Board Workshop

Forward 2044

3/21/23

FW44

Board Workshop Agenda

Date: March 21, 2023
Time: 11:30 a.m. – 2:30 p.m.
Lunch will be provided.
Location: Mount Trashmore Recreation Building 948

1. Welcome (5 minutes)

a. Welcome
b. Workshop Goals

2. Current State of Solid Waste Regionally (10 minutes)

a. Lack of Landfills
b. Regional State Policies
c. Waste is not Stagnant

3. Overview (15 minutes)

a. Objectives of Forward 2044
    i. Overview of current Board decisions
b. Planning for the future
    i. Vision Map
    ii. Landfill Lifespan: Operational and Capacity

4. Transfer Station (TS) (1 hour)

a. Long-Term Needs for TS
b. Expected Services at TS
c. Next Steps

5. Organic Waste (1 hour)

a. Results of AD Research and Discussion
b. Compost Site/Organics Park
    i. Regionalization Approach
    ii. Vision for Current Site
c. Next Steps

6. Next Steps (15 minutes)

a. Action Items
b. Path Forward

Memorandum

Date:	Tuesday, February 14, 2023
Project:	Forward 2044
To:	Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) Karmin McShane, Executive Director
From:	HDR Engineering, Inc. (HDR) Lori Calub, Kate Bartelt, Morgan Mays
Subject:	**Forward 2044 Executive Summary of TM 2022 Food Waste Digester Feasibility Study**

Introduction

This Memorandum summarizes findings from the 2022 *Food Waste Digester Feasibility Technical Memorandum* (TM), prepared for the City of Cedar Rapids by HDR. It provides recommendations for the next steps for the Cedar Rapids Linn County Solid Waste Agency (CRLCSWA or the Agency). The TM discussed the feasibility and benefit of diverting food wastes generated within the CRLCSWA service area to a dedicated anaerobic digestion (AD) digester owned and operated by the Cedar Rapids Water Pollution Control Facility (WPCF).

Overview of Anaerobic Digestion and How it Works

AD is a biological process that breaks down food waste with the help of microbes in an oxygen-free environment to create biogas and digestate. When food waste arrives at the anaerobic digestion facility, the material is placed into a digester, which is a large, airtight tank (or container) where the materials break down.

Inside the digester, special microbes break down (or digest) the food waste. This process creates a biogas, which is a renewable energy source that's a mixture of gases and one of the products of anaerobic digestion. It's mostly comprised of methane but also includes a small amount of other gases. The biogas can be processed into renewable natural gas (RNG), which can be used in place of fossil natural gas and for vehicle fuel, energy products, or bioproducts such as bioplastics. Potential revenues and tipping fees generated by the AD facility will depend on the quantity and quality of RNG produced. The TM used RNG revenues ranging from $10 per Metric Million British Thermal Unit (MMBtu) to $20/MMBtu to reflect the volatility in the RNG market.

A product called digestate, a wet mixture of solids and liquids rich in nutrients that can be used to create fertilizer, compost, and other agriculture and gardening products, is also produced. The biogas is captured, and the digestate is turned into valuable material for use.

Study Objectives

The purpose of the evaluation was to investigate if AD at the WPCF would be a viable and mutually beneficial waste solution for food waste in the near term or post-closure of the existing landfill (beyond 2044). Please note that the study did not explore other types of AD systems, such as high solids, plug flow, or dry digestion, but rather remained focused only on wastewater-type digestion at the WPCF as an expansion of the already planned improvements.

Analysis
CRLCSWA does not currently have a food scrap diversion program, so the evaluation looked at two different AD solutions. For each Alternative, a separate digester was evaluated to manage food waste only. Two sizes of digesters were evaluated. Alternative 1 looked at building a full-sized AD digester similar to those planned during the Phase 1 improvements at the WPCF. While Alternative 2 looked at an optimized-sized digestor that meets the expected food waste volume diverted from CRLCSWA, assuming a voluntary food waste program is initiated.

> *Alternative 1* evaluated an individual digestor being installed for the Cedar Rapids WPC Solids Project could accommodate up to 47,300 pounds of volatile solids per day. As CRLCSWA alone does not have sufficient food waste separated for management at this time, this Alternative assumes a feedstock blend would include the diverted food waste, high-strength waste, fats, oils, and greases (FOG); and dilution water until such a time that the organics tonnage could be increased.
>
> *Alternative 2* was performed to review the benefits of installing a smaller digester that processes the food waste volume assumed to be available through diversion from CRLCSWA through a voluntary collection program.

Both analyses assumed that the digestors would process 20 tons per day (TPD) or 7,300 tons per year (TPY) of food waste. The key difference is the size of the digestor – thus, the amount of RNG produced and the volume of material paying a tipping fee for management.

Language Differences Between Solid Waste and Wastewater
Solid waste and wastewater treatment facilities use different metrics to discuss sizing and capacity. The solid waste industry measures inputs in tons, while wastewater treatment facilities measure inputs in volatile solids loading rate. The capacity of digesters is measured in volatile solids pounds per day (VS dry lbs/day). Food waste has a volatile solids content of approximately 85 percent volatile and a 50% dry matter solids content; therefore, the 7,300 tons/year of food waste added to the digester is equivalent to 40,000 lbs per day or 17,000 dry lbs VS/day.

Summary of Key Findings

First, AD has the potential to manage food waste successfully. The evaluation identified, in either Alternative, that food waste AD could successfully be managed at the WPCF. The joint development of the AD at the WPCF would result in reduced overall capital through shared infrastructure.

The evaluation of the two alternatives results in several key findings.

- Alternative 1: Full-scale digester with a feedstock of food waste, high-strength waste, and FOG, processing up to 47,300 dry pounds of volatile solids per day.
    - A receiving facility would de-package the food waste to prepare it for processing in the digester. The food waste would be blended with other feedstocks until more food waste tonnage can be diverted.
    - The digester size is 1.8 million gallons (MG).
    - The estimated food waste processed through the digester will be 7,300 TPY, or 3 percent of MSW disposed of at the CRLCSWA Site #2 landfill in fiscal year (FY) 2022.

  - The estimated capital cost of the full-scale food waste digester is $29.2M.
  - Estimated operations and maintenance (O&M) costs for the full-scale food waste digester onsite at WPC are $1.1M per year.
  - Revenue projections from tipping fees for the FOG and high-strength waste are $820,000 per year.
  - The food waste treatment cost per ton ranged from $92 to $228, depending on the revenues from RNG sales.
  - Depending on RNG revenues, the payback period for the WPC ranges from 17 years to 43 years. This payback period does not include cost factor-share with CRLCSWA or food waste tipping revenues received by CRLCSWA.
- Alternative 2 (Food Waste Only): Small digester with a feedstock of food waste only, processing up to 17,000 dry pounds of volatile solids per day.
  - The digester size is 0.72 MG.
  - The estimated food waste processed through the digester will be 7,300 TPY, or 3 percent of MSW disposed of at the CRLCSWA Site #2 landfill in fiscal year (FY) 2022.
  - The estimated capital cost of the small digester is $16.1M.
  - The estimated O&M costs are $477K per year.
  - There were no non-food waste tipping revenues from the small digestor.
  - The food waste treatment cost per ton ranged from $133 to $188, depending on the revenues from RNG sales.
  - The payback period would be at least fifty years due to low revenues. The facility would have a negative net revenue if RNG is at the lower end of the estimated potential ($10/MMBtu).

Forward 2044 Comparisons

The food waste diversion estimates developed for CRLCSWA's Forward 2044 project were based on general industry knowledge and focused on diverting as much of the organic waste stream from landfill disposal as possible. In contrast, the TM assumed that food waste would be collected through a voluntary diversion program developed over time. Other methods can be evaluated, such as mandatory diversion.

The voluntary diversion program estimated that food waste comprises 22 percent of the MSW stream, and 20 percent of that could be captured and brought to the digester facility.

The expenses and revenues presented in the TM are all assumed to be the City's responsibility, given the unknown nature of cost-sharing with CRLCSWA. Potential landfill tipping fee revenues were not included in the study.

Table 1 shows the costs for the construction and operation of AD in Alternatives 1 and 2. Please note the cost of collecting, separating, and processing organics is not included in these costs.

Table 1 – Comparison of Alternative 1 and 2

		Alternative 1		Alternative 2	
		Year 1		Year 1	
Food Waste Tonnage	Food Waste Tons Available for AD	37,900 TPY	Food Waste Only	37,900 TPY	Food Waste Only
	Currently Available Food Waste Tons Available for AD	7,600 TPY	-	7,600 TPY	-
	Total Organics to Digester	7,300 TPY	20 TPD	7,300 TPY	20 TPD
Other Feedstock, if needed	FOG & High Strength Waste to Digester, Industrial	47,500 gpd	Added until Food Waste tonnage meets full capacity	Not Needed	-
Opinion of Costs	AD Capital Cost	$29.2M	Includes $7.7M for Dewatering Facility & AGS Expansion; $2.5M Biogas Treatment	$16.1M	Includes $2.3M for AGS Expansion; $1.0M Biogas Treatment
	Amortized Capital Cost	$2.4M/yr	20 years @ 5%	$1.3M/yr	20 years @ 5%
	O&M Costs	$1.1M/yr	-	$477,400/yr	-
	RNG Revenues	$1.5M/yr	To City at $15/MMBTU	$597,000/yr	To City at $15/MMBtu
	Tipping Fee Revenues – Food Waste	$0	Not Included	$0	Not Included
	Tipping Fee Revenues – Other	$820,000/yr	FOG, High Strength Waste, Industrial, Regional Partners	$0	None
Net Total Food Waste Treatment Cost, $/Ton (before Tipping Fee Revenues)		$185/Ton	Average @ RNG $15/MMBTU	$160/Ton	Average @ RNG $15/MMBTU

Forward 2044 Recommendations

The following are items for CRLCSWA to consider next in the Forward 2044 process regarding the potential food waste digester project with City's WPC Facility.

- **Finding** - AD is a management tool that can successfully manage food waste.
- **Recommendations** - This study evaluated co-digestion using the WPC Facility but did not explore other organics treatment technologies to understand costs better.

  Near-Term – HDR believes that if either Alternative 1 or 2 were installed, it would not create a significant diversion in the tonnage going to Site 2. Thus, not creating a significant increase in the life of Site 2. HDR does not recommend proceeding with this option to meet Near-Term needs.

  Forward 2044 – HDR believes that AD is a successful management method for food waste, and the economic viability may be more reasonable on waste management beyond 2044. HDR recommends keeping this option for further consideration.

  Start cost-share discussions with the WPC and City leadership. Cost sharing does occur within the Forward 2044 solid waste campus scenarios. The estimated combined tip fee for each scenario internalizes the cost-sharing between the solid waste facilities (i.e., the operations and management costs of landfilled tons are less than the tip fee, while the anaerobic digester facility costs per managed ton are greater than the current tip fee).

  Voluntary Food Waste Programs. Additional information should be developed on the voluntary food waste programs that could be created. Although the proposed food waste digester project would only divert about 3% of MSW from the landfill, developing a food waste collection and diversion program could lead to other projects, such as a regional active aeration compost facility.

  The Agency should explore other treatment methods, such as composting or dedicated anaerobic digestion (such as high solids wet or plug flow digestion or dry or stacked digestion), and compare the results of those options to these results before determining the preferred path forward.

References:

1. HDR, 2022. *Technical Memorandum Food Waste Digester Feasibility*. WPCF Solids Phase 1. Cedar Rapids, IA.
2. HDR, 2021/2022. *Long-Term Waste Management System Evaluation (Forward 2044) Final Report*. Cedar Rapids Linn County Solid Waste Agency (CRLCSWA).

Memorandum

Date:	Tuesday, January 31, 2023
Project:	Forward 2044
To:	Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) Karmin McShane, Executive Director
From:	HDR Engineering, Inc. (HDR) Emily Altrichter, Kate Bartelt, Morgan Mays
Subject:	**2023 Summary of Waste Volumes and Projections**

Introduction

The purpose of this Memorandum is to assist the Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) in quantifying the volume and types of waste currently managed in the region, develop waste generation per capita rates for waste types, and provide a basis to predict future waste handling infrastructure needs based on these waste types and volumes. HDR prepared a "Summary of Waste Volumes and Projections" Memorandum in June 2021. This Memorandum is intended to be an update to that 2021 Memo and includes more recent information.

Population projections are used to calculate waste generation and provide guidance to determine waste stream capture rates and market demands. Tonnage information in this Memorandum is provided by fiscal year (FY), which is July 1 to June 30 each year, coinciding with the Iowa Department of Natural Resources (IDNR) solid waste reporting requirements.

Detailed Solid Waste Volumes

HDR recognizes that based on the East Central Iowa Council of Governments' *Regional Comprehensive Integrated Solid Waste Management Plan 2016-2026*, the regional waste stream is comprised of approximately 30 percent residentially generated waste and 70 percent commercially generated waste. For analysis purposes, the municipal solid waste (MSW) stream combines both residentially and commercially generated wastes. This allows the median tonnage and population census to be used to calculate future tonnage volumes, as shown in **Table 1**. This is the same methodology the US Environmental Protection Agency (EPA) incorporates to characterize the MSW stream at the national level.

Table 1 summarizes detailed solid waste volumes received at CRLCSWA facilities and the City of Cedar Rapids curbside recycling program, by source and type, based on tonnage information received from CRLCSWA. The materials accounted for in the table include MSW, special waste, construction and demolition (C&D) waste, shingles, organics (yard and food waste), and recyclables. Recyclables include glass, old corrugated cardboard (OCC), single stream sort

materials, metals, white goods, and materials collected curbside by the City of Cedar Rapids. Brown goods and household hazardous waste (HHW) are not included in these totals.

Table 1 – Detailed Solid Waste Volumes – CRLCSWA Facilities[1] (In Tons)

CRLCSWA Facilities Waste Stream (In Tons)		Fiscal Year[2]			
		FY2019	FY2020	FY2021	FY2022
Solid Waste	MSW	167,404	160,086	199,755	174,626
	Special Waste	21,253	16,612	37,582	23,706
	C&D	12,337	25,960	102,040	40,134
	Shingles	1,309	9,091	42,550	4,062
Total Disposed – Landfill		**202,303**	**211,749**	**381,927**	**242,528**
Organics	Organics	28,781	29,710	40,130	30,333
	Subtotal	**28,781**	**29,710**	**40,130**	**30,333**
Recyclables	Glass	625	601	871	663
	OCC	451	536	607	668
	Single Stream Sort	2,978	2,389	2,344	2,440
	City of Cedar Rapids[3]	8,170	8,346	8,919	8,513
	Metal	480	454	683	496
	White Goods	521	422	553	527
	Subtotal	**13,225**	**12,748**	**13,977**	**13,307**
Total Recycled/Recovered		**42,006**	**42,458**	**54,107**	**43,640**
Total Materials to Facilities		**244,309**	**254,207**	**436,034**	**286,168**

Notes

[1]Includes Site 2 and Site 3 waste receipts, as well as City of Cedar Rapids recyclables volumes managed by Republic Services MRF.
[2]CRLCSWA Fiscal Year period is July 1 to June 30.
[3]The City of Cedar Rapids began taking curbside recyclables to Republic Services MRF in 2016. These volumes are included in the totals above but are not managed by CRLCSWA.
Table prepared by BB and checked by EAA (1/24/2023).

CRLCSWA Per Capita Waste Generation Rates

The primary purpose of the per-capita waste evaluation is to forecast waste generation volumes managed by CRLCSWA. The data is used to plan for future programs and infrastructure development. **Table 2** summarizes the per capita generation rate, in tons per year and pounds per day, based on population and waste stream. Recyclables collected curbside by the City of

Cedar Rapids were included in **Table 1** for completeness, but not in **Table 2** or **Table 3**, as that waste stream is not managed by CRLCSWA.

Table 2 – CRLCSWA Annual Per Capita Waste Generation Rates (In Tons)					
	FY2019	FY2020	FY2021	FY2022	4-Year Average
Linn County Population[1]	226,700	228,600	230,300	228,900	**N/A**
Material Disposed (in tons/yr per capita)					
MSW	0.74	0.70	0.87	0.76	0.77
Special Waste	0.09	0.07	0.16	0.10	0.11
C&D	0.05	0.11	0.44	0.18	0.20
Shingles	0.01	0.04	0.18	0.02	0.06
Materials Recycled/Recovered (in tons/yr per capita)					
Organics	0.13	0.13	0.17	0.13	0.14
Single Stream/Glass/OCC	0.02	0.02	0.02	0.02	0.02
Scrap Metal/White Goods	0.004	0.004	0.005	0.004	0.005
Total Annual Per Capita Generation Rate (in tons)	1.08	1.11	1.89	1.25	1.33
Total Annual Per Capita Generation Rate (in lbs/day)	5.91	6.09	10.37	6.85	7.31
Total Annual Per Capita Disposal Rate (in tons)	0.89	0.93	1.66	1.06	1.13
Total Annual Per Capita Disposal Rate (in lbs/day)	4.89	5.08	9.09	5.81	6.21
Total Annual Per Capita Disposal Rate (in lbs/yr)	1,784.76	1,852.57	3,316.78	2,119.07	2,268.30

Notes

[1]Population from U.S. Census Bureau.

[2]Conservative estimate utilized in 4-year average.

Table prepared by BB and checked by EAA (1/24/2023).

Table 2 is used to determine the individual per capita rates for waste disposal and recycling. The waste disposal per capita 4-year average rate for CRLCSWA was calculated to be 1.13 ton per person, per year, while the recycling per capita 4-year average rate is 0.16 ton per person, per year. This value was calculated using the recyclables accepted by CLRCSWA, which includes organics (yard and food waste), single stream, glass, OCC, scrap metal, and white goods. It does not consider materials collected curbside by the City of Cedar Rapids, brown goods, or HHW.

Material-Handling Projections

Material-handling projections are presented in **Table 3**. Material-handling projections for 2030, 2040, and 2050 are calculated using the CRLCSWA annual per capita waste-generation rate 4-year average, as shown in **Table 2,** and the associated population projections. Projections of the Linn County Population for 2030, 2040, and 2050 were obtained from Woods and Poole Economics, Inc.

Table 3 – CRLCSWA Material Handling Projections (In Tons)

Material	Fiscal Year			
	FY2022	FY2030[1]	FY2040[1]	FY2050[1]
Linn County Population	**228,900**	**241,600[2]**	**253,000[2]**	**263,200[2]**
Materials Landfilled				
MSW	174,626	185,367	194,113	201,939
Special Waste	23,706	26,163	27,398	28,503
C&D	40,134	47,498	49,739	51,744
Shingles	4,062	14,982	15,689	16,321
Subtotal Materials Landfilled	**242,528**	**274,010**	**286,940**	**298,508**
Materials Recycled				
Organics	30,333	34,047	35,653	37,091
Single Stream/Glass/OCC	3,771	4,009	4,198	4,368
Scrap Metal/White Goods	1,023	1,092	1,144	1,190
Subtotal Materials Recycled	35,127	39,148	40,995	42,648
Total Materials	277,655	313,159	327,935	341,156

Notes

[1] The 4-year average annual per capita waste generation rate in tons is used with population projections for years 2030, 2040, 2050.

[2] Woods and Poole Economic, Inc., population projections.

Table prepared by BB and checked by EAA (1/24/2023).

Detailed MSW Composition

Detailed MSW composition data for CRLCSWA was included in the *2022 IDNR Material Characterization Study* (SCS Engineers 2022). The IDNR commissioned the study to develop an understanding of waste composition throughout the state of Iowa. The IDNR uses waste characterization studies to track waste disposal trends over time.

SCS Engineers (SCS) collected site-specific data from ten host facilities, including CRLCSWA, to estimate Iowa's overall waste composition. The waste sort at CRLCSWA was conducted during late June 2022. Data from the study is presented in **Table 4** below. It includes both residentially and commercially generated wastes in the MSW stream.

Table 4 – CRLCSWA Waste Composition by Weight[1] (%)

Component	Mean Composition (%)	Standard Deviation (%)	90% Confidence Limits (%)	
			Lower	Upper
Paper (Mixed, OCC, Compostable)	17.7	17.6	13.6	21.8
Plastic (#1 -#7, Plastics Films)	11.2	8.0	9.4	13.1
Metal (Aluminum, Ferrous Materials)	4.5	8.5	2.5	6.4
Glass	1.4	2.0	0.9	1.9
C&D (Wood, Carpet, Furniture)	20.6	26.3	14.5	26.7
Organics (Yard and Food Waste)	22.1	24.7	16.4	27.9
Consumer Products (Textiles, Rubber)	12.1	21.2	7.2	17.1
Household Hazardous Materials	0.2	0.5	0.1	0.3
Other (Diapers, Fines)	10.1	11.7	7.4	12.8

Notes

[1]This data was included in Appendix B of the *2022 Iowa Statewide Material Characterization Study* (SCS Engineers).
Table prepared by BB and checked by EA (1/24/2023).

The data presented above indicates that organics (yard and food waste), C&D, and paper were the most prevalent materials in the loads sampled. Paper, plastic, metal, and glass, which all have well-established recycling markets, made up approximately 35% of these samples. This fraction would constitute roughly 61,000 tons of the MSW stream accepted in FY2022. This information indicates that focused efforts on diverting these materials could save considerable airspace. In addition, portions of C&D waste found in MSW could also be recycled or condensed by shredding, reducing the airspace consumed by these materials.

Considerations

The following are items for CRLCSWA to consider as next steps in the Forward 2044 process:

- **Population and Tonnage Projections** – Population and tonnage projections are provided for planning purposes as part of the CRLCSWA Long-Term Waste Management Evaluation. Projections should be reviewed and updated on a yearly basis to maintain accurate material handling tonnage.
- **Recycling Export** – The City of Cedar Rapids is currently exporting recycling to facilities outside CRLCSWA. Establishing a method for tracking recycling exported outside of the service area would assist in maintaining consistent data.
- **Trends in Iowa MSW Streams -** The Iowa Statewide Material Characterization Study conducted in 2022 indicated that food waste, plastic film, and OCC waste were the most prevalent throughout Iowa. The site-specific information provided previously in **Table 4** showed similar findings: OCC, yard, and food waste were among the most prevalent in the CRLCSWA study. There was also a significant quantity of C&D materials (primarily wood, carpet, and furniture) in CRLCSWA's MSW stream.
- **Diversion Potential and Airspace Conservation** - The trends mentioned above offer insight into the predominant materials in the MSW stream managed by CRLCSWA. Opportunity for diversion exists as a large fraction of these materials have well-developed recycling markets. Diverting these materials could potentially reduce the rate of airspace consumption. CRLCSWA could also potentially reduce airspace consumption by shredding bulky items such as C&D waste.

References:

1. SCS Engineers, 2022. *2022 Iowa Statewide Material Characterization Study*. Clive, IA.