresses	Mattresses and box springs processed for reclaiming the components including steel, foam, wood and fibers.		√		
	Textiles	Items made of thread, yarn, fabric, or cloth including clothes, fabric trimmings, draperies, and all natural and synthetic cloth fibers.		√		
	Florescent Bulbs	Mercury containing bulbs and ballasts recycled.		√		
	Other Batteries	Consumer batteries of various sizes and types. Examples include flashlight, small appliance, watch, and hearing aid batteries.				
	Electronics/Electronic Goods	Large and small electronic goods including microwaves, stereos, VCRs, DVD players, radios, and non-CRT televisions (such as LCD televisions); as well as computer related electronics such as processors, mice, keyboards, laptops, disk drives, printers, modems, and fax machines; and other small consumer goods such as PDAs, cell phones, phone systems, computer games and other electronic toys, portable CD players, camcorders, and digital cameras.		√		
	Other Glass	Glass windshields, CRT Glass or other non container glass that can be recycled.		√		
ORGANIC WASTES	**AGRICULTURAL PROCESSING, FOOD AND OTHER ORGANIC WASTES**					
	Fats, Oils, Grease	Liquid or solid, composed primarily of fat, oil, and grease from animal or vegetable source		√		
	Food Waste	Food material resulting from the processing, storage, preparation, cooking, handling, or consumption of food.		√		
	Poultry Litter	Includes poultry manure,			√	
	Poultry Waste	Includes poultry carcasses,			√	
	Food Processing Waste	All food remains from food manufacturing and processing including brewery wastes			√	
	Biosolids	Solids portion of industrial and municipal wastewater treatment residue that must be removed after treatment process. Includes some liquids.			√	
	Clean Wood/Mulch	Wood furniture and products that are brought off site and ground for mulch, or ground for biomass.	*Use as fuel is excluded from MSW.*	√	√	√
	GREEN WASTE					
	Leaf and Yard Waste	Plant material from public or private landscapes that is no bigger than 4 inches in diameter. Examples include leaves, grass clippings, sea weed, and plants, prunings, shrubs, and small branches with branch diameters that do		√		
	Tree Waste	Woody plant material, branches, and stumps that exceed four inches in diameter from any public or private landscape.		√		√
	Land clearing Debris	Trees, stumps and branches from trees removed for land clearing that are mulched or composted.				√

TABLE 1 – *Material Categories and Definitions (continued)*

	Material Category	*Definition*	*Excluded from MSW*	Delaware Generators of Recycled		
				MSW	*Industrial*	*C&D*
METALS	**METALS**					
	Aluminum	Any item made of aluminum other than cans including aluminum window frames, aluminum siding, and aluminum foil.	*Nonferrous metals from industrial or construction sources, ferrous metals from transportation equipment or C&D waste. Note that Delaware only counts appliances as part of MSW recycling*		√	
	White Goods / Appliances	Metal appliances including refrigerators and air conditioners (with Freon removed), as well as stoves, water coolers, water heaters and other small (mostly) metal appliances.		√		
	All other Ferrous Metals	Ferrous metals (iron and steel) in furniture, tires, and miscellaneous durables, except for appliances as included above.		√	√	√
	All other Nonferrous Metals	Other nonferrous metals (e.g., lead, copper, zinc) are found in durable products such as furniture or consumers goods other than appliances and lead acid batteries which are tracked separately. Examples include copper wire, shell casings, and brass pipe.		√	√	√
	All other Metals	Metals recycled which could not be broken into the categories above.		√	√	√
C&D WASTE	**CONSTRUCTION AND DEMOLITIONWASTES**					
	Asphalt	Asphalt Roofing including composite shingles and other roofing material made with asphalt (i.e. asphalt shingles and attached roofing tar and tar paper). Also asphalt paving materials that are taken off-site and processed and then reused.	Excluded from MSW		√	√
	Concrete and Brick	Concrete and brick removed from C&D sites and processed or otherwise used for construction materials.	Excluded from MSW			√
	Land clearing (See "Green Waste")		Excluded from MSW			
	Soils and Stones	Soils and aggregate materials contaminated with petroleum products or other potentially hazardous wastes are removed off site for thermal treatment and then reused.	Excluded from MSW		√	√
	Clean Wood	All untreated and unpainted wood, including clean lumber and engineered wood products such as oriented strand board, medium density fiberboard, and plywood.	Excluded from MSW, except for non C&D clean wood			√
	Gypsum Board	Clean cuttings, scraps and demolition gypsum board also known as sheetrock or wall board.	Excluded from MSW			√
	Painted and Treated Wood	Boards, fencing, and other construction wood that is painted, stained or otherwise treated including wood siding, piers, and docks.	Excluded from MSW			√
	Mixed C&D	Any C&D materials that are recovered for recycling but that are reported as mixed materials instead of by separate commodities.	Excluded from MSW			√
INDUSTRIAL WASTE	**INDUSTRIAL WASTE**					
	Mixed Plastics	Plastic wastes from a manufacturing process that are taken offsite for reclamation.	On-site reuse or reclamation is excluded.		√	
	Biosolids (Wet Tons)	These are typically from waste water treatment plants and referred to as "sludge" that is land applied or composted. Figures were obtained from DNREC on dry tons, and then corrected to wet tons based on the moisture content reported.	Excluded from MSW		√	
	Bottom and Fly Ash	Bottom ash is the residue remaining in the bottom of the combustion chamber after the combustion of fuel or waste, while fly ash are the particles removed from gases by use of electrostatic precipitators or fabric filters prior to the release from the stack. Fly ash is often used in cement production, but in Delaware in 2014 both were used for the construction of the Phase II cell at the Indian River Landfill. In the past, they had been used to stabilize municipal solid waste with the resultant mix used as a landfill cover material at DSWA facilities.	Excluded from MSW		√	

The spreadsheet model used carries forward the totals calculated from prior years so that numbers can be compared year to year by material type. This also enables some check on both figures reported as well as end uses of materials year to year.

The totals for each generator category are also carried forward by material type to tabulate totals for each material type.

The final database was then cross checked to ensure material flow was documented and totals represented material that was counted only once. Data were then separated by generator type into residential or commercial for all MSW materials. Finally, totals by material category were linked to data tables that would match those created for the Plan. The results are discussed below.

RECYCLING SURVEY RESULTS

DSM achieved high response and participation rates in all categories of MSW and non-MSW materials. While DSM used the same categories as shown in the Plan (and found in the *Plan* Appendix Table A-1), a few categories were added for CY 2014 to report on new materials recycled (e.g. mattresses, other batteries, and construction and demolition related materials), or to illustrate the growth in materials recycling of a particular material (e.g. plastic retail bags). The original table (Table Appendix A-1 to the Plan) can be found in Appendix A-1 of this report for reference.

Results for CY 2014 are shown in Table 2 (on the next page) and are compared against the quantities reported in the Plan (Appendix Table A-1).

In comparing the Current Recovery (CY 2014) and Plan (CY 2008) Recovery, the original sources used for CY 2008 included data from three reports:

- Table note (1) source "Eighth Annual Report of the Recycling Public Advisory Council, November 2009", Authored by: The Recycling Public Advisory Council.

- Table note (2) is also from "Eighth Annual Report of the Recycling Public Advisory Council, November 2009", Authored by: The Recycling Public Advisory Council with data from "State of Delaware Assessment of Municipal Solid Waste Recycling for Calendar Year 2008" by DSM Environmental Services, July 2009.

- Table note (3) estimates were made from the "Assessment of Commercial and Industrial Recycling Activity" Final Report ("Bridge Report"), July 2006. Prepared for DSWA.

Also note that packaging and paper was originally reported to DSM as mixed recyclables or a single stream in 2008, but then adjusted to illustrate an estimated material composition, net of contamination, and rounded. This was not done for this report, and instead the single stream material is reported as a total which reflect deliveries to single stream processing facilities from Delaware generators only.[5]

[5] *Roughly 37,700 tons of single stream material was originally reported as recycled from the residential and commercial sector.*

***TABLE 2** – Comparison of CY2008 Solid Waste Plan Recovery with Current Recovery (CY 2014)*

	Material Category	RECOVERY (CY '08) Total Solid Waste (Tons)	RECOVERY (CY '14)[2] MSW Res (Tons)	MSW Comm (Tons)	Non-MSW (tons)	Total Solid Waste Total (Tons)
PAPER	ONP (old newspapers)	11,200	200	1,547		1,747
	OCC (old corrugated containers)	76,500	462	60,987		61,449
	Mixed Paper	30,300	23	24,508		24,531
PACKAGING	Mixed Glass (bottles)	11,410	0	4		4
	Plastic Bottles and EPS	1,330	12	171		183
	Aluminum Cans	360	2,263	251		2,514
	Pallets, mulched and other	20,900	0	3,828	20,669	24,497
	Shrink Wrap/Recoverable Film (1)	2,000	0	757		757
	Retail Bags (2)	0	251			251
SINGLE STREAM	"Mixed recyclables": collected mixture of different categories of recyclables. (3)	0	88,539	31,252		119,791
	SUBTOTAL, PACKAGING:	154,000	91,751	123,305	20,669	235,725
VEHICLE WASTE	Oil Filters (4)	800	354	89		443
	Lead Acid Batteries	2,400	2,388	597		2,984
	Tires (5)	9,960	1,492	373	3,344	5,209
SPECIAL WASTES	Carpet	65	0	98		98
	Textiles (6)	3,310	3,413	359		3,772
	Fluorescent Bulbs	35	0	16		16
	Other Batteries (7)	0	280	31		311
	Mattresses (8)	0	225	0		225
	Electronics / Electronic Goods	1,880	992	1,094		2,086
AG, FOOD, ORGANIC WASTES	Fats, Oil, Grease	8,400	0	3,640		3,640
	Food Waste	5,700	25	17,356		17,381
	Poultry Litter (9)	77,700			57,900	57,900
	Poultry Waste (10)	375,400			363,200	363,200
	Food Process Wastes (wet tons) (11)	9,800			39,200	39,200
	Ag Biosolids (wet tons) (12)	9,400			83,300	83,300
GREEN WASTE (13)	Leaf and Yard Waste	67,200	93,020	10,336	5,114	108,470
	Trees and Branches	55,200	41,864	41,864		83,727
	Land clearing (e.g. trees, stumps), mulched (14)	1,500			73,596	73,596
METALS	Aluminum (15)	2,500			4,162	4,162
	White Goods	23,920	26,834	2,982		29,815
	Ferrous	62,000			92,209	92,209
	Non-Ferrous, All Other	12,500			10,077	10,077
C&D WASTE	Asphalt	350,200			511,000	511,000
	Concrete	379,600			617,600	617,600
	Land clearing (See "Green Waste") (16)	25,500			0	0
	Soils and Stone (17)	106,400			23,600	23,600
	Clean Wood (and Mulch)	140	16	5,130		5,146
	Asphalt Shingles (18)	0			6,984	6,984
	C&D Wood (18)	0			8,618	8,618
	Gypsum (18)	0			4,678	4,678
	Mixed C&D (19)	59,500			19,943	19,943
INDUSTRIAL WASTE	Mixed Plastics	2,200		2,423	2,422	4,844
	Biosolids (Wet Tons) (20)	63,700			64,400	64,400
	Bottom and Fly Ash (21)	101,350			15,709	15,709
	Slag (22)	80,000			0	0
	TOTAL RECOVERED:	2,052,300	262,653	209,691	2,027,700	2,500,068

TABLE 2 NOTES:

(1) One large reporter can be attributed to the majority of the volume in 2008, and who did not report in 2014.
(2) Retails bags were recycled in 2008 but were reported in the Total for Shrink Wrap.
(3) Recyclables collected as a single stream in 2008 (roughly 37,700 tons) are accounted for in the totals above by commodity type, net of contamination (See Appendix A-1 for detail).
(4) DSWA's oil filter collection program accounted for a large percentage of the total in 2008 and was discontinued.
(5) Reporting of tire recycling has declined due to changes in tire handling that are now mostly performed by out of state companies. Tire derived fuel is included in Non-MSW, and in both totals.
(6) Reporting of textile recycling has changed from mostly Salvation Army and Goodwill to many individual brokers/handlers with 24/7 unmanned drop boxes and who do not report.
(7) Other Batteries (non lead acid) is a new category added, although they were also recycled in 2008.
(8) Mattress recycling was a new category for CY 2014 and includes both DSWA and retailers reporting.
(9) Poultry litter as reported by the Delaware Nutrient Management Division plus off-site composting of horse manure reported by large generator in CY 2014.
(10) Poultry production has increased but processing methods have changed, reducing poultry wastes but increasing sludges managed.
(11) Estimates provided from DNREC Residuals Management Section converted to wet tons and after subtracting out assumed poultry wastewater/sludges.
(12) As reported by poultry processors in wet and dry tons, and converted to wet tons, supplemented by reports from DNREC residual management section in dry tons converted to wet tons. DNREC does not report on material beneficially used out of state.
(13) See Delaware Yard Waste Study (2015) for details on Green Waste reporting and accounting.
(14) All land clearing waste is included above in Green Waste Category for 2014.
(15) Included some aluminum and steel cans reported in aggregate quantities by scrap metal dealers in 2008.
(16) Land clearing debris reported in both green waste and C&D waste in 2008.
(17) Soil processing volumes fluctuate greatly from year to year and only include material generated in Delaware.
(18) Asphalt shingles, C&D wood and gypsum were not reported separately in 2008 but were in 2014.
(19) Mixed C&D includes different materials reported in aggregate and encompasses all or most of the materials listed above.
(20) Bottom and fly ash totals vary greatly year to year due to changing management practices.
(21) Slag is no longer generated in Delaware due to a steel manufacturer closing the DE facility.
(22) All blue highlighted categories were not separately accounted for in CY 2008.

In reviewing Table 2, note that there are several key differences between data reported for CY 2014 and CY 2008 (the original data used in the State Solid Waste Plan). These are:

- Single stream material composition is not available for CY 2014, and so only total packaging can be compared. Also, since CY 2014 single stream materials are reported as material delivered for processing, not out-going sales. Some percent of incoming is contamination and should be deducted to account for total material marketed, net of contamination.[6]

- There is one category that no longer exists in CY 2014 – steelmaking slag – as the steel manufacturer closed the facility in 2013.

- There are two categories showing large declines – soil that was bio-remediated, and bottom and fly ash. The decline in soils reported may be due to a change in activity (brownfields that were being remediated during that time – 2005/6) or may have included material that was in inventory from prior years but processed in the year of the original survey. For bottom and fly ash, beneficial use of the material declined in 2014 with much of this material instead being landfilled.

- There are several material categories that have increased substantially – packaging materials, green wastes and C&D wastes due to major changes in Delaware's legislation and management practices for these materials, including: universal recycling legislation; development of single stream processing infrastructure (and transfer locations) in Delaware; yard waste landfill bans along with an increase in yard waste drop-off locations; and, development of mixed C&D waste processing infrastructure in Delaware.

The difference between 2008 and 2014 quantities are shown below in Table 3. The right hand column ('14 – '08 change) reflects this difference with negative entries showing declines and positive entries the increases in material tonnages diverted. As illustrated by Table 3 despite the loss of slag and decline in beneficial use of bottom ash, total diversion has increased by roughly 20 percent over this period.

[6] *While residue is also a factor with other material streams, it tends to be larger in single stream than in separate streams of paper and other packaging.*

***TABLE 3** – Difference between CY2008 Solid Waste Plan Recovery and with Current Recovery (CY 2014)*

	Material Category	RECOVERY (CY '08) Total Solid Waste (Tons)	RECOVERY (CY '14)[2] Total Solid Waste Total (Tons)	'14 - '08 *Difference* (Tons)
PAPER	ONP (old newspapers)	11,200	1,747	
	OCC (old corrugated containers)	76,500	61,449	
	Mixed Paper	30,300	24,531	
PACKAGING	Mixed Glass (bottles)	11,410	4	
	Plastic Bottles and EPS	1,330	183	
	Aluminum Cans	360	2,514	
	Pallets, mulched and other	20,900	24,497	
	Shrink Wrap/Recoverable Film (1)	2,000	757	
	Retail Bags (2)	0	251	251
SINGLE STREAM	"Mixed recyclables": collected mixture of different categories of recyclables. (3)	0	119,791	
	SUBTOTAL, PACKAGING:	154,000	235,725	81,725
VEHICLE WASTE	Oil Filters (4)	800	443	-357
	Lead Acid Batteries	2,400	2,984	584
	Tires (5)	9,960	5,209	-4,751
SPECIAL WASTES	Carpet	65	98	33
	Textiles (6)	3,310	3,772	462
	Fluorescent Bulbs	35	16	-19
	Other Batteries (7)	0	311	311
	Mattresses (8)	0	225	225
	Electronics / Electronic Goods	1,880	2,086	206
AG, FOOD, ORGANIC WASTES	Fats, Oil, Grease	8,400	3,640	-4,760
	Food Waste	5,700	17,381	11,681
	Poultry Litter (9)	77,700	57,900	-19,800
	Poultry Waste (10)	375,400	363,200	-12,200
	Food Process Wastes (wet tons) (11)	9,800	39,200	29,400
	Ag Biosolids (wet tons) (12)	9,400	83,300	73,900
GREEN WASTE (13)	Leaf and Yard Waste	67,200	108,470	41,270
	Trees and Branches	55,200	83,727	28,527
	Land clearing (e.g. trees, stumps), mulched (14)	1,500	73,596	72,096
METALS	Aluminum (15)	2,500	4,162	1,662
	White Goods	23,920	29,815	5,895
	Ferrous	62,000	92,209	30,209
	Non-Ferrous, All Other	12,500	10,077	-2,423
C&D WASTE	Asphalt	350,200	511,000	160,800
	Concrete	379,600	617,600	238,000
	Land clearing (See "Green Waste") (16)	25,500	0	-25,500
	Soils and Stone (17)	106,400	23,600	-82,800
	Clean Wood (and Mulch)	140	5,146	5,006
	Asphalt Shingles (18)	0	6,984	6,984
	C&D Wood (18)	0	8,618	8,618
	Gypsum (18)	0	4,678	4,678
	Mixed C&D (19)	59,500	19,943	-39,557
INDUSTRIAL WASTE	Mixed Plastics	2,200	4,844	2,644
	Biosolids (Wet Tons) (20)	63,700	64,400	700
	Bottom and Fly Ash (21)	101,350	15,709	-85,641
	Slag (22)	80,000	0	-80,000
	TOTAL RECOVERED:	2,052,300	2,500,068	447,768

TABLE 3 NOTES:

(1) One large reporter can be attributed to the majority of the volume in 2008, and who did not report in 2014.
(2) Retails bags were recycled in 2008 but were reported in the Total for Shrink Wrap.
(3) Recyclables collected as a single stream in 2008 (roughly 37,700 tons) are accounted for in the totals above by commodity type, net of contamination (See Appendix A-1 for detail by the residential vs the commercial sector).
(4) DSWA's oil filter collection program accounted for a large percentage of the total in 2008 and was discontinued.
(5) Reporting of tire recycling has declined due to changes in tire handling that are now mostly performed by out of state companies. Tire derived fuel is included in Non-MSW, and in both totals.
(6) Reporting of textile recycling has changed from mostly Salvation Army and Goodwill to many individual brokers/handlers with 24/7 unmanned drop boxes and who do not report.
(7) Other Batteries (non-lead acid) is a new category added, although they were also recycled in 2008.
(8) Mattress recycling was a new category for CY 2014 and includes both DSWA and retailers reporting.
(9) Poultry litter as reported by the Delaware Nutrient Management Division plus off-site composting of horse manure reported by large generator in CY 2014.
(10) Poultry production has increased but processing methods have changed, reducing poultry wastes but increasing sludges managed.
(11) Estimates provided from DNREC Residuals Management Section converted to wet tons and after subtracting out assumed poultry wastewater/sludges.
(12) As reported by poultry processors in wet and dry tons, and converted to wet tons, supplemented by reports from DNREC residual management section in dry tons converted to wet tons. DNREC does not report on material beneficially used out of state.
(13) See Delaware Yard Waste Study (2015) for details on Green Waste reporting and accounting.
(14) All land clearing waste is included above in Green Waste Category for 2014.
(15) Includes aluminum and steel cans reported by scrap metal dealers in 2008.
(16) Land clearing debris reported in both green waste and C&D waste in 2008.
(17) Soil processing volumes fluctuate greatly from year to year and only include material generated in Delaware.
(18) Asphalt shingles, C&D wood and gypsum were not reported separately in 2008 but were in 2014.
(19) Mixed C&D includes different materials reported in aggregate and encompasses all or most of the materials listed above. Most mixed C&D recycling reported in CY 2014 was transferred out of state.
(20) Bottom and fly ash totals vary greatly year to year due to changing management practices. CY 2014 represents practices at Indian River in 2014, which differ year to year.
(21) Slag is no longer generated in Delaware due to a steel manufacturer closing the DE facility.
(22) All blue highlighted categories were not separately accounted for in CY 2008.

COMPARISON OF RESULTS TO GOALS SET IN SOLID WASTE PLAN

The Statewide Solid Waste Management Plan Tables 7.4 and A-6 (Interim Goals [2015] for Recycling and Diversion have been reproduced below in Table 4 with the results from Table 2 inserted to measure progress toward the interim goals set. As shown in Table 4, Delaware has met or exceeded interim goals in almost all categories with the exception of food waste composting.

TABLE 4 *- Comparison of Interim Goals for Recycling and Diversion to Reported Activity*

DIVERSION	Current *2009 (1)*	Mid *2015*	10 years *2020*	Mid 2015 (Actual)	NOTES
Major Measures	(tons)	(tons)	(tons)	(tons)	
Universal Recycling - *Residential Only (2)*	30,800	68,500	105,800	91,751	Residential packaging materials only although Universal Recycling refers to Commercial recycling as well.
Yard Waste Diversion	67,200	91,300	119,000	103,356	Residential and Commercial Yard Waste. Does not include tree waste, or land clearing debris.
Food Waste Composting	5,700	35,000	72,000	17,381	Residential and Commercial Food Waste only.
Subtotal:	**103,700**	**194,800**	**296,800**	**212,488**	
Other Measures					
Commercial Recycling (Packaging) (3)	125,700	150,800	215,000	143,974	Paper, paper and other materials packaging (including plastic film), containers and pallets.
Special Waste (4)	5,290	6,600	29,100	6,508	Mattresses and other batteries new reporting categories included.
C&D (5)	921,340	1,013,500	1,079,700	1,197,569	Increase due to mixed C&D, gypsum, land clearing debris and concrete recycling.
Trees, Branches and Compostable Paper	55,200	69,000	91,100	83,727	Increase may be due to landfill bans and better reporting of tree waste.
Other Metals	98,420	108,300	123,000	136,264	Includes all metals except for beverage and food packaging and other small containers.
Subtotal:	**1,205,950**	**1,348,200**	**1,537,900**	**1,568,041**	
No Change					
All Other (6)	742,610	742,610	742,610	719,539	No slag and reduced bottom and fly ash recovery.
Total Diverted:	**2,052,000**	**2,286,000**	**2,577,000**	**2,500,068**	

TABLE 4 NOTES:

(1) Current 2009 was the column header used in the 2010 Plan.

(2) When the State Plan was finalized, the Universal Recycling requirement was recommended but not adopted in law, but the term universal access to recycling was recognized in the plan as an important method to reach recycling goals. This category listed refers to residential recycling totals only.

(3) The Universal Recycling Law's requirements differ for the commercial sector with a later implementation date than for residential recycling. The totals shown are for printed paper, paper and other materials packaging (including plastic film), containers and pallets.

(4) *Carpet, textiles and electronics were included in the Plan (2009 Current) although mattresses and other batteries (non-lead acid) were added for the Mid 2015 (Actual) totals shown.*
(5) *Increase is due to wood, gypsum and mixed C&D diversion and recycling activity as well as increased asphalt and concrete processing for recycling reported for CY 2014.*
(6) *Vehicle waste, poultry waste and litter, horse manure composting, food processing waste, biosolids, mixed plastics, bottom and fly ash and for 2009 slag. Note that the majority of the difference between the current 2009 total and the Mid 2015 total is due to the absence of slag and the change in bottom and fly ash management methods.*

The difference between current recycling and diversion and the measured activity when the Plan was written is explained below by major material category.

Universal Recycling – the universal recycling law, which was passed and signed into law in 2010 required that residential curbside refuse haulers provide curbside recycling to their customers in 2011 with the price bundled into a total service price. Specifically, the law said:

> *"Universal Recycling shall be implemented in accordance with the following provisions:*
>
> *(a) Effective no later than September 15, 2011, the Authority shall cease providing curbside recycling services, including yard waste collection, and all persons providing solid waste collection services in the State of Delaware shall also provide:*
>
> *(1) Single stream curbside recycling collection services to all of their Delaware single-family residential customers, including delivery of a container for the purpose of storage and collection of recyclables that is adequately sized for the customers use such that recycling is encouraged and disposal of recyclables is discouraged; and the recyclables collection service shall be provided at a frequency of not less than once every other week.*
>
> *(2) Source separated recycling collection services to dealers who provide on premise sales, including delivery of a recyclables container that is adequately sized for the premise being served and a frequency of recyclables collection that shall preclude the recycling containers from overflowing and otherwise causing a nuisance.*
>
> *(3) All single-family residential and on premise sales customers with a single charge for the collection of waste and recyclables on their "waste services" bill that is inclusive of the combined waste and recycling collection service costs. Local governments that do not presently bill separately for the costs of waste collection are exempt from this requirement.*
>
> *(4) Notification to all customers that the single stream recycling service will be provided and instructions on participation prior to September 15, 2011.*

For multi-family households, refuse haulers were required to offer recycling collection by January 1, 2013.

Implementation of this requirement dramatically increased access to curbside recycling and the results are evident with the increase in recycling of residential (and commercial, as discussed below) packaging materials through single stream collection with Delaware very close to the goal for 2020. Note that changes in packaging, including the increase in use of light weight, flexible plastic packaging, and a decrease in heavier weight glass, combined with

the decline in newspaper (especially) generation resulted in a reduction in per capita generation of recyclable packaging and printed paper by weight between 2009 and 2014. Without this reduction, the impact of the universal recycling law would have been even greater.

Yard Waste Diversion has increased substantially and is likely due to the yard waste bans enacted at both the Central and Southern (Jones Crossroads) landfills requiring separation as well as at Cherry Island; and, like curbside recycling, greater access to curbside yard waste collection.

Food Waste Composting - Food waste diversion from commercial generators was beginning to climb subsequent to the Plan adoption because of access to separate collection by several Delaware haulers who could use the Wilmington Organics Recycling Company's facility located near the Port of Wilmington (Peninsula)[7] as well as Blue Hen Organics in Sussex County. However the Peninsula facility was ordered to stop accepting material by November 1, 2014 and discontinue composting activity by January 2015, and an alternative facility within a reasonable distance is not currently available. Therefore cost efficient separate collection services for food waste are unlikely to be offered.

Commercial Recycling (Packaging) – The increase in commercial recycling has not been as dramatic as residential with the total reported falling just short of the 2015 goal. While the universal recycling law requires all commercial businesses to participate in a comprehensive recycling program, the implementation requirement was much later - programs must be in place no later than January 1, 2014.[8] As a result, the 2014 reported recycling activity for commercial generators was not much greater than 2013. It may be 2015 or even 2016 before the law is fully implemented and businesses and haulers understand the requirements. Note that the requirement for commercial recycling falls on the generator – the business or institution – to participate in the recycling program and not the hauler to provide the service and bundle it in the price of refuse collection.[9] [10]

Special Waste – This refers to carpet, textiles, electronics, other batteries and mattresses which are all recycled in Delaware but with growth only documented in electronics recycling. While carpet recycling has experienced some difficulties in making recycling economical, electronics and textiles are being recycled in increased quantities, but much of this increase is difficult to document. Electronics recycling by all commercial entities are hard to track if

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[7] *Peninsula began operating in the end of 2009 with DNREC authorizing the site to handle up to 160,000 tons per year. According to Delaware Online "a company official testified late last year that operations diverted 600,000 cubic yards of waste from landfills over the life of the plant, while producing 175,000 cubic yards of compost" and that "DNREC said Peninsula was taking in about 115,000 tons per year before its shutdown". However the vast majority of this material was from out of state.*

[8] *Delaware State Senate 145th General Assembly, Senate Bill No. 234, which says "It is the express requirement of this legislation that Universal Recycling be adopted by the commercial sector and that all commercial businesses actively participate in a comprehensive recycling program no later than January 1, 2014." This includes for-profit and not-for profit retail or wholesale stores, offices, food service establishments, warehouses, and other manufacturing, industrial or processing activities, and institutions such as social, charitable, educational, healthcare, professional and government services.*

[9] *See this link for a copy of the Recycling Public Advisory Council's report to the Governor on implementation of commercial recycling: http://www.dnrec.delaware.gov/dwhs/recycling/Documents/Implementing%20Universal%20Recycling10-31%20final%20with%20formatted%20appendices.pdf*

[10] *The implementation plan requires DNREC to provide notification of this requirement and outreach on recycling as well as promoting the commercial recycling round of the Recycling Grant and Low Interest Loan.*

they do not use DSWA or electronic recyclers that report annually, and the free drop-off textile recyclers are difficult to track.

C&D – C&D recycling activity has already exceeded the 2020 goal mainly due to an increase in reported concrete recycling activity and better reporting on asphalt road material recycling. These are both heavy materials that have a big impact on recycling rates. DSM contacted a large number of construction companies to ensure asphalt and concrete recycling were accurately reported, and also received an estimate on use of RAP (recycled asphalt pavement) in DOT jobs, which is regulated. While road work is expected to continue to see declines because of budget challenges, the better reporting of RAP and private asphalt plants' activity resulted in an increase in asphalt recycling activity. Similarly better reporting of concrete crushing and reuse along with several large demolition projects documenting their efforts in 2014 resulted in large numbers for concrete recycling.

However, the most dramatic change in C&D recycling activity in Delaware cannot be described in tons alone. Access to mixed C&D materials recycling through the new *Revolution Recovery* facility has enabled many more contractors and haulers alike to have access to C&D recycling, even if the quantities recycled on a tonnage basis are not as significant as reported tons of concrete and asphalt. In addition, Republic has also begun offering C&D recycling in southern Delaware, transferring unseparated materials out of state for processing. Offering sorting of C&D materials off the job site allows many more contractors to opt for C&D recycling, even if the cost may be slightly more.

FIGURE 1 – Concrete and Asphalt Recycling
(Courtesy: Revolution Recovery http://revolutionrecovery.com/de/what-rubble.html)

Finally, DSWA's process of segregating and processing C&D at the Southern Landfill to remove gypsum and metals and to create a shredded material that can be mixed with soil and used as an alternative daily cover material extends landfill life, puts ground C&D materials to use replacing other valuable materials.

Trees and Branches – Trees and branches has seen some growth in mulching and composting activity, mainly due to better reporting and the landfill ban creating opportunities for more drop-off sites and mulchers to set up facilities.

Compostable Paper **-** Compostable paper has seen little growth because food waste and other types of composting other than yard waste and poultry wastes has not become widespread, reducing the demand for compostable paper as a carbon source. Neither of the two instate composting facilities operating in Delaware reported deliveries of compostable paper although some small amount of compostable paper may be mixed in with food waste deliveries but not reported.

Other Metals - Metals recycling activity is probably one of the areas least impacted by any State efforts to increase recycling. Because metals recycling is typically an economic endeavor, metals prices continue to drive recycling activity. And while average metals prices have dropped around 25% in the last year, there has been no decline in reported metals recycling activity. However capturing all metals recycling activity in the State and excluding any junk automobiles including parts is challenging and DSM relies on the representations of the scrap metal dealers as to the totals they report by metal types.

All Other – This last category encompasses the following materials: poultry waste and litter; horse manure composted off-site; food processing wastes; biosolids; mixed plastics; bottom and fly ash; slag; and, vehicle wastes. As noted above, slag is no longer generated in Delaware since CitiSteel ceased operations in Claymont, reducing the total by 80,000 tons. Bottom and fly ash production declined with the closure of several coal fired boilers in Delaware, and the remaining Indian River Plant diverts only a small portion of bottom and fly ash to beneficial uses, landfilling the majority of the ash. And, while poultry waste and litter should in theory increase in generation, and in turn beneficial uses through nutrient management program and land application of processed sludge's due to expansion of the industry in Delaware, the totals actually showed a small decline, likely due to enhancements in processing efficiencies and possibly the result of lower reporting of litter through the nutrient management program.

Finally while a decrease in vehicle waste recycling is shown by the numbers recorded, DSM believes that the figures do not fully account for this recycling activity in the State. Oil filters are likely to be properly managed by most vehicle repair shops and only do it yourselfers would need to dispose of their oil filters. Similarly tires are likely to be collected separately for recycling by tire recyclers directly from tire retailers who change and sell new tires, and very few are thought to be landfilled as tires are often removed at the face if they are encountered in loads. It is possible that the large volume of tires reported back in 2008 overinflated tire recycling activity due to one processor who had a large inventory and continuously recycled material to create a product used in construction of several cells at DSWA landfills.

VERIFYING THE DENOMINATOR

Delaware is relatively unique in that almost all waste generated within the State is disposed in one of the three DSWA landfills, and only Delaware waste is delivered to these landfills.[11] This allows for much more accurate data on total waste disposed than is possible in most states, where imports and exports of waste make it difficult to accurately determine how much waste from in-state sources is being generated for disposal.

DSWA maintains accurate data on deliveries to all of its landfills by vehicle type, truck number and broad waste category. Because of this detailed data, DSM has previously worked with DSWA to attempt to more accurately quantify the breakdown between residential and commercial waste deliveries to the DSWA landfills. This was accomplished by surveying trucks arriving at the three landfills over a two-week period. The type of truck was recorded (e.g., rear loader, front loader, container truck) and the driver was asked whether he had collected residential, commercial or industrial waste, or a mix of more than one. If he answered that it was a mix, he was asked his best estimate of the amount of each type (as a percentage of the total).

The survey data by truck type were averaged (weighted by truck weights), by landfill to develop "conversion factors" that could be applied to each truck type to estimate the amount of each generator type of waste being delivered by truck type. For example, the weighted average for rear loading trucks delivering waste to the Cherry Island landfill was found to be 89 percent residential and 11 percent commercial in 2008. Therefore, DSWA could now allocate 11 percent of each rear loader delivering waste to the Cherry Island landfill as commercial waste and 89 percent as residential, as compared to the previous allocation which would have assumed that all rear load waste was residential. Surveys were performed and allocation factors developed for all 6 DSWA facilities where waste was delivered.

DSM updated the allocation in 2012 through survey work at the Cherry Island landfill and the Pine Tree Transfer Station, where C&D volumes had declined and automated side load vehicles were beginning to deliver a larger portion of waste and allocations were not available.

Table 5 presents the result of applying these "conversion factors" by vehicle type to total CY 14 weigh data by landfill and transfer station. The net result is that residential waste deliveries to DSWA landfills and transfer stations are approximately 41 percent of total deliveries, while commercial deliveries are approximately 39 percent with self-haul deliveries at 6 percent (rounded) and C&D deliveries at 14 percent rounded.

Total tons delivered by generator type are shown below for all facilities.

[11] *Relatively small quantities of Delaware solid waste are disposed out-of-state at the Covanta facility in Chester Pennsylvania. In addition, there is one private landfill, the Waste Management/DRPI landfill located in Delaware that is permitted to accept dry waste or primarily C&D waste.*

***TABLE 5** – Percentage of Self Haul, Residential, Commercial and C&D Waste Delivered to Each DSWA facility Using Vehicle Type to Allocate Waste Type (By Weight) (1)*

DSWA Facility	Waste, By Generator Type, 2014				Total
	Self Haul (tons)	Res (tons)	Com (tons)	C&D (tons)	
NSWMC	14,827	148,061	159,657	39,081	361,626
CSWMC	6,406	33,292	29,566	8,184	77,449
SSWMC	12,402	22,016	35,336	54,901	124,654
PTCTS	3,373	32,993	30,435	2,725	69,527
MTS	2,490	20,627	14,130	636	37,883
RT5TS	5,868	48,541	21,691	853	76,953
TOTAL:	45,366	305,529	290,815	106,382	748,092

(1) Totals reported reflect weights of incoming deliveries adjusted for removal/recovery of materials such as tires, scrap metal, gypsum and other C&D wastes.

The next step is to allocate self-haul waste deliveries equally to residential, commercial and C&D waste based on survey work done in the self-haul areas of each facility during the waste characterization study completed in 2006. This computation is shown below in Table 6 and indicates that C&D waste may total about 123,000 tons (rounded) or roughly 16% of all deliveries.

***TABLE 6** – Allocation of Self-Haul Waste to the Residential and Commercial Sectors and to C&D Waste Classification*

SECTOR	Total, From Above (tons) 2014 (tons)	Reallocation of Self-haul 2014 (tons)	TOTAL 2014 (tons)
Residential	305,529	15,122	320,651
Commercial	290,815	15,122	305,937
C&D	106,382	15,122	121,504
Self Haul	45,366		
TOTAL:	**748,092**	**45,366**	**748,092**

In addition to waste deliveries to DSWA, DSM collected data from three other facilities. A FOIA request was submitted to DNREC to obtain information on the Indian River Facility ash landfill, and Covanta and DRPI were contacted for CY 2014 disposal tonnages coming from Delaware generators. These figures are combined with DSWA totals and shown below in Table 7.

TABLE 7 *– Total Solid Waste Disposal from Delaware Generators (1)*

Solid Waste Type	Total Reported (tons)
Residential Solid Waste	320,651
Commercial Solid Waste	338,137
Total Municipal Solid Waste (MSW):	**658,788**
C&D and Other Non MSW	308,359
Total Solid Waste Disposal:	**967,147**

(1) Commercial Solid Waste includes some out of state disposal not included in Table 6. Other Solid Waste Disposal includes fly and bottom ash that is landfilled and C&D waste.

The final estimates for deliveries to DSWA landfills combined with deliveries of Delaware waste to the Waste Management/DRPI landfill, reported deliveries to out-of-state disposal facilities, and the Indian River Facility, represent *Total Solid Waste* disposal which is used in the denominator of the recycling rate calculation (as shown in Table 8).

CALCULATION OF DELAWARE'S RECYCLING/DIVERSIONRATE FOR TOTAL SOLID WASTE

The disposal total shown in Table 7 represent the disposal portion of the denominator in the equation to calculate the recycling/diversion rate for Mid 2015. This calculation must be done to compare against the Plan Interim Goals that can be found in the Plan Appendix, TABLE A-6: Interim Goals For Recycling and Diversion.

Table 8 shows the calculation.

TABLE 8 *– All Materials Recycling/ Total Solid Waste Diversion Rate (CY 2014)*

DIVERSION AND DISPOSAL	Current *2009*	Mid *2015*	10 years *2020*	Mid 2015 (Actual)
Total Diverted (Table 4)	2,052,000	2,286,000	2,577,000	2,500,068

DIVERSION RATE	Current *2009*	Mid *2015*	10 years *2020*	Mid 2015 (Actual)
DISPOSAL	(tons)	(tons)	(tons)	(tons)
Total Disposed	**1,094,600**	**860,600**	**570,000**	**967,147**
Total Non MSW	125,000	100,000	50,000	308,359
Total MSW	969,600	760,600	520,000	658,788
TOTAL GENERATION	3,146,600	3,146,600	3,147,000	3,467,216
Recycling/Diversion Rate	***65%***	***73%***	***82%***	***72%***

OUTSTANDING ISSUES

While Delaware fell just short of the 73% goal set, it is almost entirely due to the denominator increasing from the reporting of ash disposal from the Indian River Power Plant.

Clearly, separate organics management remains the largest challenge to reaching specific state diversion goals. Food waste separation, collection and composting continue to be a challenging waste management strategy. The closure of the Peninsula facility, the challenges faced at Blue Hen, and reductions in the types of materials accepted (and tighter specifications) at Blessings and other facilities illustrate the difficulties of operating composting facilities that accept food and other (less homogenous) waste streams. Development of facilities that are less sensitive to contamination associated with food waste and other organics will be key to further increasing organics diversion.

In addition, accurate reporting of yard waste diversion continues to be a challenge. Because of the closure of the Peninsula facility, there is no longer an outlet that can accept contaminated yard waste. DSM's on-site and telephone survey work with several mulchers indicated that there is concern about the quality of curbside yard waste and whether or not it is an acceptable material for mulching. Several of these facilities did accept small quantities of material from Peninsula and found it to be highly contaminated (with glass as well as other materials) and not acceptable for mixing with their mulch and compost products. If the ban is to remain in effect, permitted and properly operated yard waste outlets may need to be developed. For example, in the course of DSM's surveys, a facility was identified that was stockpiling material and not processing yard waste. While the quality and ultimate disposition of that material was not reviewed (and may not be counted as materials composting), DNREC did perform a follow up site visit and the facility reported they are looking into managing the material differently on-site.

Another ongoing challenge to increasing the recycling rate will be what is referred to as the evolving ton entering materials recycling facilities. As printed paper and newspaper continue to decline in generation and as packaging continues to move from glass, metals and rigid plastics to flexible pouches and film, measurements of recycling activity by weight will become less meaningful. For example, the City of Calgary went from 58,000 metric tons of single stream material collected in 2010 to less than 53,000 tons in 2013 even though the program became mandatory, participation is high and more households have been added in recent years. On a per-household served basis, there was a five percent reduction in kilograms recycled between 2010 and 2011 and a nine percent reduction between 2012 and 2013.[12] Once Delaware reaches all households with curbside recycling service, which is likely to be the case now, it will be less likely to continue to see increases in the quantity of residential recycling processed unless the state sees significant population growth.

Accounting for some of these changes through different measurement standards may become necessary. For example, DSWA's focus on recovery rates by coupling materials recycled and diverted with current waste characterization data will enable the State to examine where the greatest opportunities currently lie to increase diversion.

[12] *Morawski, Clarissa and Kelleher, Maria. The Evolving Ton Explained. Resource Recycling, May 2015.*

CONCLUSIONS AND RECOMMENDATIONS

As illustrated in Table 4 above and summarized in Table 9 below, Delaware has met most of the interim goals set in the Plan with an increase in the total amount recycled and diverted of roughly 214,000 tons. The largest gains were in residential recycling, yard waste diversion and C&D recycling, with food waste composting falling short.

TABLE 9 – *Difference between Goal Targets and Actual Reporting by Major Measures (1)*

DIVERSION	Mid *2015*	Percentage of Goal Met
Major Measures	(tons)	(%)
Universal Recycling - *Residential Only (1)*	23,251	134%
Yard Waste Diversion	12,056	113%
Food Waste Composting	-17,619	50%
Subtotal:	**17,688**	**109%**
Other Measures		
Commercial Recycling (Packaging) (2)	-6,826	95%
Special Waste (3)	-92	99%
C&D (4)	184,069	118%
Trees, Branches and Compostable Paper	14,727	121%
Other Metals	27,964	126%
Subtotal:	**219,841**	**116%**
No Change		
All Other (5)	-23,071	97%
Total Diverted:	**214,000**	**109%**

(1) A negative number indicates the total fell short of the goal.

The biggest difference on a percentage basis is a failure to meet the food waste composting goal set. While a major instate facility – Peninsula – accepted large volumes of food and yard waste, the majority of the material accepted was from out of state, with in-state generators slower to adopt food waste separation and collection programs. This may have been a smart move – as the facility was ordered to stop accepting material in November 2014 and close by January 1, 2015.[13] The facility's closing not only impacts Delaware but the whole region's food waste diversion efforts. Looking ahead, Delaware's growth in separate food waste collection and composting is contingent upon a cost effective tip site for the material that, like WORC, will be able to accept material with some level of contamination.

[13] *On October 20, 2014 Peninsula Composting was issued a Secretary's Order by DNREC requiring the cessation of waste acceptance and the completion of site closure activities no later than March 31, 2015.*

Closure of the Peninsula facility may also have some impact on yard waste composting. While there has clearly been growth in yard waste diversion from disposal, curbside yard waste collection is not as widespread as curbside refuse collection. And leaves and yard waste collected curbside is more likely to have some contamination because of the trucks used, or the set out procedures (leaves may be collected or even vacuumed along with street sweepings, which often contain litter). Therefore many mulch sites do not want to accept yard waste from curbside haulers because they believe it may not be a quality feedstock for their products. Peninsula had wider specifications for yard waste deliveries with the ability to remove some contaminants in the screening process as well as break down organic materials, such as paper products, through the composting process.

Despite these challenges to food waste diversion, the Recycling/Division Rate is just shy of the 73% goal. This deficit is mainly due to a rising denominator rather than a lack of growth in diversion activity. And this unexpected increase in the denominator is attributed to the landfilling of fly and bottom ash in the Indian River landfill, which was not counted in the 2008 data or referenced in the 2010 Plan.

Other conclusions from this work are that some slight changes might be considered in the RPAC MSW Recycling Rate methodology and focus. Specifically, these include:

- The addition of new materials such as mattresses to be tracked.

- More careful guidelines for mulchers and other yard waste consolidation sites in reporting yard waste and trees and branches to the exclusion of land clearing debris.

- Some tracking of the contamination rate of materials collected in a single stream, so that a better comparison of the year to year growth in residential - mainly but some commercial as well - recycling can be made.

- Awareness of the growing challenge to recycling glass through single stream processing and either market development for more contaminated glass or the consideration of separate collection programs for glass.

- Recognition that certain material types continue to be difficult to track, and continue to be under-reported, such as tires, oil filters, florescent tubes and electronics. Because these are mostly managed through regulated programs, it would probably be safe to assume that if they are not found in the landfill, they are likely to be properly managed even if they are not fully tracked through the annual recycling survey.

- And finally, while some discussion of expanding the definition of metals recycling beyond appliances should be considered, DSM would recommend against this mainly because scrap metal recycling encompasses such a broad range of materials that disaggregating durables from vehicles and other transportation equipment as well as from construction and demolition activity would be extremely difficult. And more importantly, if counted, the impact on the MSW recycling rate would be significant, making it more difficult to recognize the subtle changes in harder to recycle materials such as food waste and some plastics.

In closing, DSM believes that the materials recycling and diversion estimates developed in this report are reasonably accurate, and confirm that Delaware is meeting the interim goals adopted in the Plan.

The data presented in this report should be helpful in allowing DSWA to develop accurate materials recovery rates by material type once the next waste composition study is completed. Recovery rates are a much better measure of success in meeting recycling goals than recycling rates, which can be difficult to compare across states because of differences in what materials are counted.

DSM ENVIRONMENTAL SERVICES, INC.
Resource Economists
Environmental Scientists

APPENDIX

Appendix A-1

From 2010 Statewide Solid Waste Management Plan

DSM ENVIRONMENTAL SERVICES, INC.

Resource Economists
Environmental Scientists

Table A-1: ESTIMATED RECOVERY, BY MATERIAL TYPE (CY 2008, In Tons)

		CURRENT RECOVERY (CY '08 tons)					
			MSW			Non-MSW	All Waste
	Material Category	Res (5)	Res (6)	Comm (7)	Comm (8)	(9)	Total
PAPER	ONP (old newspapers)	0	7,200	3,735	4,000	0	**11,200**
	OCC (old corrugated containers)	0	2,300	71,389	74,200	0	**76,500**
	Mixed Paper (1)	306	12,800	16,311	17,500	0	**30,300**
PACKAGING	Mixed Glass (bottles)	4,729	11,400	0	10	0	**11,410**
	Plastic Bottles	0	1,300	23	30	0	**1,330**
	Aluminum Cans	0	300	49	60	0	**360**
	Pallets, mulched and other	0		4,465	4,500	16,400	**20,900**
	Shrink Wrap/Recoverable Film (2)	0		1,983	2,000	0	**2,000**
VEHICLE WASTE	Oil Filters	686	700	105	100	0	**800**
	Lead Acid Batteries	1,992	2,000	398	400	0	**2,400**
	Tires	7,052	7,100	1,763	1,800	1,060	**9,960**
SPECIAL WASTES	Carpet (3)	43	45	20	20	0	**65**
	Textiles	3,305	3,310	0	0	0	**3,310**
	Fluorescent Bulbs	0	0	34	35	0	**35**
	Electronics / Electronic Goods	1,429	1,430	454	450	0	**1,880**
AG, FOOD, ORGANIC WASTES	Fats, Oil, Grease	0		8,393	8,400	0	**8,400**
	Food Waste	0		5,650	5,700	0	**5,700**
	Poultry Litter					77,700	**77,700**
	Poultry Waste					375,400	**375,400**
	Food Processing Wastes					9,800	**9,800**
	Biosolids					9,400	**9,400**
GREEN WASTE	Leaf and Yard Waste	59,953	60,000	7,157	7,200	0	**67,200**
	Trees and Branches	49,110	49,100	6,138	6,100	0	**55,200**
	Landclearing (e.g. trees, stumps), mulched	0		0		1,500	**1,500**
METALS	Aluminum & Steel Cans	0	500	0		2,000	**2,500**
	White Goods (4)	23,555	23,600	119	120	200	**23,920**
	Ferrous	0		0		62,000	**62,000**
	Non-Ferrous, All Other	0		0		12,500	**12,500**
SINGLE STREAM	"Mixed recyclables": collected mixture of different categories of recyclables; includes City of Wilmington collection	33,300	0	4,387	0	0	**0**
C&D WASTE	Asphalt	0		0		350,200	**350,200**
	Concrete	0		0		379,600	**379,600**
	Landclearing (See "Green Waste")	0		0		25,500	**25,500**
	Soils and Stone	0		0		106,400	**106,400**
	Clean Wood	0		0		140	**140**
	Mixed C&D	0		0		59,500	**59,500**
INDUSTRIAL WASTE	Mixed Plastics	0		0		2,200	**2,200**
	Biosolids (Wet Tons)	0		0		63,700	**63,700**
	Bottom and Fly Ash	0		0		101,350	**101,350**
	Slag	0		0		80,000	**80,000**
	Total Recovered	**185,500**	**183,100**	**132,600**	**132,600**	**1,736,600**	**2,052,300**

NOTES:

NUMBERS MAY NOT ADD DUE TO ROUNDING.

(1) Includes Sorted Office Paper and Undeliverable Mail categories.

(2) Includes plastic grocery bags and other cleaner films.

(3) Includes some textiles in current recovery.

(4) Includes 200 tons of small appliances in current recovery.

(5) Recovery from "Eighth Annual Report of the Recycling Public Advisory Council, November 2009", Authored by: The Recycling Public Advisory Council

(6) Residential material composition adjusted to account for single stream, net of contamination. All material estimates are rounded.

(7) Recovery from "Eighth Annual Report of the Recycling Public Advisory Council, November 2009", Authored by: The Recycling Public Advisory Council and from "State of Delaware Assessment of Municipal Solid Waste Recycling for Calendar Year 2008" by DSM Environmental Services, July 2009.

(8) Commercial material composition adjusted to account for single stream, net of contamination. All material estimates are rounded.

(9) Estimates from "Assessment of Commercial and Industrial Recycling Activity" Final Report, July 2006. Prepared for DSWA. All estimates are rounded.