NEXTCYCLE MICHIGAN

BUILDING A ROBUST CIRCULAR ECONOMY THROUGH PARTNERSHIP & INNOVATION

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CENTREPOLIS Accelerator at Lawrence Technological University

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GAP ANALYSIS: 2020 EXECUTIVE SUMMARY

In 2018, Michigan diverted 18 percent from landfill to recycling and composting activities and disposed of 8.83 million tons of municipal solid waste (MSW)[1]. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) is working to expand recycling opportunities, increase recycling participation, and grow end-use recycling markets with the goal of tripling Michigan's recycling rate to 45 percent. In working toward this goal, EGLE recognizes there are gaps in Michigan's recycling supply chain that need attention. The work described in this report is intended to illuminate gaps in Michigan's recycling supply chain to guide the development of the Innovation Challenge Tracks, focus activity within Renew Partnership Portal Projects, and benchmark progress on the NextCycle Michigan Initiative to date. Attachment A contains detailed analysis and data informing the conclusions presented below.

HIGHLIGHTED GAPS FOR PRIORITIZATION – IN SUMMARY

Tripling Michigan's diversion rate will require innovation, investment, collaboration, and partnership to build the capacity and end markets necessary to create a robust circular economy.

Building on the 2019 Michigan Recyclables Market Development Study, this 2020 Gap Analysis has delved deeper into the data to gain a better understanding of the gaps and opportunities to grow Michigan's circular economy across the supply chain. Some of this year's take-aways include the following recommended priorities for innovation, collaboration, and investment, aggregated in six key areas – end markets, economic sectors, processing capacity, comprehensive drop-off centers, underserved regions of the state, and market values.

END MARKETS

- Increases in recycled content, especially post-consumer, by both the public and private sector, is key, requiring commitments to work through the technical, economic, administrative, and consumer acceptance barriers so that economies of scale can be achieved that bring strong financial, community and environmental benefits.
- Glass, mixed- and lower-value grade plastics, textiles, wood waste, and food scraps all represent opportunities for significant growth in end market development.
- Organics use in road building, agriculture, living shoreline applications, and other soil-building, water-retention capacities is critical to increasing demand-pull for compost. Policies requiring locally-produced, certified compost as a percentage of organic content in new developments, road-building, and other related uses can serve as a driver to improve end market opportunities.
- Materials that fall outside of the parameters of this study that demonstrate opportunity for end market investment and recovery potential include tires, asphalt shingles, and other bulky recoverable materials.

ECONOMIC SECTORS

- The commercial and institutional sectors generate 53 percent of the municipal solid waste stream, and additional diversion from these sectors is necessary to reach a 45 percent diversion rate.
- Retail trade, accommodation and food services, and transportation and warehouse services account for 45 percent of the waste generated in the commercial/institutional sector.
- More than half the waste generated in the accommodation and food services sector is organics.
- Drilling down to the regional level provides additional detail regarding specific opportunities for increased diversion based on the percentage of commercial activity in those areas.

[1] Municipal solid waste includes waste generated from households, businesses, and institutions. It does not include industrial waste or construction and demolition waste.

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PROCESSING CAPACITY

- At current processing capacity statewide, achieving a 45 percent recycling rate would necessitate an additional 900,000 tons/year of throughput capacity for recyclables.
- The Gap Analysis 2020 Slide Deck outlines several hypothetical scenarios for building out this needed capacity considering optimized hub and spoke efficiencies and options for small, medium, and large facility throughput in recycling facility sizing – responding to local conditions and the integration with or independence of commercial versus residential recycling processing.
- While some additional capacity can be achieved with increased work hours, equipment upgrades, and/or expansion of existing MRFs, greater recycling processing capacity will also be needed to meet this future throughput.
- Food scrap processing is woefully lacking in Michigan with only five of the 150 composting sites statewide accepting food scraps for processing. Both wet and dry anaerobic digestion represent processing opportunities that warrant further exploration as do more conventional composting technologies.

COMPREHENSIVE DROP-OFF CENTERS

- Up to half of recoverable materials cannot efficiently be collected curbside. An estimated 100 drop-off centers statewide could provide convenient access and increase diversion of these materials from landfill.
- Comprehensive drop-off centers placed in seventeen key communities in southeast Michigan could provide access to almost 50 percent of Michigan's population.

UNDERSERVED REGIONS OF THE STATE

- The southeast region of Michigan represents the largest demographic and hence the greatest opportunity for significant recovery.
- Many parts of rural Michigan have limited or no curbside recycling or commercial recycling collection service, limited or no drop-off sites for residential or commercial recycling, and no comprehensive drop-off centers for bulky and hard-to-recycle materials.
- The entire state has inadequate food scrap/organics collection for residential, commercial/institutional sectors, and insufficient processing or robust end markets for compost or anaerobic digestion outputs.

MARKET VALUES

- The combination of China's tightening restrictions for import of recyclables, the follow-on policies of other nations, U.S. trade policies, and COVID-19 economic disruptions have all served to destabilize many recycling markets. The depressed fossil fuel prices have dramatically impacted most PCR plastics grades. However some alliances in the manufacturing sector have been forged that are committing to increased use of PCR content in their products and packaging with very ambitious goals. It is anticipated that this will have a positive impact on many commodity markets in the coming years.
- As a result of the above forces, increased development of domestic end market supply chains and manufacturing capacity as North American-based industries absorb the tons no longer moving to Asia.

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PRIORITIES AND RECOMMENDED CONNECTIONS TO NEXTCYCLE MICHIGAN INITIATIVE

The NextCycle Michigan Initiative represents an opportunity to bring communities, entrepreneurs, organizations, and funders together to address these pressing access and processing gaps and develop innovative and creative partnerships and solutions to grow end markets and Michigan's circular economy. As EGLE's Materials Management Infrastructure (Mega Data) Project gathers and analyzes further data, it will inform subsequent NextCycle Michigan Gap Analyses each year of this initiative. Each year's Gap Analysis will provide NextCycle Michigan's Technical Advisory Committee with the information necessary to set the priorities and opportunities for the coming year's Innovation Challenge Tracks and will assist the NextCycle Michigan team in bringing focus to Renew Partnership Portal projects. The resulting partnerships, investments, and projects will lead directly to outcomes and impacts that will increase recovery and grow robust circular solutions for Michigan's economy and environment.

All the gaps identified represent opportunities for innovation, investment, and partnership. To demonstrate how some of these prioritized gaps align with and inform the Innovation Challenge Track development within the NextCycle Michigan Initiative, consider the following:

FOOD, LIQUIDS, AND ORGANIC WASTE SYSTEMS (FLOWS) TRACK

- Access, collection, processing, and end market development for organics all present opportunities for growth in all regions of the state.
- Residential and commercial food scrap collection, processing capacity, and marketable compost development are stand-out priorities for this track.
- End market development for compost and other by-products of organics processing offer diverse and multiple opportunities, from agriculture to erosion control to roadway construction and more.

INTERGOVERNMENTAL INITIATIVES (I^2) TRACK

- Public-public, public-nonprofit, and public-private partnerships are essential to developing a robust circular economy in Michigan, with opportunities to have significant impact across all identified gaps.
- Intergovernmental agreements, development of authorities, and other available mechanisms offer opportunities to close gaps in access, processing, and end markets to increase cost effectiveness and efficiencies across the supply chain.
- Best practice policy development at the local and regional level can achieve significant outcomes. Policy development and implementation can improve access, collection, communication, and outreach, and increase use of compost and other recyclables in many applications.

MICRO SCALE 3RS SOLUTIONS (MICROS) TRACK

- Access, collection, processing, and end market development sometimes start small, and some communities, entrepreneurs or endeavors may need only a small boost of funding, expertise, or mentorship to get an idea off the ground.
- Many communities with interest in collaborating across their region lack the resources to meet and develop collaborative approaches to filling gaps in diversion in their areas.
- Demonstration projects that are replicable at small scale, or scalable, can take their next step towards implementation to determine viability for growth and investment.

RECYCLING INNOVATIONS & TECHNOLOGY (RIT) TRACK

- The development of an innovative process, product, or service that increases the use of recyclables that are lacking end markets represents a significant opportunity for economic development and diversion in Michigan.
- Materials prioritized for innovation initiatives include glass, textiles, tires, wood waste, food scraps, mixed plastics, film plastics, tires, and asphalt shingles.

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- Innovations in sortation technology, including improvements in robotics, conveyance, AI, and decontamination all represent opportunities for investment.

ROADS (ROADS) TRACK

Road-building provides ample opportunity for investment, innovation and partnership in the increased use of recycled-content materials that are high priorities for end market development, including post-consumer glass, asphalt shingles, tires, and compost. The use of mixed plastics in drain beds and other applications also offers opportunities for increased recovery.

RECYCLING SUPPLY CHAIN (RSC) TRACK

Convenient and cost-effective access to recycling and organics recovery is a highlighted priority. Numerous gaps across the supply chain have been identified in this report. Top access recommendations include:

- Comprehensive curbside collection and drop sites for residential, commercial, and institutional use.
- Comprehensive drop-off centers statewide will provide convenient access for up to half of the material stream that cannot be recovered curbside. One hundred drop-off sites statewide would provide adequate coverage for the recovery of paints, motor oil, batteries, e-waste, large appliances (including refrigerant recovery), mattresses, bulky plastics, marine shrink wrap and agricultural plastics, tires, wood waste, textiles and more.
- Strategically placing 17 comprehensive drop-off centers would provide convenient access (within 30-minute drive) to almost half of all Michiganders in the state.
- Hub and spoke MRF infrastructure development to meet the growing need for processing.
- Increase food scrap collection and drop-off, both residential and commercial/institutional.

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APPENDIX A: DATA AND ANALYSIS SUPPORTING THE GAP ANALYSIS 2020 CONCLUSIONS

To identify the magnitude of diversion infrastructure gaps, RRS analyzed Michigan's current disposal stream and applied a composition estimate to MSW so that the proportion of recoverable material in MSW could be identified. Overall, 84 percent of disposed MSW is estimated to be recoverable through recycling and organics processing activities. RRS estimated a reasonable capture rate for each disposed commodity[2] that if achieved would move enough recyclables and organics from disposal to recovery for Michigan to triple the state's diversion rate. From this analysis, diversion infrastructure gaps were identified (Table 1).

Table 1. Summary of Additional Diversion and Diversion Infrastructure Gaps

	Needed Capture Rate	Additional Collection Tons	Identified Infrastructure Gap	Next Steps
Mixed Recycling Processing at Material Recovery Facilities (MRFs)	56%	1.23 million	13 to 64 new MRFs depending on facility throughput across the state for robust hub and spoke network	1. What portion of commercial material can bypass a MRF and go straight to processors and end markets? 2. Where are smaller community MRFs preferable over larger scale 35- and 50-TPH MRFs? 3. What is the average recycling transfer distance in Michigan currently and how would a more robust hub and spoke system alleviate some of the higher transfer distances?
Other Recycling at Recycling Drop-Off Facilities	17%	305,000	100 strategically placed comprehensive drop-offs would provide access to 98% of Michiganders, 17 sites in most densely populated areas provides access to half of Michigan's population	1. What is the current drop-off diversion capacity in Michigan? 2. Not every County needs a drop-off, but all Michiganders need access. How can the drop-off network be established to allow cross-County access? 3. Where are opportunities to co-locate MRFs, transfer stations, landfills, and drop-offs?
Organics Processing	33%	1.12 million	Approximately 500,00 additional organics processing capacity for food waste and 300,000 additional processing capacity for wood waste is needed in Michigan	1. What compost facilities have the potential to expand? 2. What compost facilities have the potential to accept food waste? 3. Where is backyard composting an ideal approach?

[2] Capture rate refers to the movement of recoverable material from disposal to recycling or organics processing to reach 45% recovery rate. For example, it may not be reasonable to assume 100% of plastic PET bottles in the disposal stream could be captured for recycling. However, it may be reasonable to assume 50% of plastic PET bottles in disposal could be captured for recycling with improved outreach and education, collection, and processing programs. Thus for this example the capture rate for plastic PET bottles would be 50%.

Finally, RRS researched end markets in Michigan and market trends. A summary of commonly recycled commodities along with a forecast description and likely trend over the next several years is presented in Table 2.

Table 2. Summary forecast of commonly recycled commodities.

Commodities	Long Term Forecast Description	Trend
Polyethylene Terephthalate	Low cost virgin PET oversupply will push market down but demand driven increase in rPET (recycled PET) should eventually delink market with virgin PET within 3 years, similar to NHDPE, and pricing will trend up.	Low but Trends Up
Natural High-Density Polyethylene	While currently low, CPG commitments and minimum recycled content policy expected to improve demand and NHDPE pricing should increase over time.	Low but Trends Up
Colored High-Density Polyethylene	New, virgin capacity natural gas cracking markets and Chinese polyethylene will keep CHDPE bale pricing low for the next 1-3 years. However, similar to NHDPE, long-term trend is emergence of a rCHDPE bale with higher demand.	Stay Low, then trend up
Mixed Plastic	#3-#7 bales will continue to trade at or below zero for the next 2-5 years. However, plastics industry is responding through chemical recycling initiative which deconstructs polymers. Megatrend will grow markets for mixed plastic.	Stay Low
Polypropylene	New virgin PP capacity and low oil / natural gas markets will keep #5 bale pricing low for next 1-3 years.	Stay Low, then trend up
Mixed Bulky Rigids	Increase virgin capacity and low oil and natural gas prices will result in a glut of cheap virgin PP and HDPE, keeping bale prices low.	Stay Low
Old Corrugated Cardboard (OCC)	OCC will have increased demand for containerboard but much less than predicted. Market will be steady.	Steady
Mixed Paper	Market will recover in 3 to 4 years from increasing demand with dwindling supply and domestic mill capacity increase.	Low, Trend Up
Sorted Residential Papers and News (SRPN)	True mixed ONP (SRPN, #8 will have a differential of $20 or more compared to mixed paper because of lower contaminants from more sorting and because it can be used in groundwood applications.	Trend Up
Aseptic Packaging and Gable-Top Cartons	Cartons have maintained a positive value since the grade was tracked. Markets in Michigan are strong and may improve as supply for sorted grades increases.	Trend Up
Glass 3 Mix Glass	3-mix glass has been disrupted by the COVID deposit state loss, which accounts for 33% to 50% of all cullet. At the same time, despite talk of recycled content, price will continue to trend lower, as construction slows (fiberglass usage) with the economy.	Trend Low
Aluminum Cans	Though aluminum cans have a home both for going back to can sheet or secondary aluminum pricing will remain low through 18 months.	Stay Low
Steel Cans	There will be some recovery once factories get back to work, but any extended recession will result in the market to remaining low.	Stay Low

Tripling Michigan's diversion rate will require investment in collections, processing, and end markets throughout the state. There is no single track or pathway that taken alone will get Michigan to 45 percent diversion. Processing and end market gaps and solutions vary by commodity type so that a comprehensive approach to waste diversion must be undertaken to truly move the needle on Michigan's diversion efforts.

MICHIGAN'S MUNICIPAL SOLID WASTE DISPOSAL STREAM

In 2018, Michigan disposed of 8.83 million tons of municipal solid waste. Of that disposal, approximately 84 percent could be recovered while the remaining16 percent is considered non-recoverable (Figure 1). Recoverable material includes traditional mixed recyclables such as paper; glass and plastic bottles and jars; plastic tubs and containers; and metal cans and containers that are processed at MRFs around the state before going to end market (26 percent of the disposal stream). Also included as recoverable are other recyclables such as textiles, appliances, scrap metal, electronics, bulky plastics, and plastic films (20 percent of the disposal stream). These materials are not suitable for today's MRF and are typically collected via government and private business drop-off, scrap yards, or takeback programs. Finally, recoverable materials include organics such as yard and food waste as well as compostable paper and compostable food service packaging (38 percent of the disposal stream).

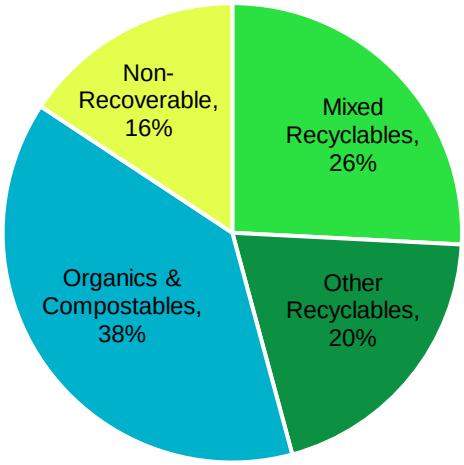

Figure 1. Composition of Michigan's Disposal Stream

Waste can be analyzed regionally across the state using Michigan's Councils of Government or COGs (Table 3). Michigan is organized into 14 COGs that group counties together based on geographic similarities. For example, COG 1 encompasses Livingston, Macomb, Monroe, Oakland, Saint Claire, Washtenaw, and Wayne Counties and disposed of 1.07 million tons of mixed recyclables, 828,000 tons of other recyclables, and 1.59 million tons of organics and other compostables in 2018. In total approximately 2.28 million tons of mixed recyclables, 1.76 million tons of other recyclables, and 3.40 tons of organics and compostables were sent to disposal in 2018 from the entire state.

Table 3. Breakdown of Michigan's Disposal Stream by Council of Government

COG	Mixed Recyclables	Other Recyclables	Organics & Compostables	Non-Recoverable
1	1,069,215	827,755	1,594,408	651,149
2	68,028	52,665	101,442	41,429
3	128,564	99,531	191,714	78,295
4	63,176	48,909	94,208	38,474
5	120,427	93,231	179,580	73,339
6	108,249	83,804	161,421	65,924
7	196,142	151,847	292,486	119,450
8	282,291	218,541	420,950	171,914
9	29,872	23,126	44,545	18,192
10	68,724	53,204	102,481	41,853

11	12,262	9,493	18,285	7,468
12	49,617	38,412	73,988	30,217
13	17,670	13,679	26,349	10,761
14	65,163	50,447	97,171	39,684
Total	**2,279,400**	**1,764,644**	**3,399,028**	**1,388,149**

As noted above, the total disposal stream analyzed here is MSW which includes the residential, commercial, and institutional sectors and encompasses 60 percent of material generated in-state that goes to landfill[3]. Increasing the diversion rate will mean that the recoverable commodities generated in all three of these sectors currently heading to disposal in Michigan will need to be collected, processed, and sent to end markets. Roughly 47 percent of municipal solid waste sent to disposal is generated in the residential sector and the other 53 percent is generated in the commercial and institutional sectors (Figure 2).

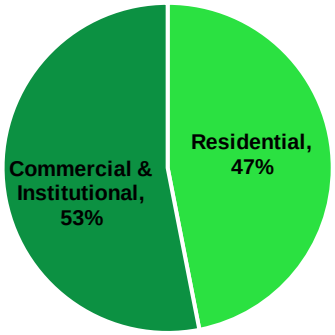

Figure 2. Source of Municipal Solid Waste Disposal

Within the commercial and institutional sectors there is significant variety in generators, each with unique waste stream characteristics and diversion needs. The top three commercial and institutional generators in Michigan are retail trade, accommodation and food services, and transportation and warehousing. Retail trade generates a significant amount paper, cardboard, glass, metal, and plastic, much of which could either be collected from the business directly as source separated material or otherwise collected as mixed recycling and sent to a MRF. More than half of the waste generated at accommodation and food services is organics, mainly food waste and compostable paper that would need to go to a compost or anerobic digestion facility. Transportation and warehousing generates a significant amount of metals and cardboard that is likely most suited to source separated collection for sale direct to end markets. A breakdown of the source of commercial and institutional waste by COG is provided in the accompanying Gap Analysis 2020 slide deck.

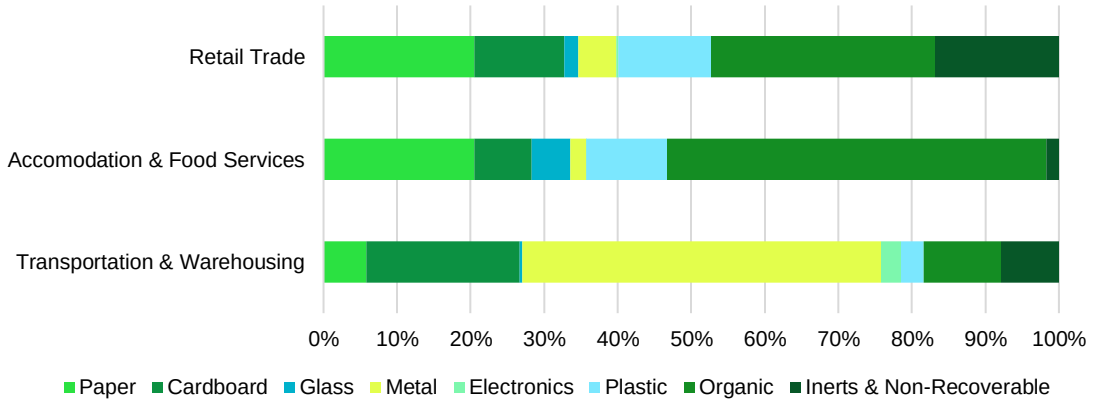

Figure 3. Estimated waste composition of the top three generating commercial and institutional sectors in Michigan

[3] The remaining material generated in-state and sent to disposal includes industrial and construction and demolition waste which is not analyzed in this report.

Given the diversity of generation and materials in the stream, no one sector or commodity focus will substantially move Michigan's diversion rate from 2018 levels of 18 percent to 45 percent. Instead a holistic approach needs to be taken providing recovery solutions for residents, businesses, and institutions across the state.

MIXED RECYCLING PROCESSING

CURRENT MATERIAL RECOVERY FACILITY PROCESSING

In 2019, Michigan MRFs had the processing capacity to manage approximately 315,000 tons annually (Figure 4 and *Table 4*)[4]. The new MRFs in Lansing and Marquette County will add 49,000 tons of processing capacity, and the rebuilt Ann Arbor MRF will add approximately 30,000 - 50,000 tons of processing capacity annually so that total processing capacity will exceed 400,000 tons per year in Michigan. MRFs are generally concentrated around Michigan's population centers, and there are some regions without any processing capacity. Specifically, COG Regions 2, 3, 5, 6, 13, and 14 do not have any MRF processing capacity. COG Region 6, which encompasses the state's capitol Lansing, will add 40,000 tons of processing capacity when the new Emterra MRF becomes operational in late 2020.

Table 4. Current Material Recovery Facility Throughput (Tons Per Year)[5]

COG	MRF Throughput
1*	158,012
2	0
3	0
4	9,200
5	0
6*	0
7	21,212
8	91,860
9	402
10	30,750
11	2,122
12*	1,934
13	0
14	0
Total	**315,492**

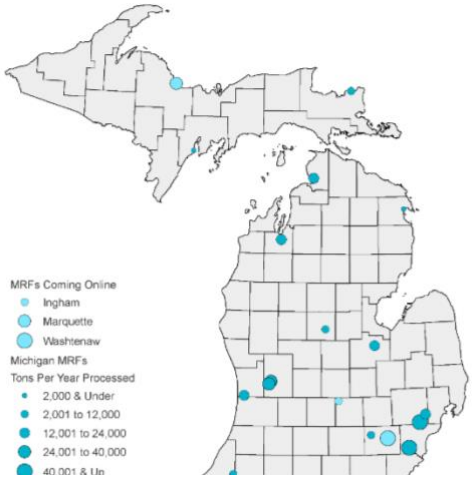

Figure 4. Material Recovery Facilities (MRFs) in Michigan

It should be noted that in 2018 Michigan recycled 1.22 million tons of traditional recyclables that are often associated with MRF processing such as paper, cardboard, aluminum, glass, and plastic bottles and

[4] Data of MRF processing capacity was obtained from research by Government Advisory Associates (GAA). Exact MRF processing capacity is challenging to quantify because MRFs can often increase or decrease throughputs with adjustments in equipment, sorting line speeds, and staffing relatively quickly. Additionally, there may be light or specialized MRFs predominantly handing commercial recycling, and data on that activity is unknown in Michigan.

[5] COG 1, 6 and, 12 are adding processing capacity: COG 1 – 30,000 to 50,000 TPY, COG 6 – 40,000 TPY. COG 12 – 9,000 TPY

jars, as well as paper and plastic take out containers. This is significantly greater than the in-state MRF processing capacity stated above. There are a couple factors to consider. First some of Michigan's recyclables are processed out-of-state and in Canada; however out-of-state processing most likely accounts for only a small portion of the total recycling processed from Michigan. A more likely explanation is that a large portion of the 1.22 million tons of traditional recyclables is bypassing known MRFs or is processed at private sector operations with little transparency. Of the 1.22 million tons of traditional recyclables that were recovered in Michigan, more than half is estimated to be sourced from the commercial and institutional sectors which can often be collected source separated from the business directly. Without greater data tracking and transparency in Michigan, it is challenging to understand exact MRF processing operations across the state and business-to-business recovery operations that are significantly contributing to Michigan's overall diversion rate.

ADDITIONAL MATERIAL RECOVERY FACILITY PROCESSING

For Michigan to achieve a 45 percent diversion rate, both recycling and organics collection and processing will need to be ramped up throughout the state. On the recycling side, an additional 1.29 million tons of residential, commercial, and institutional mixed recyclables will need to be collected from the disposal stream and processed at MRFs (56 percent capture rate, Table 5). Mixed recyclables include things such as paper, cardboard, aluminum, glass, and plastic bottles and jars, as well as paper and plastic take out containers. The additional recycling can be broken down by COG to understand the regional implications.

Table 5. Additional Mixed Recyclables with Triple the Diversion Rate (Tons)

COG	Residential	Commercial & Institutional	Total
1	250,145	353,241	603,386
2	15,902	22,461	38,363
3	30,052	42,456	72,508
4	14,770	20,859	35,629
5	28,164	39,774	67,938
6	25,312	35,752	61,064
7	45,823	64,739	110,562
8	66,017	93,240	159,257
9	6,949	9,828	16,777
10	16,028	22,654	38,682
11	2,853	4,039	6,892
12	11,577	16,363	27,940
13	4,104	5,808	9,912
14	15,222	21,507	36,729
Total Additional MRF Diversion	**532,918**	**752,721**	**1,285,639**

Table 6 compares Michigan's current MRF processing and the needed MRF processing with triple the diversion rate. From this comparison the MRF processing gap can be calculated by subtracting the needed MRF processing from the current MRF processing. In all of Michigan COGs, more processing capacity is needed, with the largest MRF processing gaps occurring in COGs 1, 7, and 3. Overall Michigan needs processing capacity for an additional 970,000 tons of mixed recyclables.

Table 6. Comparison of Current MRF Processing and Needed MRF Processing

COG	Current MRF Processing (TPY)	Needed MRF Processing (TPY)	MRF Processing Gap (TPY)
1	158,012	603,386	(445,374)
2	0	38,363	(38,363)
3	0	72,508	(72,508)
4	9,200	35,629	(26,429)
5	0	67,938	(67,938)
6	0	61,064	(61,064)
7	21,212	110,562	(89,350)
8	91,860	159,257	(67,397)
9	402	16,777	(16,375)
10	30,750	38,682	(7,932)
11	2,122	6,892	(4,770)
12	1,934	27,940	(26,006)
13	0	9,912	(9,912)
14	0	36,729	(36,729)
Total	**315,492**	**1,285,639**	**(970,147)**

The additional recycling and MRF gap calculation can be translated into number of additional MRFs needed for processing. For example, COG 1 could support 30 additional 10-TPH (tons per hour) MRFs, nine additional 35-TPH MRFs, or six additional 50-TPH MRFs (Table 7). There is most likely no one size fits all solution for each Michigan COG region. For example, COG 1 may be better suited for larger, regional 50-TPH MRFs due to the high population density and challenges in securing land for industrial development. On the other hand, less densly populated regions in Michigan may still want to consider adding MRF processing capacity rather than relying on transfer and could be better suited to smaller processing facilities due to lower collection volumes. In total, Michigan would need 13 to 64 new MRFs depending on facility throughput across the state with triple the diversion rate.

Table 7. Translating additional MRF recycling to additional MRFs

COG	10-TPH 1-Shift	35-TPH 1-Shift	50-TPH 1-Shift
1	30	9	6
2	2	1	0
3	4	1	1
4	2	1	0
5	3	1	1
6	3	1	1
7	6	2	1
8	8	2	2
9	1	0	0
10	2	1	0
11	0	0	0
12	1	0	0

13	0	0	0
14	2	1	0
Total	**64**	**18**	**13**

There are many ways Michigan could organize an efficient hub and spoke network with additional MRFs for added mixed recycling processing. One hypothetical example is shown in Figure 5. Existing and planned MRFs are shown as dark and light blue squares respectively, hypothetical MRFs are shown as yellow squares, and transfer points are shown as green circles. Hypothetical MRFs are shown only for illustration of where strategically placed and sized MRFs throughout the state could add vital access for recycling processing. Where collection volumes are lower, hypothetical transfer stations are used to show how material would be moved to the nearest regional MRF for processing. Maps showing examples of what a low, medium, and high centralized hub and spoke network in Michigan could look like is shown in the accompanying Gap Analysis 2020 slide deck.

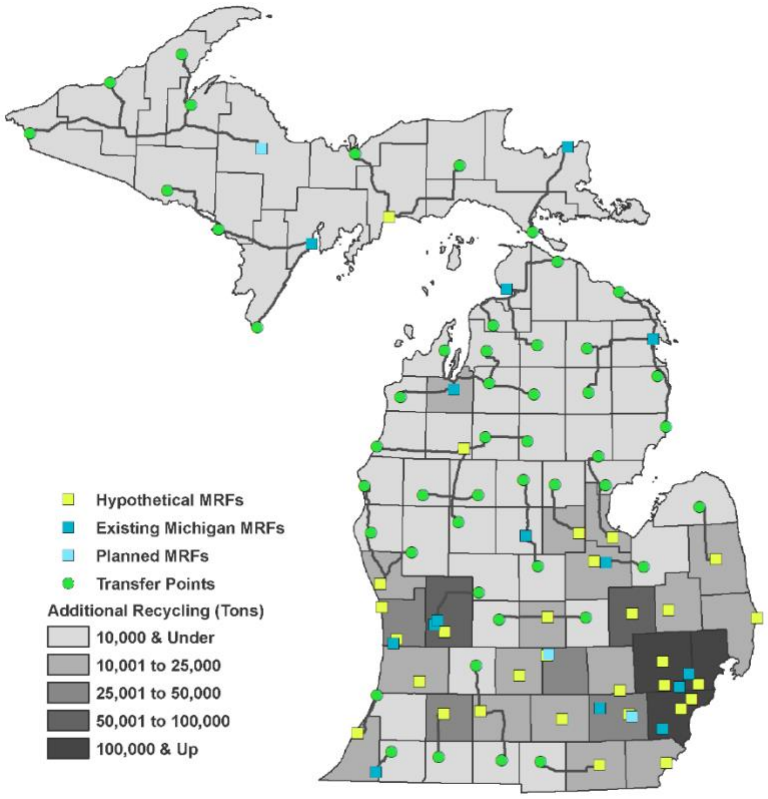

Figure 5. Hypothetical hub and spoke MRF collection system

RECYCLING DROP-OFF

Along with the traditional MRF recyclables, the waste stream includes many recoverable materials that are not presently suitable for MRF processing such as textiles, large bulky plastics, plastic films, electronics, and scrap metal. In 2018, Michigan collected 185,000 tons of these Other Recyclables and disposed of 1.76 million tons of Other Recyclables (Table 8).

Table 8. Total Tons Other Recyclables Diverted from Disposal

Material	Tons Collected
Total E-Waste	12,011
Total Batteries	45,182
Total Paint	225
Total White Goods	75,747
Recovered Metal	48,297
Total Textiles	3,805
Total	**185,267**

Current collection methods for these items varies across Michigan and is often provided to residents as a patchwork of private business takeback programs, scrap yards, and government organized collection sites or events. To reach a 45 percent diversion rate, Michigan needs to capture 17 percent of this category of Other Recyclables going to landfill for recycling, or an additional 305,000 tons of Other Recyclables would need to be collected across Michigan (Table 9).

Table 9. Additional Other Recyclables with Triple the Diversion Rate (Tons)

COG	Residential Additional Other Recyclables	Commercial Additional Other Recyclables	Total Additional Other Recyclables
1	80,055	63,375	143,430
2	5,086	4,028	9,114
3	9,616	7,610	17,226
4	4,724	3,740	8,464
5	9,011	7,134	16,145
6	8,098	6,411	14,509
7	14,657	11,599	26,256
8	21,123	16,720	37,843
9	2,219	1,755	3,974
10	5,121	4,053	9,174
11	909	721	1,630
12	3,700	2,931	6,631
13	1,310	1,039	2,349
14	4,870	3,855	8,725
Total Additional Diversion	**170,499**	**134,971**	**305,470**

Instead of a patchwork approach that requires residents to visit multiple locations to drop off hard to recycle items, comprehensive drop-offs provide a one-stop location for residents to recycle many different kinds of materials including hard to recycle items mentioned above along with tires, hazardous household waste (HHW), residential construction and demolition debris, mattresses, furniture, bulky plastics and more. When siting any drop-off facility, the goal is to maximize the number of residents that have convenient access. Doing this across the state requires careful strategic planning to ensure as many Michiganders as possible have access to a drop-off and that site access is not overlapping giving uneven or unequal access in different regions. An example of a strategic drop-off map is shown in Figure 6 where 100 hypothetical drop-off locations are located such that 98 percent of Michigan residents are within a 30 to

45 minute drive of a site. The green squares represent drop-off locations while the lines emanating from each square represents the regions served by the drop-off site. While this hypothetical map maximizes resident access with placement, it would also require inter-county cooperation. In many instances, it may make more sense for a resident to cross county lines to go to a drop-off in a neighboring county instead of every county only providing access to in-county residents. Finally, as noted earlier, population density is not evenly distributed across Michigan such that nearly half of Michigan residents could be provided with convenient access to a comprehensive drop-off with 17 strategically placed sites in some of the most densely populated regions of the state (Table 10).

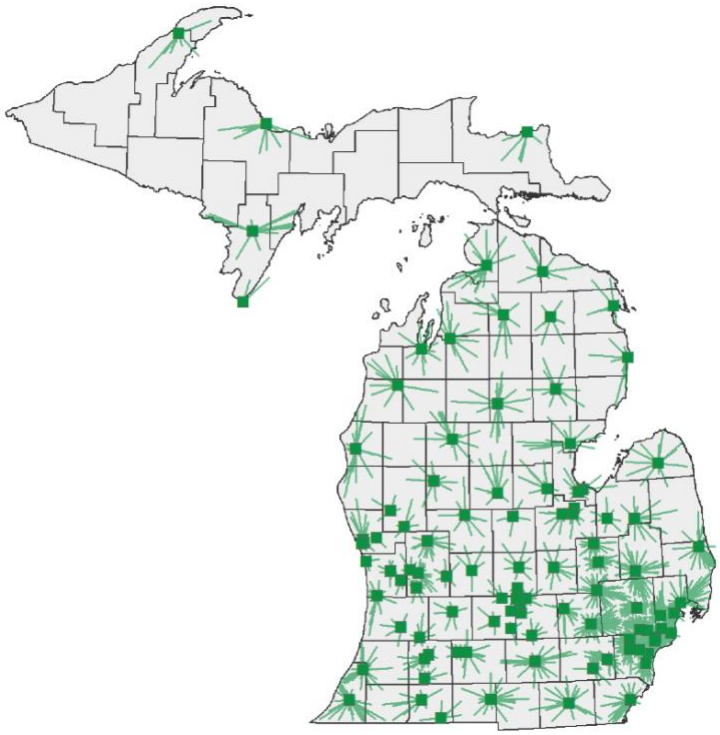

Figure 6. 100 Strategically placed comprehensive drop-off sites

Table 10. 17 drop-off locations that could provide access to nearly half of Michiganders

	Community Name	Population Using Site
1	Sterling Heights city	338,528
2	Brighton city	283,064
3	Grand Rapids city	277,777
4	Pontiac city	272,052
5	Livonia city	269,054
6	Westland city	267,417
7	Ypsilanti city	265,096
8	Mount Clemens city	256,486
9	Chesterfield township	248,958
10	Southfield city	245,806
11	Dearborn Heights city	245,505

12	Southgate city	241,682
13	Oak Park city	234,671
14	Flint city	223,841
15	Center Line city	219,908
16	Melvindale city	206,596
17	Harper Woods city	204,029
	Total	**4,881,455**

ORGANICS PROCESSING

Since 1995, yard waste has been banned from Michigan landfills, and many Michigan communities have instituted yard waste curbside collection or drop-off programs. Overall Michigan has more than 150 registered composting facilities in the state, most accepting yard waste. While yard waste composting access is abundant across the state, only eight of the more than 150 registered compost sites reported accepting any food waste in 2018 (Figure 7). The abundance of yard waste composting facilities coupled with limited food waste processing access is borne out in the numbers. In 2018, Michigan compost facilities accepted 340,000 tons of yard waste and 3,800 tons of food waste. Additionally, facilities accepted 11,500 tons of wood waste and 12,000 tons of other organics (manure, spent brewery grain, compostable products, etc.) so that a total of 367,000 tons of organics were processed at Michigan compost facilities in 2018 (Table 11). Approximately 93 percent of processed organics in Michigan was yard waste while only one percent was food waste (**Error! Reference source not found.**).

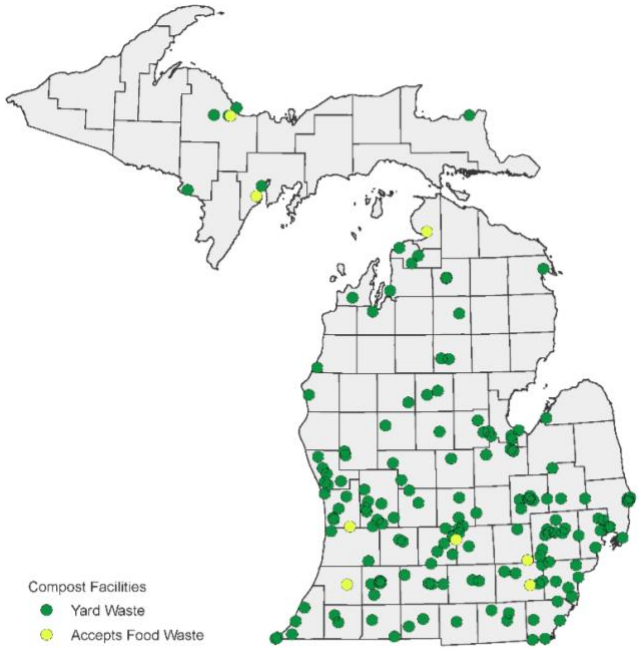

Figure 7. Compost Facility Infrastructure in Michigan

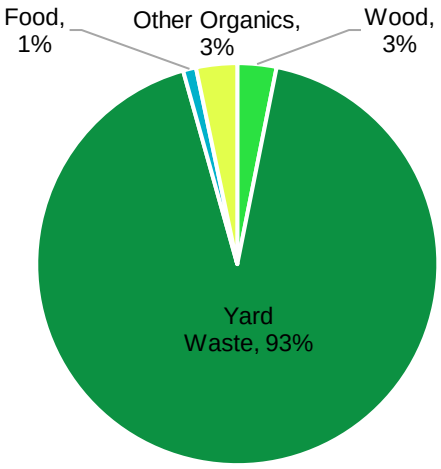

Figure 8. Proportion of Organics Processed at Michigan Compost Facilities

Table 11. Tons of Organics Processed at Michigan Compost Facilities in 2018

COG	Wood	Yard Waste	Food	Other Organics	Total
1	655	160,309	560	494	162,018
2	807	2,234	0	0	3,041
3	0	9,570	0	0	9,570
4	1,088	2,880	250	1,356	5,575
5	0	56,521	0	1,309	57,830
6	1,666	21,374	596	5,976	29,613
7	779	24,325	0	0	25,104
8	6,030	45,464	2,224	2,982	56,700
9	0	2,537	0	5	2,542
10	72	4,454	188	3	4,717
11	0	124	0	0	124
12	444	5,330	30	0	5,803
13	0	0	0	0	0
14	0	4,563	0	0	4,563
Total	**11,540**	**339,685**	**3,848**	**12,125**	**367,197**

To triple Michigan's diversion rate, approximately 33 percent of the organics currently going to disposal will need to be captured for organics processing at compost or anerobic digestion facilities. This would require processing capacity for an additional 1.12 million tons of organics (Table 12).

Table 12. Total Additional Organics Collection (Tons)

COG	Residential	Commercial	Total
1	265,838	258,019	523,857
2	16,908	16,410	33,318
3	31,956	31,016	62,972
4	15,703	15,240	30,943
5	29,937	29,057	58,994
6	26,909	26,118	53,027
7	48,738	47,305	96,043
8	70,176	68,108	138,284
9	7,410	7,192	14,602
10	17,068	16,562	33,630
11	3,043	2,953	5,996
12	12,323	11,962	24,285
13	4,382	4,252	8,634
14	16,190	15,717	31,907
Total Additional Diversion	**566,581**	**549,911**	**1,116,492**

With so much of Michigan's yard waste already being captured for composting due to Michigan's yard waste landfill ban, the majority of the additional collection is other organics streams such as food waste (46 percent), wood waste (28 percent), and compostable paper and compostable food service packaging (17 percent). A small portion (9 percent) of the additional organics collection needs to include yard waste (Table 13 and Figure 9).

Table 13. Total Additional Organics Collection (Tons)

Material	Tons	Percent
Food	511,090	46%
Wood	314,877	28%
Compostable/ soiled and all other paper	186,435	17%
Yard waste - general	104,090	9%
Total	**1,116,492**	**100%**

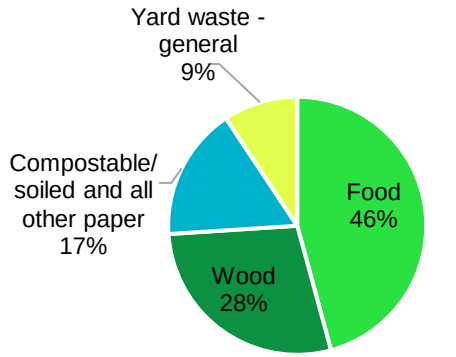

Figure 9. Proportion of Additional Organics Collection

It may be possible for some of Michigan's existing compost facilities to start accepting more food waste and compostable paper without substantial changes to operations. Other facilities may need upgrades in composting technology or expansions of their sites. It is not currently possible to adequately gauge what portion of Michigan's existing composting infrastructure could start accepting food waste today or expand to accept food waste in the near future, however we hope to increase our understanding of these opportunities with the Mega Data project in the coming year. Additionally, food waste is an ideal stream for anerobic digestion processing, and Michigan has very limited anaerobic digestion facilities within the state. Expanding anerobic digestion capacity throughout the state to capture food waste and particularly food waste from large quantity generators such as the food manufacturing industry in Michigan could be a focus of Michigan's FLOWS and RSC Challenge Tracks.

While there is not an absolute measure of Michigan's compost facility capacity, the level of additional organics processing needed across the state can be gauged by examining regional compost processing activity against needed organics collection in each COG. In most COGs, yard waste processing capacity is greater than needed capacity for that material (demonstrated by positive number in Table 14 Excess Yard Waste column) indicating that it is likely thee regions could process more yard waste today if collections were ramped up. In COGs 2, 4, 11, and 13, yard waste processing capacity is slightly below yard waste need capacity (indicated by negative number in Table 14 Excess Yard Waste column). However, this analysis does not account for backyard composting opportunities which especially in rural regions could provide significantly more composting opportunity for residents. Using the same analysis method shows a significantly different picture across the state for food waste processing capacity. In all COGs, excess food waste capacity is negative in Table 14 which indicates that needed processing capacity for food waste is greater than available food waste processing capacity. The biggest gap occurs in COG 1 where more than 200,000 tons of food waste that needs to be diverted from landfill for Michigan to reach 45 percent diversion has no outlet and thus the vast majority of these organics have nowhere else to go but to the landfill. Finally, as noted above, 28 percent of additional organics diversion could come from wood waste. In all COGs, more wood waste needs to be collected than is currently being processed at Michigan's compost facilities (indicated by negative numbers in Table 14). It is unknown if current compost facilities have the capability to accept additional wood waste.

Table 14. Excess Compost Capacity Over Generation (Tons)[6]

COG	Excess Yard Waste	Excess Food Waste	Wood Waste
1	111,452	(239,214)	(147,082)
2	(872)	(15,253)	(8,589)
3	3,698	(28,826)	(17,759)
4	(5)	(13,915)	(7,639)
5	51,020	(27,004)	(16,637)
6	16,430	(23,677)	(13,289)
7	15,375	(43,971)	(26,308)
8	32,571	(61,075)	(32,969)
9	1,179	(6,692)	(4,117)
10	1,323	(15,213)	(9,414)
11	(434)	(2,747)	(1,692)
12	3,068	(11,091)	(6,405)
13	(800)	(3,958)	(2,437)
14	1,590	(14,607)	(8,999)
Total	**235,595**	**(507,242)**	**(303,337)**

The magnitude of the processing gap is shown in Figure 10. Both wood waste and food waste have a negative processing gap indicating that the current capacity to process these streams is less than the additional needed processing. Yard waste has a positive processing gap indicating that the current capacity to process yard waste is greater than the additional needed processing. In the case of yard waste, the gap in diversion is a matter of collection and education and outreach programs. For wood and food waste additional processing solutions must be addressed as well as end market pull before collections of these streams can be implemented.

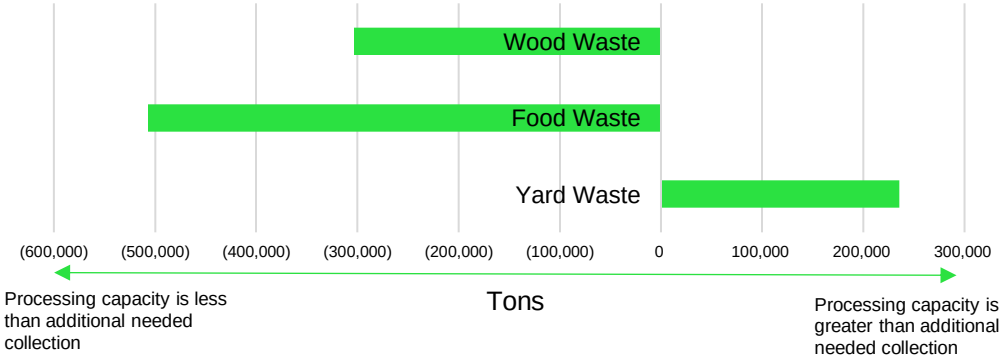

Figure 10. Total Processing Gap for Food, Wood, and Yard Waste in Michigan (Tons)

[6] Positive numbers in this table indicate current processing capacity is greater than additional processing needs for material.

Negative numbers in this table indicate current processing capacity is less than additional processing needs for material.

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END MARKETS

Expanding processing capacity throughout the state must be coupled with end market development to ensure that the additional collected and processed material has a home. Whether a material has an available end market depends on several factors such as cost to process material, price of virgin versus recycled commodity, transportation costs and distance to end markets, and demand for finished products. Each commodity is unique so that an assessment of end markets must be conducted on a per commodity basis.

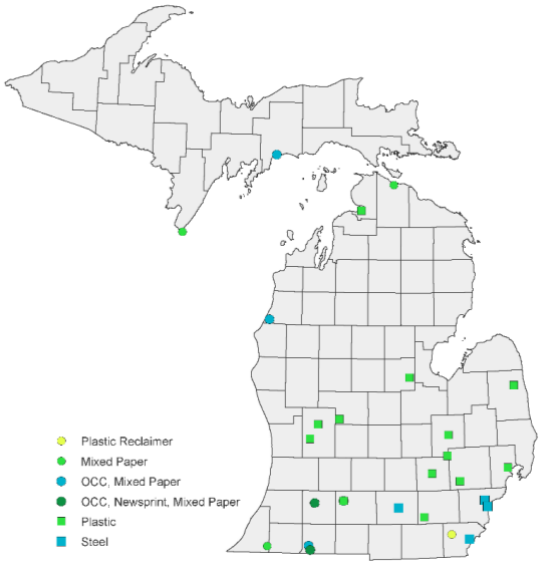

Figure 11. Michigan End Markets

Michigan has strong end markets for high value plastics, mixed paper, newspaper, corrugated cardboard, and steel. The state does not have any end markets for glass, aluminum containers or sufficient end markets for mixed plastics (**Error! Reference source not found.**). Supporting development in Michigan's end markets will require public private partnerships, policy tools at the state and local level, collaboration among units of government, and strategic and shared investment.

While local end markets in Michigan generate jobs and revenue in the state and are desirable, commodities will flow across state lines when economically supported to do so. While aluminum cans provide value, the Michigan bottle bill significantly reduces the volume that is received by MRFs. On the other hand, 3-mix glass is a net cost to most MRFs meaning that instead of selling the commodity for a profit, a MRF must pay to remove this material (-9.2 percent value share of the ACR). An additional challenge for glass is that it is heavy and expensive to move so that the profitable transportation distance for glass is significantly smaller than for aluminum. Thus even if MRFs in Michigan installed glass cleanup equipment to increase the value of their 3-mix glass commodity, Michigan MRFs would still face challenges to secure end markets for this commodity because there are no local end market available. Determining appropriate end market development paths for Michigan must be done on a per commodity basis, examining the factors described above to understand the economic and diversion opportunities involved. Fostering innovations, partnerships and investment in end market development is critical to growing a robust circular economy in Michigan.

Finally, it is important to note that the ACR has varied significantly over the past five years. In September 2020, the ACR value was $43.48 per ton which was slightly up from July 2020. However the ACR remains significantly lower than the 5-year high that occurred in 2017 where it reached above $100 per ton (*Figure 13*).

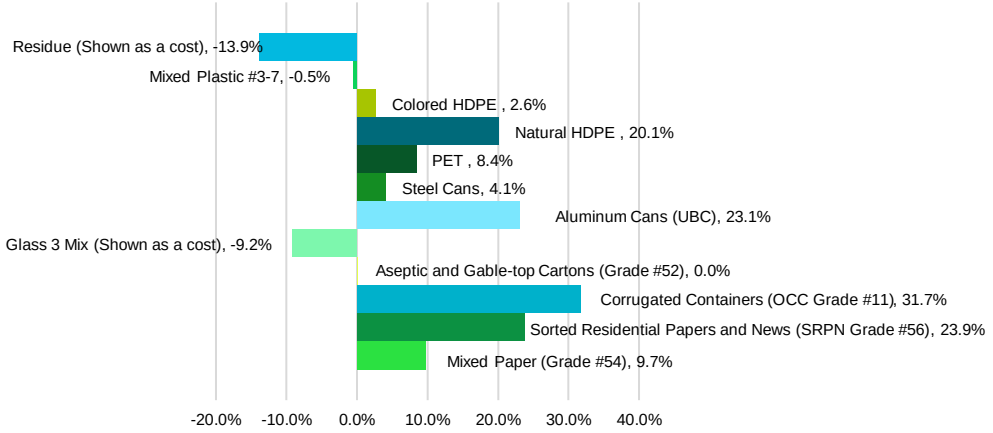

Figure 12. Percent Value Share of ACR by Commodity - Single Stream ACR September Value $43.48

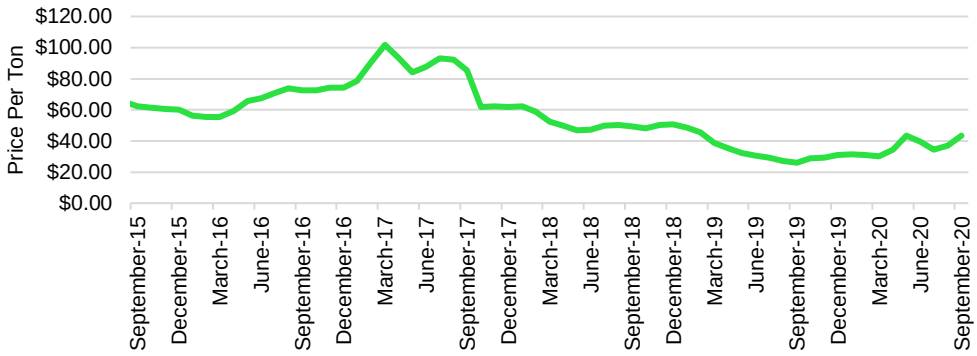

Figure 13. Five-Year Average Commodity Revenue (ACR)

To break down market trends further by commodity, RRS researched domestic and international mixed recycling commodity markets with a focus on typical curbside recyclables. While recycling accepted in curbside or drop-off programs varies throughout the state, the most commonly accepted materials included: Glass (3 color mix), Aluminum Cans (UBC), Steel Cans (Tin), Sorted Residential Papers & News (SRPN #56), Mixed Paper (MP #54), Cardboard (OCC #11), Cartons (#52), Polyethylene Terephthalate (PET #1), Natural High Density Polyethylene, (NHDPE #2) and Colored Natural High Density Polyethylene (CHDPE #2). Mixed Plastics (#3-#7), including Polypropylene (PP #5) are accepted by some municipalities and are included in this analysis due to current market value. Expanded Polystyrene (EPS), Film Plastics and Bulky Rigid Plastics are generally not explicitly accepted on most recycling materials lists; however, some community recycling websites included pictures of these types of recyclables. Additionally, Bulky Rigid Plastics have a positive value and are included in the analysis presented here. Table 15 through Table 27 presents past market behavior, impacts of COVID-19, and RRS forecast and recommendation for each commodity.

Table 15. Mixed Paper (MP #54)

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• National Sword eliminated most significant market resulting in extreme oversupply over 4M TPY. • Domestic mills did not have the cleaning equipment to use the new supply from MRFs. • Some programs have removed MP or are landfilling MP. • Domestic capacity has absorbed some of the oversupply. • Over a million tons of new capacity will come online in the next 2 years for this grade.	• Reports indicate that virus can live on hard surfaces, causing closure of some hand sorted MRFs or drop-off centers. • Online consumption has increased. MP can be substituted for OCC, but persistent oversupply still has poor price.	• SHORT TERM: MP may see some modest increases in coming months if OCC continues to climb. • LONG TERM: Market will recover in 1-3 years from increasing demand with dwindling supply and domestic mill capacity increase. With the loss of commercial sorted grades and new international demand in Asia, grade will be in supply demand balance in 1-3 years. • Keep in Programs

Table 16. Sorted Residential Papers and News (SRPN #56)

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• After initial oversupply due to National Sword, demand has returned for SRPN and price is significantly more than mixed paper. • Market was shrinking for SRPN, due to loss of newspaper and increased e-commerce communication, now has movement for all the sorted tons that can be made.	• Mills consuming SRPN have shut down. • GDP is down approximately 35 percent, recovery estimates are for late Q4. • Daily newspapers have shut down.	• SHORT TERM: All sorted grades, including SRPN, if it can be sorted to 2 percent contamination or less, will see price increases in coming months due to supply shortages both domestic and export. • LONG TERM: SRPN pricing has separated from mixed paper with good market balance. True mixed ONP (SRPN, #8 ONP) will have a differential of $25 or more compared to mixed paper because of lower contaminants from more sorting, and because it can be used in groundwood applications. • Keep in programs.

Table 17. Cardboard (OCC #11)

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• OCC historically tracked significantly higher in price in the Great Lakes than the national average. • Imports to China continued to decline with ban in 2021, and other markets continued restrictions. • China's need for highly sorted #12 grows demand for this grade.	• Some reports indicate that virus can live on OCC for 24 hours. However, conflicting reports are emerging. • Sharp increase in demand and loss of commercial OCC supply. This is due to surge in online grocery delivery, and medical, sanitary and PPE Supplies coupled with loss of commercial OCC. • E-commerce orders up 62 percent in March.	• SHORT TERM Pricing will continue to increase in the short-term. • LONG TERM: OCC will have increased demand for containerboard but much less than predicted. Market will be steady. • Keep in programs. Capture more OCC through better sorting of small format materials.

Table 18. Glass 3-Mix

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• MRF quality of recovered glass had been a significant issue. • Glass container market was losing share to other types of packaging or use of virgin alternatives.	• Reports indicate that virus can live on hard surfaces, causing closure of some hand sorted MRF's or drop-off centers. Numbers are changing. • Deposit states have ceased redemption. Glass	• SHORT AND LONG TERM: 3-mix glass will continue to trade low and may decrease further, as fiberglass for construction slows with the economy, and glass packaging continues to decline.

	cullet for recycling is not available from these sorted sources.	• However, glass is popular to recycle and the public expects to have convenient access. • Keep in programs but evaluate if markets disappear completely.

Table 19. PET Bottles (#1)

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recomme
• Low cost virgin resin historically had capped pricing on recycled PET. • Nationally, PET recycling rate had been flat for the past 10 years at around 30 percent. • Brands made pledged to increase recycled content of packaging.	• 8 of 10 deposit states have temporarily shut down deposit system, hand sort MRFs closing throughout country causing a decreased in supply.	• SHORT TERM: Volatile s market and virgin PET oversupply, offset by los deposit PET bales and rPET demand. Pricin uncertain given volatilit energy sector. • LONG TERM: Low cost v oversupply will push ma down but demand drive increase in rPET. Should eventually de-link mark virgin PET within 3 year to NHDPE, and pricing w up. • Keep in programs.

Table 20. Other Plastic Packaging (Mixed Plastics #3-7)*

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• National sword significantly decreased imports to China. • Residential programs began deleting #3-#7 from programs. • Some markets collected mixed plastics to separate PP (#5) due to higher value.	• Reports indicate that virus can live on hard surfaces, causing closure of some hand sorted MRF's or drop-off centers.	• SHORT AND LONG TERM: #3-#7 bales will continue to trade at or below zero for the next 2-5 years. However, plastics industry is responding through chemical recycling initiative which deconstructs polymer molecules. This trend may grow markets for mixed plastic. • Cost of sorting with no markets for #3, #6, and #7, is not justified. However, balance decision with availability of regional markets in Canada and likelihood of major company investments in chemical recycling.

Table 21. Bulky Rigid Plastics

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• Mixed bulky rigids were a casualty of National Sword. • Markets that sourced mixed bulky rigids do so primarily to target HDPE and PP.	• Reports indicate that virus can live on hard surfaces, causing closure of some hand sorted MRF's or drop-off centers. • COVID-19 Response: Oil drop, propane cracking market erodes. • Decrease demand for products made from Bulky Rigid Plastics due to slowing economy.	• SHORT AND LONG TERM: Increase virgin capacity and low oil and natural gas prices will result in a glut of cheap virgin PP and HDPE, keeping bale prices low. • Keep in programs.

Table 22. Polypropylene (PP, #5)

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• Was an emerging grade with volatile demand. • Market Tracked with virgin PP and oil markets as a lower quality, low-cost substitute. • Pricing was at historic low, but pricing in MW above the national average due to high relative demand.	• Reports indicate that virus can live on hard surfaces, causing closure of some hand sorted MRF's or drop-off centers.	• SHORT AND LONG TERM: New virgin PP capacity and low oil / natural gas markets will keep #5 bale pricing low for next 1-3 years. • Keep in programs. Consider sorting in some programs. Consider hub & spoke for mixed plastics in state. Expect low prices until clear rPP market emerges. •

Table 23. Steel Cans (Tin)

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• Steel in U.S. comes from recycled scrap, rather than ore. • China has command of steel market. • MRF-generated steel cans were discounted due to contamination.	• Reports indicate that virus can live on hard surfaces, causing closure of some hand sorted MRF's or drop-off centers. • Steel market decimated with closure of many manufacturing operations, including Automakers and parts with scrap flows down 60-75 percent in final two week in March. While operations have resumed, supply chain disruptions continue.	• SHORT TERM: Disruption to supply and demand brings market further down through outbreak. • LONG TERM: There will be some recovery once factories get back to work, but any extended recession will result in the market remaining low. • Keep in programs. Has always been a positive market.

Table 24. Aluminum Cans (UBC)

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• World demand for all aluminum went down for the first time in 10 years. • Plastic had been replacing aluminum packaging. • Large U.S. mills, Novelis and Constellium, stopped making can sheet and produces automotive body sheet.	• Reports indicate that virus can live on hard surfaces, causing closure of some hand sorted MRF's or drop-off centers. • Pure Aluminum is a world market. Price is off 10 percent (LME) and 6 percent in U.S. (COMEX). • 8 of 10 deposit states shut down deposit system temporarily totaling 1/3 of entire U.S. UBC supply. Backlog of returnables continues even though deposit bottles being accepted now statewide.	• SHORT TERM: Supply disruption- may be short term price gain, dissolves as mills get back to work. • LONG TERM: Though aluminum cans have a home both for going back to can sheet or secondary aluminum, pricing will remain low through 18 months • Recommend to keep in programs, continues at positive value even at 40 percent of its recent price.

Table 25. HDPE Colored Bottles and Jars (CHDPE #2)

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• Mixed plastics were key target of China waste import ban in 2018 and alternative export markets. • Plastic exports overall saw historic lows, down 38 percent in 2019 compared to previous year and 60 percent compared to 2017 creating an oversupply.	• Reports indicate that virus can live on hard surfaces, causing closure of some hand sorted MRF's or drop-off centers.	• SHORT AND LONG TERM: # 3-7 bales will continue to trade at or below zero for the next 2-5 years. However, plastics industry is responding through chemical recycling initiative which deconstructs polymers. Megatrend will grow markets for mixed plastic. • Keep in programs. rCHDPE will eventually become more valuable for recycled content.

Table 26. HDPE Natural Bottles and Jars (HDPE #2)

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• Strong domestic end markets have usually absorbed all the supply in the U.S. • Recycled content commitments in single use plastics from CPG brands demonstrated a boost in demand for NHDPE. • Domestic consumption has dominated.	• Reports indicate that virus can live on hard surfaces, causing closure of some hand sorted MRF's or drop-off centers. • Increasingly soft oil market and distraction of CPGs from sustainability issues may re sult in lower pricing.	• SHORT TERM: Increasingly soft oil market and distraction of CPGs from sustainability issues may result in lower pricing in the coming months. • LONG TERM: Lower consumption of consumer goods linked to economic downturn may soften demand for HDPE in packaging. • Increase in capacity and low oil and natural gas prices will result in a glut of cheap virgin PE. • rNHDPE continues to decouple pricing from the linkage with virgin resin markets due to consumer company commitments, recycled content certification, and policy. • CPG commitments and minimum recycled content policy will prevail and NHDPE pricing should increase over time. • Keep in programs.

Table 27. Aseptics and Cartons (52)

Past Market Behavior	Impact of COVID-19	RRS Forecast and Recommendations
• Consumption and recycling of cartons has shown growth, but volumes are still low (~.5 percent by volume). • Limited MRFs sort as a separate grade and many incorporated into Mixed Paper bales.	• Cartons are an additive or a substitute for SOP in tissue mills. • Tissue mills reported as running at 120 percent capacity due to COVID-19 related demand. • SOP is generated from offices that are closed during stay-at-home orders, and mills are struggling for supply. • Concerns with virus on human-consumed containers have dissipated somewhat as spread through air has become more prevalent concern.	• SHORT TERM: Cartons will have good pricing in the near term due to supply shortage of SOP paired with extremely high tissue demand, especially since the base of aseptics/cartons is long-strand, high quality white sulfate. • LONG TERM: Cartons have maintained a positive value since the grade was tracked. Markets in the Great Lakes are likely to improve as supply for sorted grades of material increases. • Keep in programs with dwindling long-term supply problem of SOP, SWL.