Memorandum to: Susan Casey, MDE

From: Carol Adaire Jones, Silver Spring Maryland; Food Waste Initiative Co-Lead, Environmental Law Institute; Food Waste Team Co-lead, Montgomery County Food Council
Affiliations for identification purposes only; these comments represent my opinions in my personal capacity.

RE: Comment on Maryland's Climate Pathway Draft Report

Date: October 15, 2023

This comment on the **Maryland Climate Pathways** draft report focuses on policies to **promote reduction of food residuals, including prevention (source reduction), recovery of edible food, and recycling.** It elaborates on the food residual policy recommendations (within the **Waste Management** section) submitted by the Climate Coalition of Montgomery County (CCMoCo), to which I am a signatory.

To provide a context for the food residuals policy recommendations, I summarize CCMoCo's broader recommendations regarding the Waste Management Sector in the first component of the Policy Recommendations section below.

1. The larger context: Summary of CCMoCo's waste management sector recommendations

Recommendations: The Climate Coalition of Montgomery County strongly recommends that Maryland: adopt a wide range of zero-waste policies to promote source reduction, reuse and recycling, thereby reducing the waste going to final disposal; focus special attention on zero-waste strategies for reducing food residuals; and end the use of waste incineration as an option for final disposal of the remaining waste.

Rationale

The **Pathways** draft report identifies a very limited set of policies in the Waste Management section, thereby ignoring the high potential of zero-waste policies to generate GHG reductions in product sectors along their upstream and downstream supply chains as well as in the waste management sector.

Modeled policies/assumptions are limited. The report identifies two main policy interventions that Maryland has already adopted: stronger landfill methane regulations, and mandated diversion of organic waste from landfills and incinerators for selected generators. It further assumes that the State will achieve the voluntary goals for sustainable materials management[1] laid out in MDE's April 2019 Waste Reduction and Resource Recovery Plan Goals and Metrics Recommendations, plus a marginal additional reduction in landfill emissions from 2030 through 2050; however, no specific policies are recommended to achieve those gains.

The production-based Maryland GHG Inventory, which is used as a basis for prioritizing policy recommendations in the Pathways plan, provides an incomplete signal of the GHG impacts of source reduction and reuse, and recycling. Sustainable Materials Management (SMM)/zero-waste approaches are typically linked, as in the Pathways report, with the waste sector (which is responsible for 5% of Maryland's GHG emissions). [2]

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[1] Goals include: a 10% reduction goal in the amount of waste generated per capita ("source reduction"), and material-specific recycling rate goals for food scraps (60%), yard trimmings (85%), glass (55%), metal (75%), paper products (65%), and plastic (25%).

[2] Nonetheless, analyses show that introducing better waste management policies such as waste separation with recycling and composting could cut total emissions from the waste sector by 84%, or from 5% to 1% of Maryland's baseline GHG emissions.

But only a small share of the GHG benefits of SMM approaches are captured in the waste sector, under the standard IPCC GHG accounting protocol for the sector: It only counts emissions from *product end-of-life* to *final disposition* – for example, shifting from incineration or landfill to composting.

As an example, **preventing food waste** (i.e., source reduction) is one of the most potent actions for reducing greenhouse gas (GHG) emissions: Project Drawdown ranks it as either the #1 or #3 global mitigation strategy, depending upon the choice of long-run mitigation scenario. This is because preventing food waste avoids all the GHG emissions that occur along the supply chain, including emissions from land use change to support the production of wasted surplus food *through* emissions from incineration or landfill disposal. The upstream supply chain effects of preventing wasted food to begin with *will show up* in the food and other sectors in the US inventory (without attribution to waste prevention measures).

As another example, the downstream gains from **recycling food waste** to produce soil amendments, which are not captured in the production-based GHG accounting protocol, include improving the structure and health of the soil, which promotes carbon sequestration and the retention of moisture and nutrients.

CCMoCo acknowledges that these reductions will show up in the state inventory only to the extent the upstream and downstream portions of the supply chain occur in the state.

Specific zero-waste policy recommendations

The specific policies that CCMoCo recommends for adoption include: a statewide bottle deposit bill (which exists in ten states), bans on single-use plastics (e.g., eight states have banned single-use plastic bags), and extended producer responsibility programs (such as Maine's). Further to support SMM policies, the Coalition recommends creating a disposal surcharge fee both to provide incentives for diversion and also to generate revenue for prevention, rescue and diversion programs. States with disposal surcharges that fund recycling and composting programs, projects, infrastructure, and education include New Jersey, Pennsylvania, Minnesota, Wisconsin, North Carolina, Iowa, Ohio, and Indiana.

2. Reducing food residuals

Recommendation: Focus special attention on zero waste strategies for reducing food residuals: identifying aggressive goals for source reduction, recovery/rescue of edible food for hungry people, and recycling the remaining food residuals; developing a state Implementation Plan for how to achieve them; and then implementing the zero waste policies recommended in the state plan.

Rationale

Reducing food residuals can create tremendous economic and environmental benefits, including GHG mitigation. In the U.S., we waste an estimated 1/4 of all food produced. In Maryland (as elsewhere), food residuals are the largest component of municipal waste streams, and have the second lowest recycling rate (at 22.7%), only exceeding plastics. Food residuals, which produce more landfill methane per ton than other waste streams, are the largest source of landfill methane emissions.[3]

Top solutions follow the hierarchy of prevention, recovery of edible food, and recycling.

The sources of food waste span the food supply chain, with households the largest source (over 40%); followed by consumer-facing businesses: groceries, restaurants, institutional food services – schools, hospitals, prisons; then farms; with manufacturing generating the least. The reasons are numerous and

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[3] Separate collection and recycling of organic waste alone "can reduce methane emissions from landfills by 62%, even with moderate ambition."

complex across the food supply chain but the top U.S. sources of wasted tons include: trimming and byproducts, 19.3 M tons, oversupply relative to demand in markets, 18.8 M tons, not harvested, 13.9 M tons, spoiled, 11.4M tons, and date label concerns, 8M tons.

ReFED, a national nonprofit leader dedicated to achieving the U.S. goal to reduce food loss and waste by 50% by 2030 by leveraging data and insights, mobilizing and connecting supporters, and catalyzing capital to spur innovation, has identified seven key areas with a total of 42 solutions to identified causes of food waste. Five of the seven areas focus on prevention, because so much untapped potential exists for prevention actions because the emphasis typically is on composting, and to a lesser extent, food rescue:

- Prevention, addressing different sources of wasted food along the supply chain
  - Optimize the farm harvest: avoid overproduction, harvest as much as possible
  - Enhance product distribution: use technology to maximize freshness and selling time
  - Refine product management: align purchasing and sales closely, finding secondary outlets for surplus
  - Maximize product utilization: design operations and menus to use as much of product as possible (i.e., avoid trimming waste), upcycle surplus into food products
  - Reshape consumer environments: educate consumers toward better food management, less waste; shift culture to value reducing waste
- Strengthen food rescue: promote rescue of high-quality nutritious food by increasing capacity, addressing bottlenecks, and improving communication flow
- Recycling anything remaining: find highest and best use to capture nutrients, energy, other residual values

ReFED has conducted an evidence-based analysis of the 42 solutions, to project the potential impacts on several outcome variables: net financial benefits, environmental impacts (tons diverted, GHG emissions avoided, water saved), jobs created, and meals saved. Some general patterns are noteworthy:
- Prevention solutions rate highest for net financial returns and for CO2e mt reduced (which makes sense because the gains accumulate all along the supply chain): GHG reduction (and other environmental benefits) per ton diverted are 8-10 times the environmental benefits of recycling
  - Consumer education is the top performer by far in GHG reduction and net financial returns
- Recovery solutions are the greatest source of meals to address food insecurity
- Recycling solutions rate highest for number of tons diverted, and for jobs created

Specific Recommendations

Set aggressive goals for source reduction, recovery/rescue of edible food, and recycling and developing a State Implementation Plan

In recognition of the significant GHG, other environmental, and financial benefits, **the U.S. has established a goal to reduce food waste by 50%** through prevention or recovery/rescue, and to ensure that the remaining food residuals are recycled, mirroring International Sustainable Development Goal 12.3. (See Appendix A below.) Further the federal government has allocated significant sums for investments in reducing, recovering and recycling food waste to achieve this goal.

We recommend that the State commit to evaluating the feasibility of achieving the goal of 50% reduction of food waste by 2030, which the U.S. has declared a national goal. If Maryland were to adopt the U.S. goal, it would join a select number of forward-looking states and cities that have made that commitment to date, including Washington State, Oregon, California and Denver and Baltimore. (See Appendix A below for more details.)

The Implementation Plan should take an integrated approach across the hierarchy of prevention, recovery and recycling, to accomplish the following:
- identify State quantitative goals and timetables for food waste prevention, recovery of edible nutritious food for hungry people, and recycling the remaining food scraps, following consultations with the affected stakeholder groups;
- identify actions to achieve those goals, and establish an evaluation program to determine the efficacy of actions taken in order to identify any needed adjustments; and
- establish a performance monitoring plan, including plans for expanding food waste data reporting to inform planning and enable monitoring.

Several benefits accrue from such an approach:
- Setting targets and timetables expresses public commitment to reducing amount of food that goes uneaten, redistributing surplus edible nutritious foods to people in need, and recycling what remains,
- Establishing a performance monitoring plan provides for transparency and the opportunity to continuously improve, and
- Publicizing the targets can help raise awareness and mobilize support for needed policies and programs, and can often spur entrepreneurial efforts and opportunities for collaboration and recognition or other actions by businesses and households

Recommended policies to Include in the Implementation Plan

Maryland has made important strides in establishing policies to support food waste *recycling*, including establishing the food diversion mandate, updating organics processing facility permitting, and promoting compost end-markets. We recommend inclusion of a number of other tested policies and programs to promote food waste reduction, *including prevention and rescue as well as recycling,* as recommended in the Zero Food Waste Coalition's recently released Achieving Zero Food Waste: A State Policy Toolkit, as well as in ReFED's Food Waste Policy Finder and NRDC's Maryland Food Policy Gap Analysis and Inventory.

The recommended policies include:
- Providing public education for households about how to reduce and recycle food waste;
- Providing free technical assistance to commercial establishments generating food residuals, food recovery organizations and solid waste service providers (including guidance on federal sources of financial support);
- Standardizing date labels on products currently sold in the state, with a clear differentiation between safety-based and quality-based date labels;
- Expanding liability protections and tax incentives for food donation, and providing food safety guidance for food donation;
- Broadening the current food residuals diversion mandate by:
  - Expanding coverage to include restaurants and to lower the coverage threshold of food waste generated per week
  - Phasing out the distance exemption (or at least increasing the radius within which generators are covered), (see for example, Vermont, Massachusetts, California, New York and others),
  - Adding generator food donation requirements (as in New York and California), and
  - Prioritizing prevention strategies by requiring food residual generators to report on prevention strategies they have employed (as in California);
- Providing funding to support development of local programs and infrastructure investments, for prevention, recovery, and recycling; and
- Levying disposal surcharge fees to provide incentives for diversion and to generate revenue for prevention, rescue and diversion programs, and other SMM policies (with similarities to HB1139 proposed in 2023).

Benefits, costs, and equity and job impacts of implementing the policies

A Maryland-specific analysis of benefits, costs, and the distributional impact would require first specifying which policies would be adopted and then careful analysis using Maryland-specific data and assumptions, which is beyond the scope of this comment. To provide an indication of the scale of net benefits and impacts of major programs addressing food waste, we first consider the results of the analysis Washington State conducted for its *Use Food Well Washington Plan*. Next we review the results for Maryland of the financial, environmental, and the Maryland projected impacts from the ReFED analysis of the top 40 food waste solution practices.

Washington State *Use Food Well Washington Plan*
The Plan, which was developed through a collaborative consultation process, recommended 30 policies and programs that – when implemented together – can reduce food waste sufficiently to achieve two statewide goals established by the state legislature in 2019: Goal 1: Reduce food waste generated by 50 percent by 2030, and Goal 2: Reduce at least half of edible food waste by 2030. The two states are similar in total population (and the urban share of the population) and quantity of food waste generated per person.[4]

Appendix B includes the set of recommended policies and their annual financial costs, annual financial benefits, diversion potential (edible and non-edible), GHG impacts, and avoided negative externalities attributable to GHG reduction. The policies are separated into five categories:

- federal policy (focusing on expanding donations of edible food and sales of imperfect foods with policies most effectively addressed on the federal level),
- state policy (centered on creating efficiencies in communication and use of state resources, through public-private partnerships and multi-agency partnerships promoting research and action including in schools),
- funding dedicated to supporting local actions for prevention, recovery and recycling,
- public education statewide to promote food waste reduction and food waste contamination reduction, and
- infrastructure development for data and tracking and food donation and recycling infrastructure.

Not counting the four federal policy recommendations, the Plan reports that the 26 state-focused recommendations are estimated potentially to garner $1 billion in net annual financial benefits across all stakeholders in Washington State, from elements such as reduced disposal costs, development of new markets and waste uses, and avoided purchases of additional food. With full implementation of the plan (again excluding the federal policies), the analysis estimates that Washington also avoids $145 million annually in costs associated with climate change – a benefit that increases each year. Across the recommendations, the analysis estimates that for every $1 the State spends, $4 in net benefits will accrue to stakeholders in the state. The highest return is for public education campaigns.

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[4] Washington State is 25% larger in population in 2020 and generated 8% less in food waste per person in 2016 than Maryland did in 2020. Washington's population was 7,705,281 (of which 83.4% was urban) and Maryland's was 6,177,224 (of which 85.6% was urban) (Source: https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html). Estimated Maryland food scraps generated in 2016 is 899,239 (Source: ftnt 4, p. 12, Waste Reduction and Resource Recovery Goals 2018.) For Washington State, total food waste generated (disposed plus recycled, or "recovered" in their terminology) was 1,218,829 in 2016 and 1,062,022 in 2018. (Source: p. 97, Use Food Well Washington Plan.)

ReFED Roadmap to 2030: Projected impacts in Maryland

The ReFED analysis of the 42recommended food waste solutions, highlighted above, can be disaggregated by state. The solutions involve actions taken by generators in different stages of the supply chain, and require the support of government policies, investment capital, and government financial support. Appendix C includes the projected annual impacts of implementing each solution in Maryland; the key impact indicators include GHG reductions, tons food waste diverted, costs and net financial benefits, jobs created, water savings potential, and annual meal equivalents diverted. The impacts are suggestive of the impacts Maryland could have with programs and policies to promote food waste reduction across the range of stakeholders. (A separate excel file with the data is also attached.)

The three solutions with the greatest impact on GHG reductions are, in order of impact: consumer education, portion size in food servings in commercial establishments, and centralized composting. For greatest net financial benefits, the top two are again consumer education and portion size, and the third is donation education. In terms of job creation, three of the recycling solutions are projected to create the most jobs: centralized composting, centralized anaerobic digestion, and co-digestion of food scraps at wastewater treatment plants.

Adoption of all 42 solutions is projected to yield an annual reduction of 1.7 MMT CO2e, and create annual net financial benefits of $1.1 billion, and 821 additional jobs. Adoption of the top 10 solutions generating GHG reductions is projected to yield about ¾ of the GHG reductions, net financial benefits and job creation. A careful review of the data and the assumptions for the Maryland analysis is needed to ground-truth the results.

Appendix A. State and City Food Waste Reduction Goals: Context, Best Practices, and Examples

On September 16, 2015, the U.S. Department of Agriculture (USDA) and EPA announced the U.S. 2030 Food Loss and Waste Reduction goal, the first-ever domestic goal to reduce food loss and waste. The goal seeks to cut food loss and waste in half by the year 2030. In September 2021, EPA changed the target measure used for the baseline, in order to align the U.S. 2030 goal with the United Nations' Sustainable Development Goals (SDGs) Target 12.3. *Previously* EPA had interpreted the food waste target to be reduced as the amount disposed of through landfill or controlled combustion: in other words, recycling was considered a strategy for food waste reduction, along with prevention and recovery for donation. As of September 2021, EPA changed the baseline so that only prevention and recovery for donation are to be counted.

The Zero Food Waste Coalition and other food waste experts and advocates have recommended establishing food waste reduction goals at the city or state level, as a useful policy tool for achieving the U.S. goal of 50% reduction by 2030.[5] The targets may be introduced as part of the commitments made in a local or state Climate Action Plan, Zero Waste/Solid Waste Plan, or as a part of a stand-alone Food Waste Reduction Plan. In its recently released State Policy Toolkit, the Zero Food Waste Coalition identifies several features exemplifying best practices for setting targets:

- mandate the plan via legislation rather than executive order to better ensure permanence,
- feature specific targets and goals,
- require periodic updates to stay current, and
- outline concrete actions and identify an agency that is accountable for implementation.

To address the last point, the State Policy Toolkit recommends a number of other tested policies and programs to promote food waste reduction, including:

- food waste diversion mandates (or landfill bans) and related policies,
- liability protections, tax incentives and food safety guidance for food donation,
- permitting, zoning and animal feed regulations supporting organic waste processing infrastructure,
- promotion of end-markets for compost,
- improved date labeling and public education to prevent upstream food waste through, and
- other support for reductions through grants, technical assistance, public recognition and public awareness campaigns.

Below we identify selected states and cities that have established food waste reduction goals, the legal documents establishing the goals, and the key documents created for planning how to accomplish them.

State Level Precedents

- **California**: In September 2016, Governor Edmund Brown Jr. set methane emissions reduction targets for California (SB 1383 Lara, Chapter 395, Statutes of 2016) in a statewide effort to reduce emissions of short-lived climate pollutants (SLCP). The food waste targets are:
  - Reduce organic waste disposal 75% by 2025, and
  - Rescue at least 20% of currently disposed surplus food for people to eat by 2025.

  California has very extensive policies and programs, outlined in its website: https://calrecycle.ca.gov/organics/slcp/.

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[5] Founding supporters of the Coalition are NRDC, WWF, Harvard Food Law Policy Clinic, and ReFED. See, for example, Zero Food Waste Coalition's recently released Achieving Zero Food Waste: A State Policy Toolkit (May 2023) and NRDC's Tackling Food Waste in Cities: A Policy and Program Toolkit (February 2019).

- **Washington State**: In 2019, the Washington State Legislature unanimously declared statewide food waste reduction goals ([RCW 70A.205.715](#)) which are:
  - **Reduce food waste generated by 50% by 2030, and**
  - **Reduce at least half of edible food waste by 2030.**

  The State developed the *Use Food Well Washington Plan (UFWW Plan)* to provide a roadmap. In March 2022, the governor signed [HB 1799](#), which sets as targets (relative to a 2015 baseline):
  - Reduce organic waste disposal 75% by 2030 and
  - Recover for human consumption by 2025 no less than 20 percent of the volume of edible food that was disposed of as of 2015.

  (The bill defines organic waste as manure, yard debris, food waste, food processing waste, wood waste, and garden waste.)

- **Oregon**: The Department of Environmental Quality (DEQ) released in 2017 its first *Strategy for Preventing the Wasting of Food*, providing a 5-year plan to support the state's food waste goals of reducing the generation of wasted uneaten food by 15% by 2025, and 40% by 2050, articulated in the *Materials Management in Oregon: 2050 Vision.* The document placed a strong emphasis on prevention, distinguishing it from rescue/donation and recycling.

  In March 2020, the governor of Oregon issued [Executive Order 20-04](#) on climate change that directed the Oregon ECG and DEQ to take actions necessary to prevent and recover food waste, with the goal of reducing food waste by 50% by 2030, as one of a variety of state actions mandated to reduce GHG emissions. Following the executive order, DEQ published May 2020 a new *Preliminary Work Plan to Reduce Food Waste*, which includes convening a collaborative effort to develop a Phase Two Food Waste Strategy. To achieve the 50% reduction, DEQ concluded it would need to draw on recycling, as well as prevention and donation actions.

- **New Jersey**: [P.L. 2017, c. 136 (S3027)](#), signed into law on July 21, 2017, established a goal of reducing food waste by 50% by the year 2030, relative to a 2017 food waste baseline. This bill tasked the New Jersey Department of Environmental Protection, in consultation with the Department of Agriculture, to develop and commence implementation of a plan that will guide the state to achieve the food waste reduction goal. The [draft plan](#) highlights the issues of wasted food and possible short and long-term actions that can be implemented.

City Level Precedents
- **Denver Colorado**: In the *Denver Food Vision,* a vision and action plan designed to achieve an inclusive, healthy, vibrant and resilient food system published in 2017, Denver committed to a 57% reduction in food waste by 2030, along with a number of other goals.
- **Baltimore Maryland** adopted the goal of 50% reduction in food waste by 2030, as part of *The 2019 Baltimore Sustainability Plan*. The Baltimore *Food Waste and Recovery Strategy* also sets goals of higher levels of reductions to be achieved by 2040.
- **Washington DC** is a [C40 city](#) and signatory of the **Advancing Towards Zero Waste Declaration**, which means the district has committed to specific goals in efforts to implement zero waste. In its **Sustainable DC Plan,** DC has set the deadline of 2032 to reduce food waste by 60% compared to 2015.[6]

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[6] Other goals include: Reduce per-capita waste generation by 15% compared to 2015; Reuse 20% of all waste produced in the District; and Achieve 80% waste diversion without landfill, waste-to-energy facilities, or incinerators.

Appendix B. Economic Analysis of Recommendations in Washington State's *Use Food Well Washington Plan*

List of Recommendations (p. 18)

Federal policy

1. Strengthen the Bill Emerson Good Samaritan Food Donation Act, p. 24
2. Support a national date labeling standard, p. 26
3. Increase markets for lower-grade or "imperfect" produce, p. 28
4. Improve federal tax incentives, p. 30

State policy

5. Create the Washington Center for Sustainable Food Management (WCSFM), p. 32
6. Continue support for the Pacific Coast Food Waste Commitment (PCFWC), p. 35
7. Connect the *Use Food Well Washington Plan* to the Food Policy Forum, p. 37
8. Research strategies and develop partnerships to prevent food and food waste from entering landfills, p. 38
9. Improve regulatory certainty for organics facility operations, p. 40
10. Develop an emergency food distribution plan for Washington schools, p. 41
11. Support 20-minute seated lunch minimum in Washington elementary schools, p.42
12. Support recess before lunch in Washington elementary schools, p. 43
13. Increase access to food waste reduction education in Washington schools, p. 44

Funding

14. Dedicate state grant funding for statewide food waste reduction, p. 47
15. Increase funding for local health jurisdictions, p. 50
16. Increase funding for local government food waste reduction work, p.52
17. Build more farm to school partnerships, p. 54

Public education

18. Develop and maintain statewide food waste reduction campaigns, p. 56
19. Develop and maintain statewide food waste contamination reduction campaign, p. 58

Infrastructure development

20. Increase use of food waste and wasted food data tracking, p. 60
21. Develop and maintain maps of food and wasted food flows, p. 62
22. Improve food donation transportation, p. 63
23. Increase access to cold chain management, p.65
24. Build more community food hubs, p. 67
25. Support value-added food processing and manufacturing, p. 69
26. Increase infrastructure investment in schools, p. 71
27. Expand AD at WRRFs, compost facilities, and farms, p. 74
28. Develop High-solids anaerobic digesters for mixed organic residuals, p. 76
29. Increase use of small-scale anaerobic digesters, p. 77
30. Diversify food waste management systems, p. 79

Estimated impacts by recommendation (in Appendix B. Economic Analysis, pp. 100-101.)

Most impacts reported here are scalable by tons of food waste because capital costs are annualized and most unit costs or benefits are calculated yearly. Estimated impacts may be less scalable for recommendations with uncertain development and repayment timelines, highly variable site-specific attributes, or significant capital investment. Cost estimates reflect state administrative costs of each recommendation, costs of implementing projects, equipment purchases, and staffing at businesses or local governments. Costs and benefits of recommendations that involve a public development process, rulemaking, or research will vary depending on the outcomes of those processes. Cost estimates are outcomes of this research and are not the same as implementation cost estimates included in fiscal notes.

Table 8. Recommendation summary table

Rec#	Annual Costs ($/yr)	Annual Gross Benefits ($/yr)	Annual Net Benefits ($/yr)	Avoided Transaction Costs ($/yr)	Diversion Potential (tons/yr)	Edible Diversion Potential (tons/yr)	GHG Impact (MTCO2e /yr)[a]	Avoided SCC 2022 ($/yr)[b]	Avoided SCC 2030 ($/yr)[c]
FEDERAL POLICY									
1	$1,509,577	$21,617,056	$20,107,480	$0	16,311	16,311	-23,467	$1,854,690	$2,099,876
2	$177,706	$53,193,216	$53,015,511	$0	12,771	12,771	-18,374	$1,452,138	$1,644,108
3	$6,679,400	$25,930,461	$19,251,061	$0	10,206	10,206	-14,684	$1,160,529	$1,313,949
4	$19,875,000	$12,455,000	-$7,420,000	$0	10,150	10,150	-14,603	$1,154,095	$1,306,664
Subtotal	*$28,241,682*	*$113,195,733*	*$84,954,052*	*$0*	*49,437*	*49,437*	*-71,128*	*$5,621,453*	*$6,364,597*
STATE POLICY									
5	$1,000,000	$7,924,138	$6,924,138	$7,924,138	n/a	n/a	n/a	n/a	n/a
6	$203,958	$669,838	$465,880	$669,838	n/a	n/a	n/a	n/a	n/a
7	$134,236	$204,844	$70,609	$204,844	n/a	n/a	n/a	n/a	n/a
8	$1,571,114	$4,775,726	$3,204,612	$0	73,903	0	-106,329	$8,403,526	$9,514,455
9	$5,282,227	$5,411,445	$129,217	$0	54,000	0	-77,693	$6,140,284	$6,952,017
10	$2,776,883	$27,617,172	$24,840,289	$0	5,375	5,375	-7,733	$611,183	$691,980
11	$16,517	$175,380	$158,864	$0	3,168	3,168	-4,558	$360,232	$407,854
12	$16,517	$137,348	$120,831	$0	2,481	2,481	-3,570	$282,113	$319,408
13	$6,097,438	$6,609,118	$511,681	$0	2,931	2,931	-4,217	$333,258	$377,314
Subtotal	*$17,098,889*	*$53,525,010*	*$36,426,120*	*$8,798,820*	*141,858*	*13,955*	*-204,100*	*$16,130,596*	*$18,263,028*

Rec#	Annual Costs ($/yr)	Annual Gross Benefits ($/yr)	Annual Net Benefits ($/yr)	Avoided Transaction Costs ($/yr)	Diversion Potential (tons/yr)	Edible Diversion Potential (tons/yr)	GHG Impact (MTCO2e /yr)[a]	Avoided SCC 2022 ($/yr)[b]	Avoided SCC 2030 ($/yr)[c]
				FUNDING					
14*	$299,842,657	$1,362,793,518	$1,062,950,861	$0	1,225,377	168,776	-1,763,024	$139,337,107	$157,757,186
15	$47,781,785	$462,714,420	$414,932,634	$0	104,179	104,179	-149,889	$11,846,148	$13,412,184
16*	$43,686,069	$108,371,798	$64,685,729	$0	100,238	22,427	-144,218	$11,398,019	$12,904,813
17	$5,343,210	$10,469,797	$5,126,588	$0	4,508	4,508	-6,486	$512,632	$580,401
Subtotal*	53,124,995	473,184,217	420,059,222	0	108,687	108,687	-156,375	12,358,780	13,992,585
				PUBLIC EDUCATION					
18	$2,319,436	$139,041,652	$136,722,216	$0	31,014	0	-44,622	$3,526,611	$3,992,822
19	$2,319,436	$2,695,576	$376,140	$0	15,507	0	-22,311	$1,763,306	$1,996,411
Subtotal	$4,638,873	$141,737,229	$137,098,356	$0	46,521	0	-66,933	$5,289,917	$5,989,233
				INFRASTRUCTURE					
20	$21,731,857	$97,514,815	$75,782,958	$0	20,359	20,359	-29,291	$2,314,982	$2,621,018
21	$52,980	$2,641,379	$2,588,400	$2,641,379	n/a	n/a	n/a	n/a	n/a
22	$31,262,219	$215,068,931	$183,806,713	$0	48,300	48,300	-69,493	$5,492,211	$6,218,270
23	$30,129,769	$99,709,883	$69,580,114	$0	22,427	22,427	-32,267	$2,550,164	$2,887,291
24	$7,368,073	$64,572,353	$57,204,280	$0	25,405	25,405	-36,552	$2,888,828	$3,270,725
25	$28,300,064	$68,440,799	$40,140,735	$0	27,854	0	-40,076	$3,167,287	$3,585,996
26	$1,189,734	$3,087,769	$1,898,034	$0	6,811	6,811	-9,800	$774,497	$876,884
27	$105,489,939	$133,479,107	$27,989,168	$0	783,817	0	-1,127,725	$89,127,518	$100,909,993

Appendix C. ReFED Analysis of Impacts of Food Waste Solutions in Maryland.

In indicator columns with colored headers, the top 10 solutions for that indicator are colored in the header color.
This analysis appears in ReFED's Roadmap to 2030: Reducing U.S. Food Waste, https://refed.org/food-waste/the-solutions/#roadmap-2030. For a description of each solution, see: https://refed.org/food-waste/the-solutions#solutions
Calculations by ReFED are based on data from various sources. See https://insights.refed.com/methodology for more information. Data last updated May 02 2023

Solution group	Solution priority action area	Solution name	Annual GHG reduction potential (mtco2e)	Annual food waste reduction potential (tons)	Annual cost (US$)	Annual gross financial benefit (US$)	Annual net financial benefit (US $)	Jobs created	Annual water savings potential (mi gal)	Annual meal equivalents diverted
Prevention	Reshape Consumer Environments	Consumer Education Campaigns	350,917	60,870	$3,831,591	$302,731,635	$298,900,044	23	14944	101,449,814
Prevention	Reshape Consumer Environments	Portion Sizes	241,620	45,552	$842,107	$170,580,139	$169,738,031	0	21627	75,919,271
Recycling	Recycle Anything Remaining	Centralized Composting	155,362	275,402	$56,027,636	$51,376,348	-$4,651,288	284	0	0
Prevention	Reshape Consumer Environments	Meal Kits	109,180	23,017	$10,499,532	$105,018,333	$94,518,802	35	4826	38,362,291
Prevention	Refine Product Management	Waste Tracking (Foodservice)	107,884	19,735	$22,234,975	$95,773,160	$73,538,185	30	8680	32,891,659
Prevention	Reshape Consumer Environments	Standardized Date Labels	83,458	13,743	$191,915	$62,167,862	$61,975,947	0	4820	22,904,374
Prevention	Maximize Product Utilization	Active & Intelligent Packaging	83,395	13,087	$13,847,525	$83,753,485	$69,905,960	20	3739	21,812,282
Prevention	Refine Product Management	Markdown Alert Applications	81,803	17,705	$13,930,643	$81,338,554	$67,407,910	27	5757	29,507,527
Recycling	Recycle Anything Remaining	Centralized Anaerobic Digestion	59,206	93,528	$22,616,717	$20,861,393	-$1,755,324	96	0	0
Recycling	Recycle Anything Remaining	Co-Digestion At Wastewater Treatment	57,460	82,333	$18,140,293	$17,696,513	-$443,780	84	0	0
Prevention	Enhance Product Distribution	Decreased Transit Time	47,452	10,563	$6,189,497	$34,261,622	$28,072,125	-	3666	17,604,268
Prevention	Reshape Consumer Environments	Package Design	46,082	6,258	$1,119,979	$32,068,081	$30,948,102	9	2278	10,430,010
Prevention	Enhance Product Distribution	Intelligent Routing	43,207	10,891	$8,531,251	$38,335,185	$29,803,934	17	2967	18,151,232
Prevention	Maximize Product Utilization	Manufacturing Line Optimization	33,861	10,412	$2,190,137	$6,692,142	$4,502,005	0	3354	17,353,736
Prevention	Refine Product Management	Dynamic Pricing	30,381	6,830	$10,636,005	$36,664,731	$26,028,726	10	1922	11,383,013
Prevention	Enhance Product Distribution	First Expired First Out	28,864	6,891	$6,217,461	$23,821,539	$17,604,077	0	2100	11,485,760
Prevention	Maximize Product Utilization	Manufacturing Byproduct Utilization	23,446	7,210	$7,325,016	$17,707,842	$10,382,825	11	2322	12,016,013
Recycling	Recycle Anything Remaining	Community Composting	22,955	40,793	$10,873,452	$8,635,691	-$2,237,761	42	0	0
Prevention	Enhance Product Distribution	Temperature Monitoring (Pallet	20,660	5,030	$2,026,857	$15,489,160	$13,462,302	8	1648	8,383,369
Prevention	Refine Product Management	Enhanced Demand Planning	20,280	4,958	$2,091,004	$17,669,670	$15,578,666	8	1373	8,262,881
Recycling	Recycle Anything Remaining	Home Composting	19,342	32,182	$5,954,528	$3,555,972	-$2,398,556	0	0	0
Rescue	Strengthen Food Rescue	Donation Education	15,708	8,546	$4,194,994	$42,370,733	$38,175,739	32	1068	14,243,187
Rescue	Strengthen Food Rescue	Donation Transportation	15,413	6,810	$5,030,288	$33,949,651	$28,919,363	25	1015	11,350,732
Prevention	Refine Product Management	Assisted Distressed Sales	12,825	3,454	$58,834	$3,490,950	$3,432,116	5	820	5,756,885
Prevention	Refine Product Management	Decreased Minimum Order Quantity	9,628	2,378	$1,244,121	$8,221,273	$6,977,152	0	729	3,963,958
Recycling	Recycle Anything Remaining	Livestock Feed	8,251	16,770	$2,959,897	$5,359,045	$2,399,148	25	0	0
Rescue	Strengthen Food Rescue	Donation Coordination & Matching	7,636	2,719	$1,284,803	$13,659,125	$12,374,322	10	496	4,532,176
Prevention	Reshape Consumer Environments	Trayless	6,538	1,233	$255,341	$4,592,754	$4,337,413	0	585	2,054,216
Prevention	Refine Product Management	Minimized On Hand Inventory	6,208	1,166	$323,859	$4,072,422	$3,748,563	0	389	1,943,204
Prevention	Refine Product Management	Increased Delivery Frequency	6,009	1,011	$856,396	$3,493,739	$2,637,343	0	377	1,684,536
Prevention	Reshape Consumer Environments	K-12 Lunch Improvements	5,230	986	$139,738	$1,147,071	$1,007,333	0	468	1,643,500
Rescue	Strengthen Food Rescue	Donation Storage Handling & Capacity	4,943	2,427	$2,999,028	$12,054,169	$9,055,141	9	323	4,044,892
Prevention	Reshape Consumer Environments	Buffet Signage	3,872	730	$998	$2,721,501	$2,720,503	0	347	1,216,808
Prevention	Optimize The Harvest	Buyer Specification Expansion	2,487	2,201	$17,215	$8,717,250	$8,700,035	0	210	3,668,990
Prevention	Reshape Consumer Environments	K-12 Education Campaigns	1,397	263	$40,914	$496,520	$455,606	0	125	438,984
Prevention	Optimize The Harvest	Imperfect & Surplus Produce Channels	1,234	5,198	$4,983,099	$10,963,768	$5,980,669	8	169	8,663,558
Prevention	Optimize The Harvest	Partial Order Acceptance	1,155	337	$627,861	$1,309,507	$681,646	0	96	561,608
Prevention	Enhance Product Distribution	Reduced Warehouse Handling	848	207	$157,133	$780,843	$623,710	0	60	345,144
Prevention	Refine Product Management	Temperature Monitoring (Foodservice)	665	77	$3,776	$290,045	$286,268	0	43	128,040
Prevention	Reshape Consumer Environments	Small Plates	621	117	$43,937	$480,524	$436,587	0	56	195,274
Rescue	Strengthen Food Rescue	Donation Value-Added Processing	94	751	$70,532	$3,637,920	$3,567,389	3	12	1,251,898
Prevention	Optimize The Harvest	Gleaning	2	13	$19,183	$36,148	$16,965	0	0	22,145
Prevention		Subtotal	1,760,261	832,063	241,666,392	1,346,555,820	1,104,889,424	801	91,969	485,089,893
Rescue		Subtotal	13,933	10,819	8,041,254	34,953,208	26,911,954	17	1,173	18,033,232
Recycling		Subtotal	3,385	1,502	922,422	6,534,987	5,612,565	3	267	2,504,109
ALL		TOTAL	1,777,579	844,384	250,630,068	1,388,044,015	1,137,413,943	821	93,410	505,627,234
		Top ten for GHG reductions	1,330,285	644,972	162,162,934	991,297,422	829,134,487	599	64,392	322,847,218
		% total	75%	76%	65%	71%	73%	73%	69%	64%