

# Ulster County

## 2018 Inventory of Community-wide Greenhouse Gas Emissions

### Appendix D: Solid Waste Sector

#### BACKGROUND

Ulster County completed an Inventory of Community-wide Greenhouse Gas (GHG) Emissions in 2021, using 2018 as the initial baseline year. The full Inventory report and appendixes are available on the County's "Community Climate Action" [webpage](#). The Inventory was completed using the ICLEI – Local Governments for Sustainability ClearPath software<sup>1</sup> and is compliant with the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) and its accompanying Appendix E: Solid Waste Emission Activities and Sources<sup>2</sup>.

In 2018, Ulster County community GHG emissions were estimated at 1,823,672 metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e), of which the solid waste sector accounted for 77, 319 MTCO<sub>2</sub>e, or 4% of total emissions.

#### U.S. COMMUNITY PROTOCOL FOR ACCOUNTING AND REPORTING OF GHG EMISSIONS

Version 1.2 of the Community Protocol was released by ICLEI in 2019 and represents a national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

The Community Protocol's Appendix E addresses emissions arising from solid waste generated by a community, regardless of where it is disposed of, as well as emissions arising from solid waste disposed of inside a community's boundaries, regardless of where it was generated, and accounts for the following:

"GHG emissions result from management of solid waste of all types and from the natural decay of solid waste with biologic constituents. GHG emissions from the management of solid wastes include those from combustion of fossil and/or biologic fuel in equipment used to transport and process the waste... GHG emissions from the natural decay of biologic wastes are associated with landfills, digesters, and compost facilities and they include biologic CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O in differing proportions based upon the type of management process.

GHGs are generated differently from biologic and non-biologic solid wastes. GHGs are generated by non-biologic wastes only if they are combusted. GHGs are generated from biologic wastes whether they are combusted or allowed to decay naturally. Because of the social and health concerns resulting from

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<sup>1</sup> <https://icleiusa.org/clearpath/>

<sup>2</sup> Available for download at: <https://icleiusa.org/ghg-protocols/>.

allowing solid wastes to remain uncontrolled, modern communities typically apply a management method to decaying waste. In the case of combustion and composting, the biologic constituents are broken down into simpler carbon compounds by bacteria in an aerobic (oxygen rich) environment. In the case of digestion and landfilling, the biologic constituents are broken down into simpler carbon compounds by bacteria in an anaerobic (oxygen poor) environment generating roughly equal amounts of CH<sub>4</sub> and CO<sub>2</sub> by volume.”

## ULSTER COUNTY SOLID WASTE SECTOR: GHG EMISSIONS ACCOUNTING

Per the Community Protocol and the Appendix E decision trees (**Figures 2 & 3**), the emissions from the Ulster County solid waste sector were accounted for in the following ways:

- Community Sources: Solid waste GHG emissions produced by disposal sites located within the community boundary:
  - As there were no active landfills or other solid waste facilities located within Ulster County in 2018, there were no source emissions to account for.
- Community Activities: Solid waste GHG emissions from community-generated solid waste:
  - All municipal solid waste (MSW) generated in the County and disposed of outside of the County in 2018 was included in the accounting. This included calculations for the emissions associated with landfilling, landfilling process emissions, and transportation for the hauling of the waste to the Seneca Meadows landfill. For the transportation emissions: Per the 2020 Local Solid Waste Management Plan<sup>3</sup> (LSWMP), there were approximately 3,100 trips in 2018, at approximately 478 miles per round trip.

All ClearPath sources and data inputs are listed in **Tables 1 and 2** and in **Figure 4: ICLEI ClearPath Solid Waste Sector Inputs**. The default ClearPath waste characterization factor set was used for the 2018 Inventory, however this factor set can be updated for future inventories with more specific waste composition and material percentages, which may be obtained from a waste audit or other sources.

- Additionally, the transportation emissions were included for the additional C&D/MSW processed via UCCRA and transported to the landfill outside of the County. The calculations for the transportation emissions only for this portion of waste were included, as this is within the County’s jurisdictional control. However, the landfilling and landfilling process GHG emissions for this waste can be accounted for by the County and/or local municipality where it was generated, per the Community Protocol.

The Community Protocol does not provide for the accounting for emissions from Construction & Demolition (C&D) materials separately from MSW. However as all of the waste generated in the County and transported to the Seneca Meadows Landfill is included in the ClearPath records entries (this consists of 100% MSW, per UCCRA’s 2018 Permitted Transfer Facility Reports to NYSDEC<sup>4</sup>), as well as the transportation emissions for all of the the additional

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<sup>3</sup> Available on the Ulster County Resource Recovery website at: <https://ucrra.org/wp-content/uploads/2021/03/Final-Plan-w-Approval-Resolution-reduced-2.pdf>

<sup>4</sup> From NYSDEC’s “Transfer Facilities” webpage: ftp hyperlink link located at bottom of webpage under “Annual Reporting”: <https://www.dec.ny.gov/chemical/23678.html> (2018 New Paltz & 2018 Kingston).

- waste transported (i.e. the additional portion of the C&D/MSW not generated in the County), all solid waste emissions are theoretically accounted for.
- The GHG emissions associated with the landfilling, landfilling process emissions, and transportation of the biosolids (sewage sludge) handled at the New Paltz UCCRA facility were also calculated. As these were transported to the Chemung County landfill for disposal through 2020 – after which they began being transported to the Rockland County landfill for composting – this will represent a reduction in emissions associated with the disposal of biosolids after 2020 and can be quantified in future Inventory updates.
  - The Community Protocol and Appendix E do not include provisions for estimating the emissions reductions associated with community level recycling and composting, however the estimated avoided GHG emissions were completed as well, per the optional Recycling and Composting Emissions Protocol’s<sup>5</sup> recommended methodology using the EPA Waste Reduction Model (WARM) Tool version 15<sup>6</sup>.

*Table 1: Ulster County Resource Recovery Agency Local Solid Waste Management Plan (2020)*

*– 2018 UCCRA Waste Stream Totals*

<b>Material</b>	<b>Total (tons)</b>	<b>Percent of waste stream</b>
MSW	101,379	66.45%
C&D	31,970	20.96%
Biosolids	3,686	2.42%
Single Stream	6,423	4.21%
Old corrugated cardboard	1,553	1.02%
Food Waste	3,537	2.32%
Mixed News	1,051	0.69%
Wood Chips	1,169	0.77%
Commingled	526	0.34%
Brush	459	0.30%
E-Waste	304	0.20%
Glass	496	0.33%
<b>Total</b>	<b>152,553</b>	<b>100.00%</b>

<sup>5</sup> Available for download at: <https://icleiusa.org/recycling-composting-emissions-protocol/>.

<sup>6</sup> <https://www.epa.gov/warm/versions-waste-reduction-model-warm#15>

Table 2: ClearPath - Solid Waste Sector Inventory Record Entries

ClearPath: Inventory Record	NOTES	Tons	GHG Emissions (MTC02e)	Percent of GHG Emissions for the Solid Waste Sector
MSW (generated in-county) - Landfill Disposal	All MSW generated in the County and disposed of at the Seneca Meadows landfill, from the 2018 LSWMP Waste Stream Totals.	101,379	66,219.0	85.6%
MSW (generated in-county) - Transport to Landfill	Estimate of transportation emissions for MSW sent to Seneca Meadows landfill (located outside of the County).	101,379	6,784.0	8.8%
MSW (generated in-county) - Landfilling process emissions	Estimate of emissions for diesel-fueled equipment used at Seneca Meadows landfill (located outside of the County).	101,379	1,662.6	2.2%
Other C&D/MSW (via UCCRA, not necessarily generated in-county) - Transport to Landfill	Estimate of the transportation emissions for the additional C&D/MSW processed via UCCRA and transported to the Seneca Meadows landfill (located outside of the County), entered separately from the MSW total generated in the County (per the LSWMP). As reported to NYSDEC by UCRRA: the total MSW transported to Seneca Meadows in 2018 was 130,580.21, minus the 101,379 tons of MSW generated in-county, equals 29,201 of additional waste transported.	29,201	1,954.0	2.5%
Biosolids - Landfill disposal	For the Biosolids processed via UCCRA and disposed of at the Chemung County landfill, from the 2018 LSWMP Waste Stream Totals.	3,680	2,404.0	3.1%
Biosolids - Transport to landfill	Estimate of transportation emissions for biosolids sent to Chemung County landfill (located outside of the County).	3,680	190.0	0.2%
Biosolids - Landfilling process emissions	Estimate of emissions for diesel-fueled equipment used at Chemung County landfill (located outside of the County).	3,680	60.0	0.1%
		<b>TOTAL:</b>	<b>77,319.0</b>	

## RECYCLING AND COMPOSTING: AVOIDED GHG EMISSIONS

Recycling and composting diversion programs are very important tools for avoiding community GHG emissions, by serving to reduce the emissions associated with the landfilling and transportation of waste, and also by reducing upstream emissions from materials manufacturing when recycled materials displace virgin feedstocks. ICLEI developed the Recycling and Composting Emissions Protocol in recognition of the benefits that recycling and composting can make to emissions reduction efforts, and the high degree of influence that local governments have in this area.

The Recycling and Composting Emissions Protocol recommends using the WARM Tool to estimate the full emissions impacts and reductions for community-scale recycling and composting. The entries into the WARM “Analysis Inputs” tab for various waste materials that were recycled and composted in 2018, as reported in the LSWMP and/or obtained from UCCRA staff directly, are included below, as is the full WARM Summary Report.

*Table 3: Recycling & Composting: EPA WARM Model Avoided GHG Emissions*

2018 Recycling & Composting Totals	Tons	EPA Waste Reduction (WARM) Model v15 Alternative Management Scenario (vs. Landfilling) Inputs	Tons	Total Avoided GHG Emissions (MTCO2e)
		<b>Tons Recycled</b>		
<b>Recycling</b>				
Newspaper	1.00	Newspaper	1.00	-1.89
Corrugated Cardboard	7,956.00	Corrugated containers	7,971.00	-27,029.52
Paperboard	15.00	Mixed Paper (prim. from offices)	314.00	-1,180.06
High Grade Office Paper	314.00	Mixed Paper (general)	1,162.00	-4,286.07
Mixed Paper	1,162.00	Aluminum Cans	90.00	-823.29
Aluminum & Tin Cans	90.00	Glass	534.00	-158.25
Container Glass	534.00	Mixed Plastics: PET	24.00	-28.04
PET Plastics	24.00	Mixed Plastics: HDPE	2.00	-1.75
HDPE Plastics	2.00	Mixed Plastics	8.43	-8.86
Plastics 3-7	0.43	Mixed Recyclables	14,905.00	-43,792.96
Rigid Plastics	8.00	Mixed Electronics	304.00	-246.04
Single Stream Recycling	14,379.00	<b>Total avoided MTCO2e</b>		<b>-77,556.74</b>
Commingles Plastic, Glass Metal	526.00			
E-Waste	304.00	<b>Tons Composted</b>		
<b>Total tons</b>	<b>25,315.43</b>	Food Waste	3,537.00	-2,540.24
		Branches	1,628.00	569.62
<b>Composting</b>		<b>Total avoided MTCO2e</b>		<b>-1,970.62</b>
Food Waste	3,537.00			
Wood Chips	1,169.00			
Brush	459.00			
<b>Total tons</b>	<b>5,165.00</b>			
<b>Recycling &amp; Composting: Total Avoided GHG Emissions</b>				<b>-79,527.36</b>

The estimate of avoided emissions attributed to the alternative management scenarios of recycling and composting in 2018 represents a significant portion of the total GHG emissions associated with solid waste management in Ulster County. The waste materials and amounts listed above, if not diverted from the MSW waste stream, would theoretically have been transported to the Seneca Meadows landfill and would therefore have contributed significantly to the GHG emissions from landfilling, landfill processes, and transportation.

The WARM estimates of avoided emissions are not directly comparable to the solid waste sector emissions from the ClearPath software used to complete the Community GHG Inventory however, as there may be differences in the methodology and in the calculations (such as the waste compositions percentages and emissions factors, among others). However this information is useful in starting to quantify the true benefits of alternative management scenarios – including recycling and composting – as part of broader community-wide efforts to address all solid waste generated in Ulster County, including via source reduction, diversion (by recycling, composting, and other methods), and, as a last resort, landfill disposal.

Figure 1: EPA WARM Model Summary Report

GHG Emissions from Baseline Waste Management (MTCO <sub>2</sub> E):							4,755.76	GHG Emissions from Alternative Waste Management Scenario (MTCO <sub>2</sub> E):							(74,771.60)	
Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested	Total MTCO <sub>2</sub> E		Material	Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested	Total MTCO <sub>2</sub> E	Change (Alt - Base) MTCO <sub>2</sub> E
Corrugated Containers	-	7,971.00	-	NA	NA	2,037.75		Corrugated Containers	-	7,971.00	-	-	NA	NA	(24,991.77)	(27,029.52)
Newspaper	-	1.00	-	NA	NA	(0.82)		Newspaper	-	1.00	-	-	NA	NA	(2.71)	(1.89)
Mixed Paper (general)	-	1,162.00	-	NA	NA	165.17		Mixed Paper (general)	-	1,162.00	-	-	NA	NA	(4,119.90)	(4,298.07)
Mixed Paper (primarily from offices)	-	314.00	-	NA	NA	50.07		Mixed Paper (primarily from offices)	-	314.00	-	-	NA	NA	(1,124.00)	(1,180.96)
Food Waste	NA	3,537.00	-	-	-	1,917.59		Food Waste	-	NA	-	-	3,537.00	-	(622.55)	(2,540.24)
Branches	NA	1,628.00	-	-	-	(897.82)		Branches	NA	NA	-	-	1,628.00	-	(238.20)	569.62
HDPE	-	2.00	-	NA	NA	0.04		HDPE	-	2.00	-	-	NA	NA	(1.71)	(1.75)
PET	-	24.00	-	NA	NA	0.49		PET	-	24.00	-	-	NA	NA	(27.56)	(28.04)
Mixed Plastics	-	8.43	-	NA	NA	0.17		Mixed Plastics	-	8.43	-	-	NA	NA	(8.69)	(8.86)
Mixed Electronics	-	304.00	-	NA	NA	6.16		Mixed Electronics	NA	304.00	-	-	NA	NA	(239.89)	(248.04)
Aluminum Cans	-	90.00	-	NA	NA	1.82		Aluminum Cans	-	90.00	-	-	NA	NA	(821.46)	(823.29)
Glass	-	534.00	-	NA	NA	10.82		Glass	-	534.00	-	-	NA	NA	(147.43)	(158.25)
Mixed Recyclables	-	14,905.00	-	NA	NA	1,387.22		Mixed Recyclables	NA	14,905.00	-	-	NA	NA	(42,425.74)	(43,792.96)

Note: a negative value (i.e., a value in parentheses) indicates an emission reduction; a positive value indicates an emission increase.

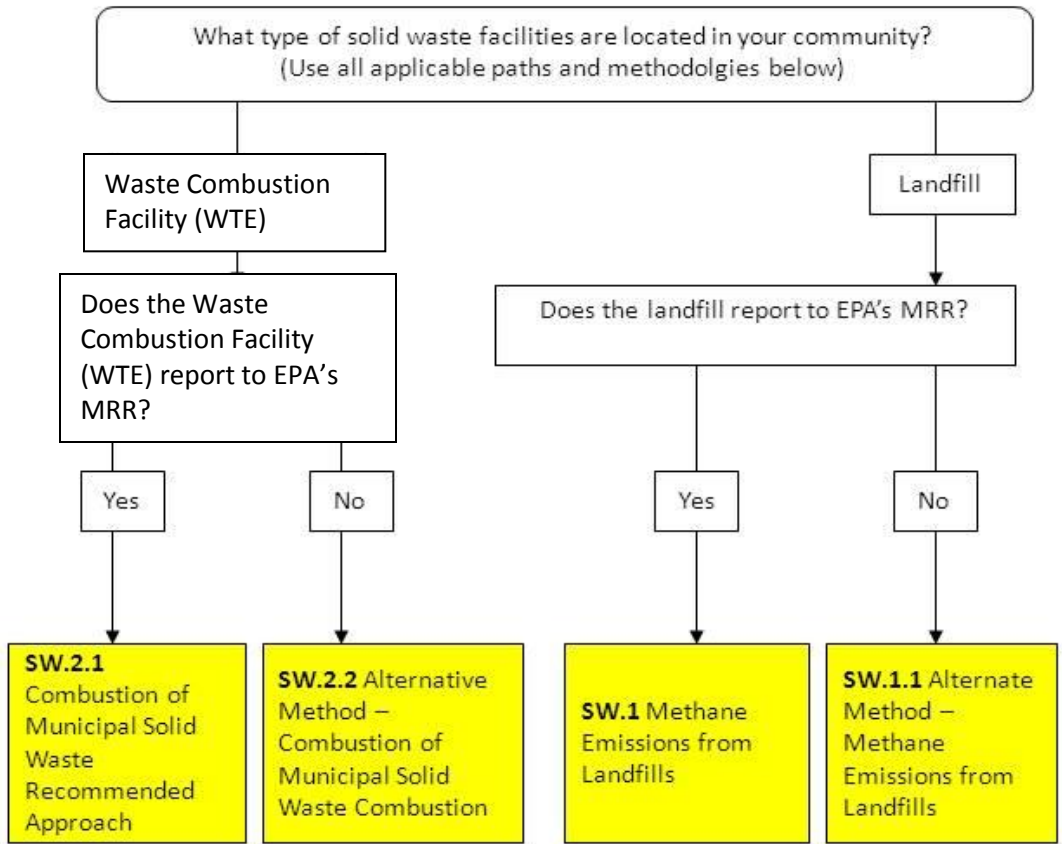
- a) For explanation of methodology, see the EPA WARM Documentation: [Documentation Chapters for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model \(WARM\)](https://www.epa.gov/warm/documentation-chapters-greenhouse-gas-emission-and-energy-factors-used-waste-reduction-model) -- available on the Internet at <https://www.epa.gov/warm/documentation-chapters-greenhouse-gas-emission-and-energy-factors-used-waste-reduction-model>
- b) Emissions estimates provided by this model are intended to support voluntary GHG measurement and reporting initiatives.
- c) The GHG emissions results estimated in WARM indicate the full life-cycle benefits waste management alternatives. Due to the timing of the GHG emissions from the waste management pathways, (e.g., avoided landfilling and increased recycling), the actual GHG implications may accrue over the long-term. Therefore, one should not interpret the GHG emissions implications as occurring all in one year, but rather through time.

**Total Change in GHG Emissions (MTCO<sub>2</sub>E): (79,527.36)**

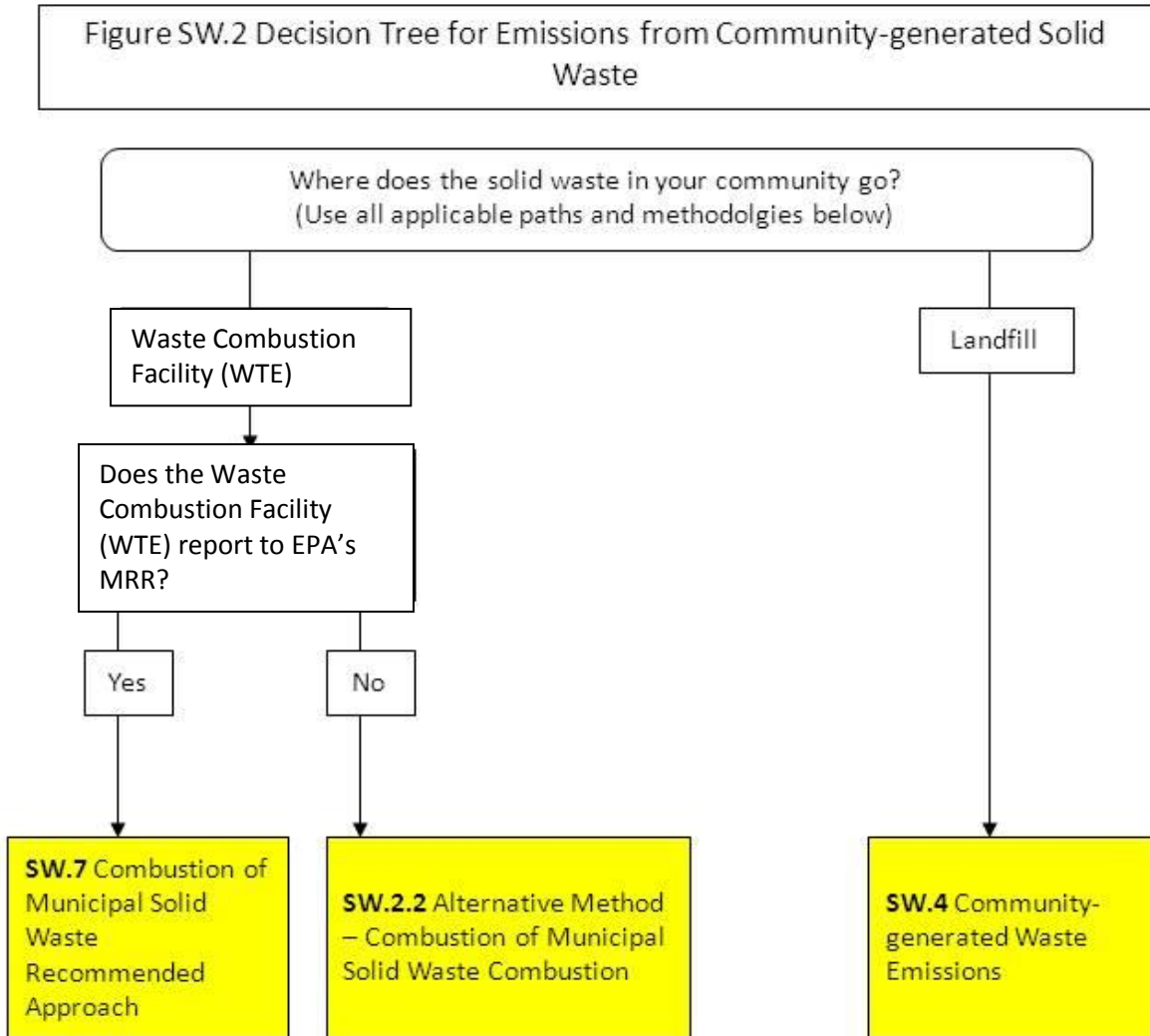
<b>This is equivalent to...</b>	
Removing annual emissions from	16,885 Passenger Vehicles
Conserving	8,948,730 Gallons of Gasoline
Conserving	3,313,640 Cylinders of Propane Used for Home Barbeques
	0.00446% Annual CO <sub>2</sub> emissions from the U.S. transportation sector
	0.00440% Annual CO <sub>2</sub> emissions from the U.S. electricity sector

**FIGURE 2**

Figure SW.1 Decision Tree for Solid Waste Emissions from Disposal Sites within a Community



**FIGURE 3**





**Figure 4: ICLEI ClearPath Solid Waste Sector Inputs**

Waste Totals	To Chemung County landfill	To Seneca Meadows landfill	Data Source
MSW - UCCRA Ulster		83,630.37	<a href="#">UCCRA Ulster - Permitted Transfer Facility Annual Report (2018)</a>
MSW - UCCRA New Paltz		46,949.84	<a href="#">UCCRA New Paltz - Permitted Transfer Facility Annual Report (2018)</a>
C&D - UCCRA Ulster			
C&D - UCCRA New Paltz			
Biosolids - UCRRA New Paltz	3,680.00		
*Total MSW generated within Ulster County (see LSWMP table below) - via UCCRA		101,379.00	
*Total other MSW - via UCCRA (transported to landfill)		29,201.21	
Total transported to landfills (via UCCRA)	3,680.00	130,580.21	

**Roundtrip mileage to landfills :**

<a href="#">Seneca Meadows</a>	478
<a href="#">Chemung County Landfill</a>	368

**ADDITIONAL INFORMATION OBTAINED FROM: [UCRAA Local Solid Waste Management Plan \(2020\)](#)**

**3.1 Solid Waste**

MSW generated within Ulster County must be brought to and processed through the transfer stations operated by the Agency as a result of flow control that was implemented in 2012. The Ulster County transfer stations also have the ability to process C&D waste. Since flow control is not implemented for C&D, private haulers can also bring C&D waste to be processed at other facilities

**2018 UCRRA Waste Stream Totals**

Material	Total (tons)	Percent of waste stream
MSW	101,379	66.45%
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Wood Chips	1,169	0.77%
Commingled	526	0.34%
Brush	459	0.30%
E-Waste	304	0.20%
Glass	496	0.33%
Total	152,553	100.00%

Based on UCRRA's current average MSW tonnages of 100,000 tons per year and an average of 32.5 tons of waste being loaded per long trailer to Seneca Meadows Landfill, it would require 3,077 trips to dispose of the material. The table below assumes trucks averaging 5 miles per gallon and a cost of \$2.75/ gallon of fuel. A cost saving of \$580,000 would be immediately recognized per year by disposing of MSW locally with the County.

	SMI	Local	Difference
Round trip miles	470	70	400
Miles per year	1,446,190.00	215,390.00	1,230,800.00
Fuel cost per year	\$795,404.50	\$215,390.00	\$580,014.50