LONG-TERM WASTE MANAGEMENT SYSTEM EVALUATION (FORWARD 2044)

Final Report

Cedar Rapids Linn County Solid Waste Agency (CRLCSWA)

March 1, 2021 to July 18, 2022

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Long-Term Waste Management System Evaluation (Forward 2044)

Goals & Objectives

with Infrastructure Options Analysis Criteria

8/2/21

GOALS & OBJECTIVES

Goal #1

Agency will amend terms of the 28E Agreement to provide integrated solid waste management services beyond 2044.

Objectives:

A. Programs and facilities will consider proven, innovative technologies for reuse, recycling and disposal to reduce the amount of material landfilled.

B. The Agency's future programs and facilities will focus on conservation of resources, management of costs, and minimization of environmental impacts.

C. The Agency's future programs and facilities will address airspace needs beyond the permitted capacity.

D. The next generation of materials management programs and facilities will provide services at competitive rates that align with community and Agency needs, and the practices of the U.S. solid waste industry.

Goal #2

Then next generation of materials management programs and facilities will increase focus on targeted waste streams such as commercial/industrial sector, construction & demolition debris, and organics waste.

Objectives:

A. Given the significant balance (~70%) of the Agency's waste stream received from commercial/industrial sector in Linn County, solid waste diversion/reduction programs and facilities will focus on materials common to industry.

B. Programs and facilities will support generators of construction and demolition debris, by promoting the development of end markets.

C. Programs and facilities will increase management of organics/food waste, accounting for a significant portion of greenhouse gas emissions at the landfill.

D. Linn County and City of Cedar Rapids leaders will support implementation of policy measures that support waste reduction, reuse and recycling efforts.

Goal #3

The Agency will implement a public education and interface platform that allows for transparent communication of information on the Forward 2044 waste planning effort for access by the general public throughout Linn County.

Objectives:

A. Public education and outreach via readily available platforms (website and social media) will convey a clear, consistent message on the long-term waste management evaluation process, costs of each option and possible outcomes.

B. Create a public understanding of the current and future status of the Agency's integrated solid waste management system promoting engagement and involvement in the Forward 2044 waste planning process.

Goal #4

The Agency will evaluate odor mitigation options for the composting operations at Site 3 to limit concerns expressed by the Board.

Objectives:

A. Identify options that further mitigate odors produced with composting operations at Site 3. Consider overall composting means and methods.

B. If an alternative technology is selected for management of organic waste, composting operations will be considered in future infrastructure development.

C. Consider relocation of Site 3 composting operations if operational and/or facility improvement options are not viable due to cost, volume constraints or limitations on growth of the program.

Infrastructure Options Analysis Criteria

Based on the Goals and Objectives developed from the feedback received at the Agency Board Workshop on June 23, 2021, the following criteria will be used to analyze infrastructure options as part of the Forward 2044 Waste Management System Evaluation.

Criteria:

A. Cost to Plan, Permit, Construct and Startup – Options should limit the need for bonding to finance planning, permitting, construction and startup of facilities.

B. Timeline to Plan, Permit, Construct and Startup – The most recent airspace calculation at Site 2 indicates availability through 2038; therefore, technologies/facilities considered need to meet a timeline to plan, permit, construct and startup of 15 years or less.

C. Proven Technologies – Technologies/Facilities must be commercially operational (5 years of successful, at-scale operation) in the United States to be considered.

D. Waste Processed – Technologies/facilities to be considered must be able to manage the materials that make up the largest portions of the Agency's and/or region's waste stream.

E. Waste Volume Alignment - Technologies/facilities to be considered can manage the projected volumes (Agency or regionally) of the waste stream for which that program or technology is dedicated.

Strategic Planning Workshop

Board of Directors – Meeting Summary

6/23/21

Forward 2044 Waste Planning

Meeting Summary

Meeting Overview

The Board of Directors (Board) for the Cedar Rapids Linn County Solid Waste Agency (Agency) and select Agency staff were invited to attend a two-hour strategic planning workshop for the Long-Term Waste Management System Evaluation project on June 23, 2021. The meeting was held at the Mount Trashmore Recreational Building. The intent of the workshop was to engage the Board in open discussions that will lead to developing consensus goals and objectives and evaluation criteria that will assist in facilitating a successful project outcome. Decisions in this process require a great deal of information, open disagreement and discussion over a period of time as the topics are multi-faceted, complicated and will affect the lives of future generations.

Meeting Details

Attendees

Eight of nine members of the Board were present at the meeting, with one Board member from the City of Marion having an excused absence. Six Agency staff also attended, and HDR supplied a facilitator, project planner and engineer to run the meeting, and an engineer to provide technical insight, as needed (Appendix A, Attendee List). The meeting was organized by Karmin McShane, Executive Director for the Agency.

Agenda and Meeting Progression

The meeting agenda is included as an appendix at the end of this document (Appendix B, Meeting Agenda). The meeting began with a welcome and brief discussion of the ground rules for facilitated meetings with specific rules for this meeting. Ground rules emphasized the importance of active participation from each participant and the facilitator's role in support of that participation. Participants were asked to "take a stand", no neutral ground was allowed, responses requested as either 'Strongly Agree', 'Slightly Agree', 'Slightly Disagree', or 'Strongly Disagree'. While each person has different viewpoints and opinions, the process is better if participants remember to assume the best of each other, and "question first" for the sake of forming a consensus.

The goal of the workshop was to garner feedback from the Board, focusing on:

Formation of the Unified Goals and Objectives for Waste Management

Feedback received will be used to develop the Goals and Objectives that will be used to establish criteria for a detailed analysis of infrastructure options for waste management. The options will be considered as the Agency looks beyond 2044, taking the opportunity to shape a vision for future waste management within Linn County, and possibly the larger region.

A series of presentation slides were used to facilitate, see Appendix C: HDR Presentation Slides.

Review SWOT and Goals

A brief overview was given of the top 3 strengths, weaknesses, opportunities and threats, and the Board's five primary goals established in October 2020. The #1 Board goal from October 2020 ("Resolve the expansion issue") was offered for confirmation of resolution given the City of Marion's recent response to the Agency. A simple 'Agree' or 'Disagree' statement was posed:

The expansion [of Site #2] issue has been resolved and is no longer an option.

The Board unanimously disagreed, acknowledging that there are clear barriers in place, but believing that time remains to resolve. Alternative technologies need to be further explored through this study and a real comparison of future costs understood. A large public education campaign is likely, regardless of the recommended solution(s) for waste management. For the sake of the Study, alternative options should not consider expansion or utilization of Site #2 beyond 2044.

Key Decisions and Discussion

Assuming no expansion of Site #2, a question was posed:

Should this Agency continue in 2044 and beyond?

A 'yes' vote means the 28E agreement would be extended or restructured, and a 'no' means the current Agency would be dissolved on June 30, 2044 and the assets and liabilities of the Agency would be divided among the two members (City of Cedar Rapids and Linn County).

Consensus was reached on "yes", some form of public agency to continue managing the waste process and system is needed. Discussion included consideration for a continuation of the status quo, a multi-county waste management approach, and partnerships in either a public-public or public-private agreement that supported new technologies.

Goals & Objectives Brainstorming Exercise

A series of six statements were offered for the Board to discuss. For each statement, Board members were asked to "take a stand" to establish the range of opinions and encourage discussion for greater understanding. Feedback received will guide HDR towards development of the goals and possible criteria for evaluating options in the next phase of the project. Objectives will be developed in support of those goals.

1) ***The Agency should be a leader with our decision, even if it means advancing a solution that has not been implemented in the Midwest.***

A 'strongly agree' or 'agree' vote means the Agency should be a leader or on the leading end of implementing a waste management or diversion solution in the region, and a 'strongly disagree' or 'disagree' means the Agency should not implement proven leading-edge technologies/programs to promote waste diversion and should act more conservatively when implementing new practices. Consensus was reached on "agree", meaning the Agency should be a leader in implementing innovative and proven waste diversion technologies/programs. Discussion by the Board suggested the Agency look to advance viable technologies that are commercially proven in the United States.

2) ***Agency Board members should support local waste diversion policy changes to make alternative technology options more economically realistic.***

A 'strongly agree' or 'agree' vote means the Board should support local policy changes that promote advancement of alternative technologies by the Agency, and a 'strongly disagree' or 'disagree' means the Board would not support changes to local policies that may promote viability of alternative technology implementation by the Agency. Consensus was reached on "agree", meaning the Board will support policies that support implementation of alternative technologies which promote waste diversion. Discussion by the Board recognized that the current fee structure would not be sustainable if the Agency implemented an alternative technology option(s).

3) ***If the solution requires new waste management infrastructure, funding would best be accomplished through bonding.***

A 'strongly agree' or 'agree' vote means the Board would support bonding or financing to fund advancement of new waste management infrastructure by the Agency, and a 'strongly disagree' or 'disagree' means the Board opposes taking on debt to develop and operate new waste management infrastructure by the Agency. Consensus was reached on "disagree", meaning the Board feels that debt should not be taken on by the Agency to fund the development and operation of an alternative technology, but rather the Agency should sustainably fund the improvements. Discussion by the Board recognized that a public/private partnership could support the development and operation of new waste management infrastructure.

4) ***With national policies focusing on environmental justice, siting potential management solutions is a large concern for my community.***

A 'strongly agree' or 'agree' vote means the Board feels that a growing focus on policies associated with environmental justice will create concern for their communities with advancement of potential management solutions, and a 'strongly disagree' or 'disagree' means the Board does not feel those policies would be of concern to their communities. A general consensus was reached on "agree", meaning while the Board recognizes that with new environmental justice policies, siting a new management solution would likely focus on rural areas where less advantaged areas are not impacted. A Board representative from Linn County, voted 'strongly agree', given their representation of the rural communities and the potential impact to their constituents. Discussion by the Board recognized that siting of a management solution would have to generally work for all their constituents; therefore, there were some concepts such as industrial parks, etc. offered as potential solutions.

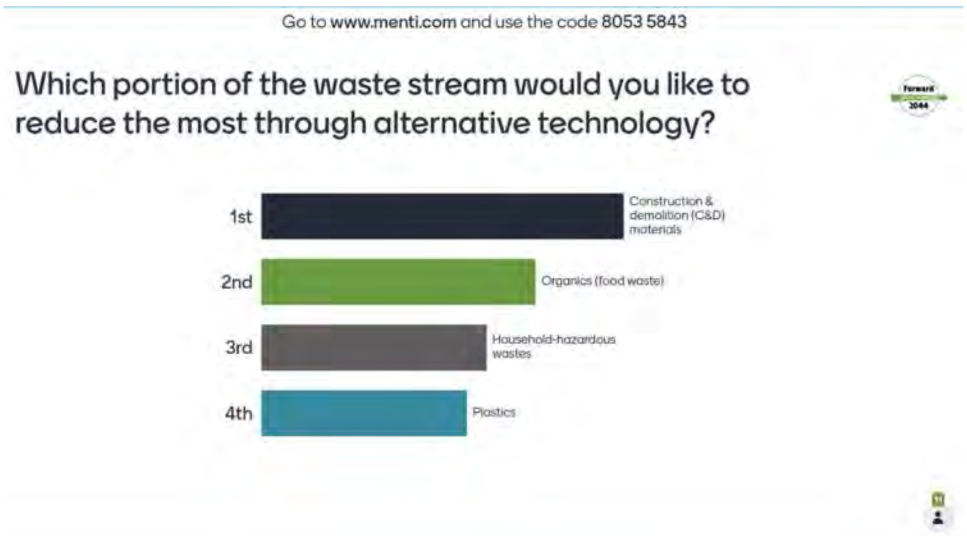
5) ***The Agency should consider partnering with other regional 28E Agencies if doing so makes more waste management solutions viable.***

A 'strongly agree' or 'agree' vote means the Board supports exploring regional partnership(s) with other solid waste agencies to improve viability of waste management solutions, and a 'strongly disagree' or 'disagree' means the Board does not feel partnering with other agencies would be advantageous to advancement of waste management solutions. Consensus was reached on "agree", meaning the Board feels if increased volumes create improved viability of improved waste management solutions long-term, then partnerships with other agencies in the region should be explored.

6) ***The Agency's obligations to manage the waste of the future will be best done through partnership with proven private entities.***

A 'strongly agree' or 'agree' vote means the Board supports exploring private partnership(s) to manage waste into the future, and a 'strongly disagree' or 'disagree' means the Board does not feel private partnership is in the best interest of the Agency when considering waste management solutions in the future. Majority was reached on "agree", meaning most Board members feel the Agency should consider private partnership(s) if that allowed the Agency to continue to control waste management in Linn County into the future, and enabling them to provide and financially support programs desired by the public into the future. Conversation also expressed concern that private entities could "close the doors" or leave at any time.

Two additional questions were posed to participants asking for them to rank their individual considerations on waste management in Linn County. Responses were ascertained using a website and were anonymous, results are as follows:



The workshop concluded with a brief review of the study process and what happens next. HDR will develop the Unified Goals and Objectives and associated criteria to establish the infrastructure options that will be further evaluated. Board confirmation will be requested.

Facilitator Thoughts and Summary

Discussion was good throughout the meeting and Board members generally were able to find common ground. While some members expressed their opinions more frequently or in more detail, each person from the Board and Agency staff contributed to the conversation. When opinions differed, there was no meaningful conflict.

One surprise was the consensus answer of "disagree" to the opening statement regarding whether the expansion issue was resolved and no longer an option. Given the City of Marion's recent response to the Agency, the level of optimism that this position was not final was unexpected. While only one member was not in attendance, conversation around this point may have been explored differently given that the member represents Marion. However, that is purely conjecture. The timeline required for any new siting and the end date of the current 28E agreement makes this topic an important one, and one that should be regularly discussed.

In any case, this process will move forward on the assumption that “no expansion” is possible, and possible solutions without expansion will be considered.

Appendix A: Attendee List

Name	Affiliation	Present
Scott Olson	Board Chair – City of Cedar Rapids (Council)	X
Beg Rogers	Board Vice Chair – Linn County (Supervisor)	X
Greg Smith	Board Secretary – City of Cedar Rapids (Fire Department)	X
Sandi Fowler	Board Treasurer – City of Cedar Rapids (Deputy City Manager)	X
Craig Adamson	Board Member – City of Marion (Representative)	
Mike Duffy	Board Member – City of Cedar Rapids (Streets Superintendent)	X
Brad Hart	Board Member – City of Cedar Rapids (Mayor)	X
Louis Zumbach	Board Member – Linn County (Supervisor)	X
Tyler Olson	Board Member – City of Cedar Rapids (Council)	X
Karmin McShane	Cedar Rapids Linn County Solid Waste Agency (Executive Director)	X
Garrett Prestegard	Cedar Rapids Linn County Solid Waste Agency	X
Scott Zilka	HDR	X
Dan Bacehowski	HDR	X
Morgan Mays	HDR	X

Appendix B: Meeting Agenda

Solid Waste Agency
Cedar Rapids Linn County
living. together. green

Meeting Details

Wednesday, June 23, 2021

Time: 1:30 – 3:30 p.m.

Location: Mount Trashmore Recreational Building 948’
2250 A Street SW
Cedar Rapids, IA 52404

Draft Agenda

1:30 – 1:45 p.m.: Introduction and Ground Rules

1:45 – 1:55 p.m.: Brief Review of Informational Session

A brief refresher on the process we are following for this project
Assumes topic discussed at June Board Meeting

1:55 – 2:00 p.m.: Review SWOT and Goals

Remind Board of the top 3 SWOT and the Board’s 5 primary goals established in October 2020
#1 Board goal from October 2020 has been achieved: Resolve the expansion issue
Does everyone agree the expansion issue has been resolved and is no longer an option?

2:00 – 2:10 p.m.: Key Decision Discussion

Assuming no expansion, the question needs to be asked
Should this agency continue in 2044 and beyond?
Vote: yes/no (yes means extend/restructure your 28E agreement, no means Agency is dissolved and the assets and liabilities are divided)

2:10 – 3:20 p.m.: Goals/objectives Brainstorming Exercise

Live survey: a series of statements for the Board to discuss and vote
Information gathered will guide HDR towards development of goals and possible criteria for evaluating options in the next phase of the project
HDR will then develop objectives which support the goals
Possible statements:

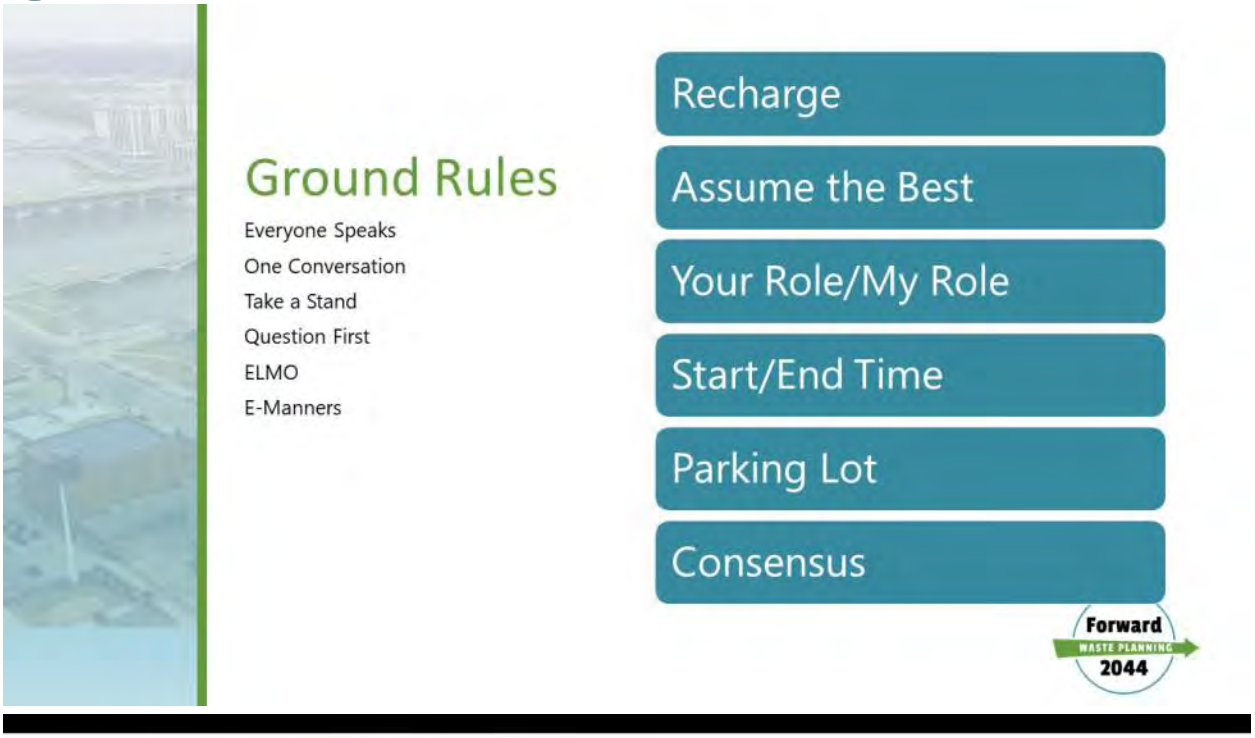
- *The Agency should be a leader with our decision, even if it means advancing a solution that has not been implemented in the Midwest.*
- *Agency Board members should support local waste diversion policy changes to make alternative technology options more economically realistic.*
- *If the solution requires new waste management infrastructure, funding would best be accomplished through bonding or rate adjustments.*
- *With national policies focusing on environmental justice, siting potential management solutions is a large concern for my community.*
- *We should consider partnering with other regional 28E Agencies if doing so makes more waste management solutions viable.*
- *The Agency's obligations to manage the waste of the future will be best done through partnership with proven private entities.*
- *Recognizing that a combination of waste management solutions is likely in Linn County after 2044, rank the following by which you think would best benefit your community and constituents:*
    - *Waste transfer*
    - *Waste diversion*
    - *Alternative technology*
    - *Landfilling*
    - *Agency no longer exists (Private Operations)*

- *Which portion of the waste stream would you like to reduce the most through alternative technology? Rank from most important (the greatest reduction) to least important (the least reduction).*
    - *Organics (food waste)*
    - *Plastics*
    - *Construction & Demolition (C&D) Materials*
    - *Household-hazardous Wastes*

3:20 – 3:30 p.m.: Wrap-up: Review Action Items, Next Steps

Dan will reiterate where we are in the process and what happens next

Appendix C: HDR Presentation Slides


Ground Rules
Everyone Speaks
One Conversation
Take a Stand
Question First
ELMO
E-Manners
Recharge
Assume the Best
Your Role/My Role
Start/End Time
Parking Lot
Consensus
Forward
WASTE PLANNING
2044


Why are we here?
Solid Waste
Cedar Rapids Linn County
Agency
Forward
WASTE PLANNING
2044

Scope of Services – Timeline

MAR 2021 - MAY 2021	JUN 2021	JUL 2021 - NOV 2021	SEP 2021 - JUN 2022	JUN 2022 - AUG 2022
Emerging Technologies, Management Practices + Industry Trends	Formation of Unified Goals + Objectives for Waste Management	Analysis of Infrastructure Options	Stakeholder Engagement	Final Report

SWOT and Goals – October 2020

WHAT WE HEARD

SWOT Analysis

Staff identified strengths, weakness, opportunities and threats at the strategic planning session. The top 3 in each category were also identified independently by Board members in their individual discussions with Karmin McShane.

STRENGTHS
Financial Responsibility
Positive, Team Oriented Environment
Highly Responsive

WEAKNESSES
Landfill Capacity
Limited Staff
Recycling Markets

OPPORTUNITIES
Mount Trashmore (Site 1)
Landfill Expansion
Additional Storm Revenue

THREATS
Landfill Expansion Opposed
Recycling End Markets
Limited Remaining Capacity

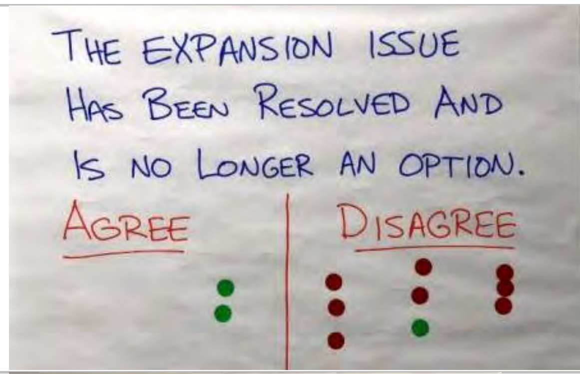
Goals

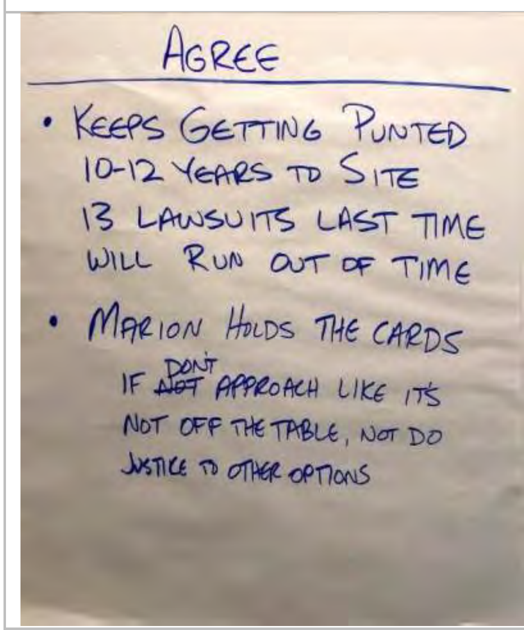
Staff strategic planning led to 5 primary goals. The Board members also identified individual goals in discussions with Karmin.

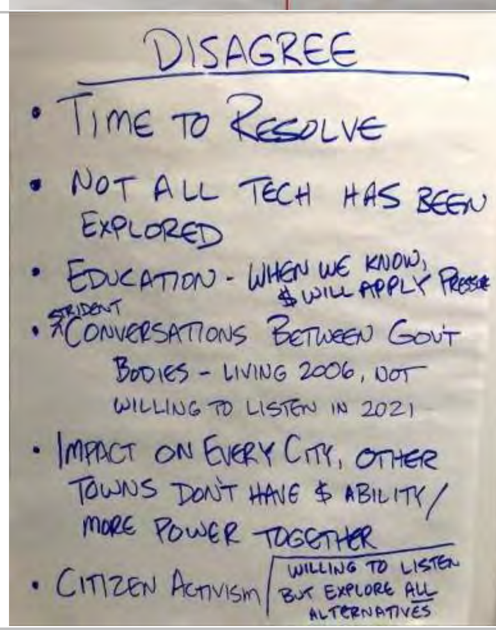
Agency Staff
Opportunities at Mount Trashmore (Site 1)
Alternative Technology Study
Landscaping Plan at Landfill (Site 2)
Communications Plan for plastic bags/polystyrene
Operational Plan for Landfill (Site 2)

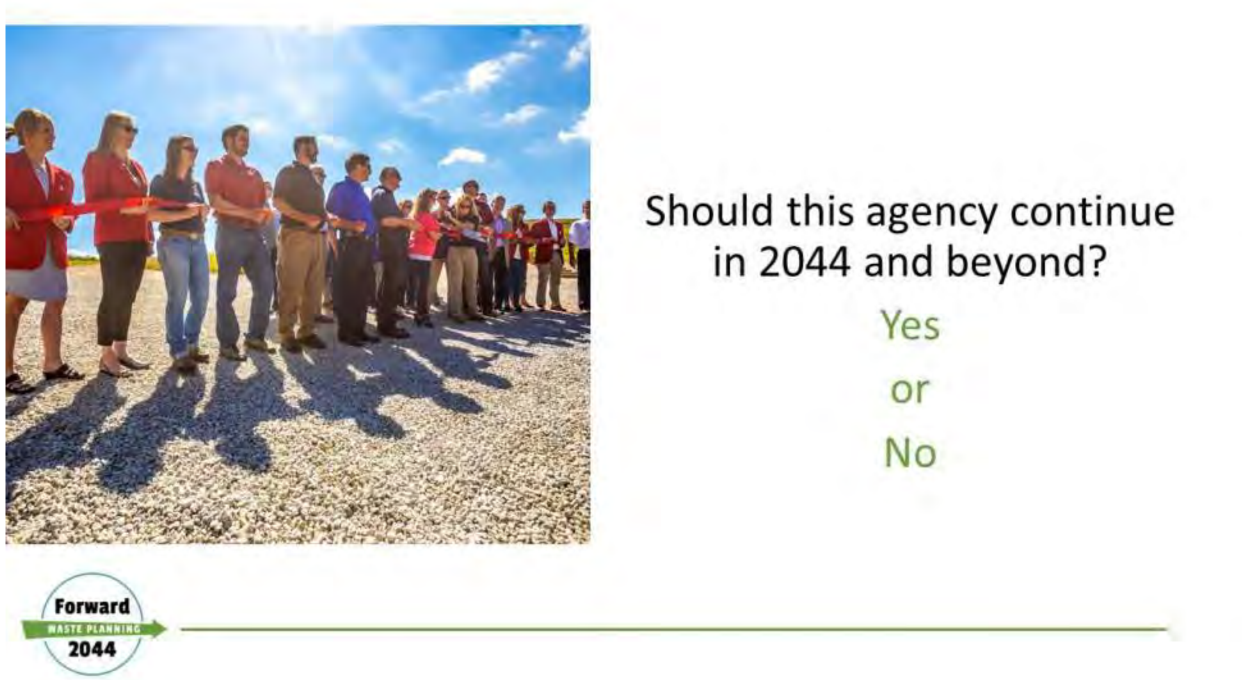
Board Members
Resolve the expansion issue
Opportunities at Mount Trashmore (Site 1)
Develop strategy for alternative technologies
Community involvement
Recycling

Documentation of the responses shown herein.









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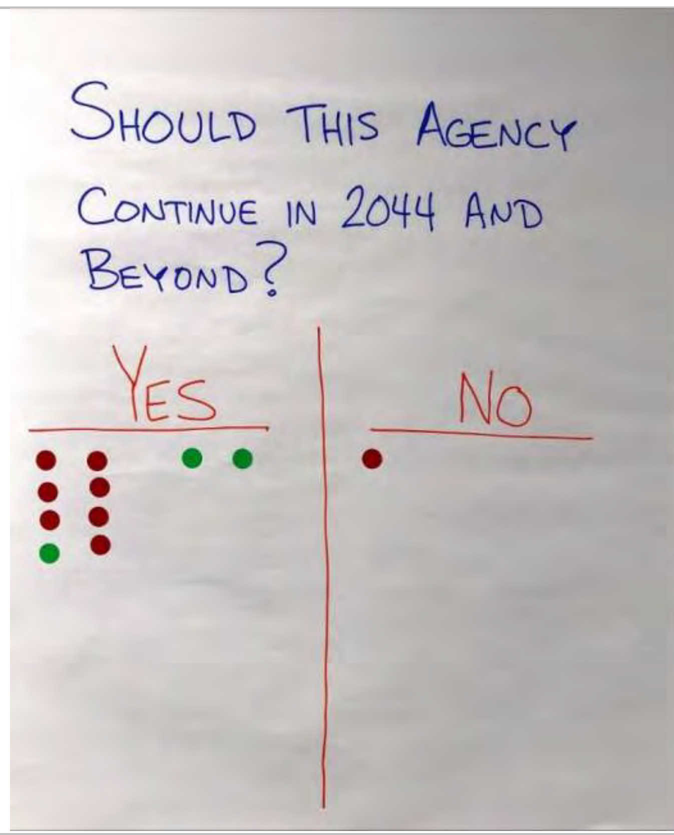
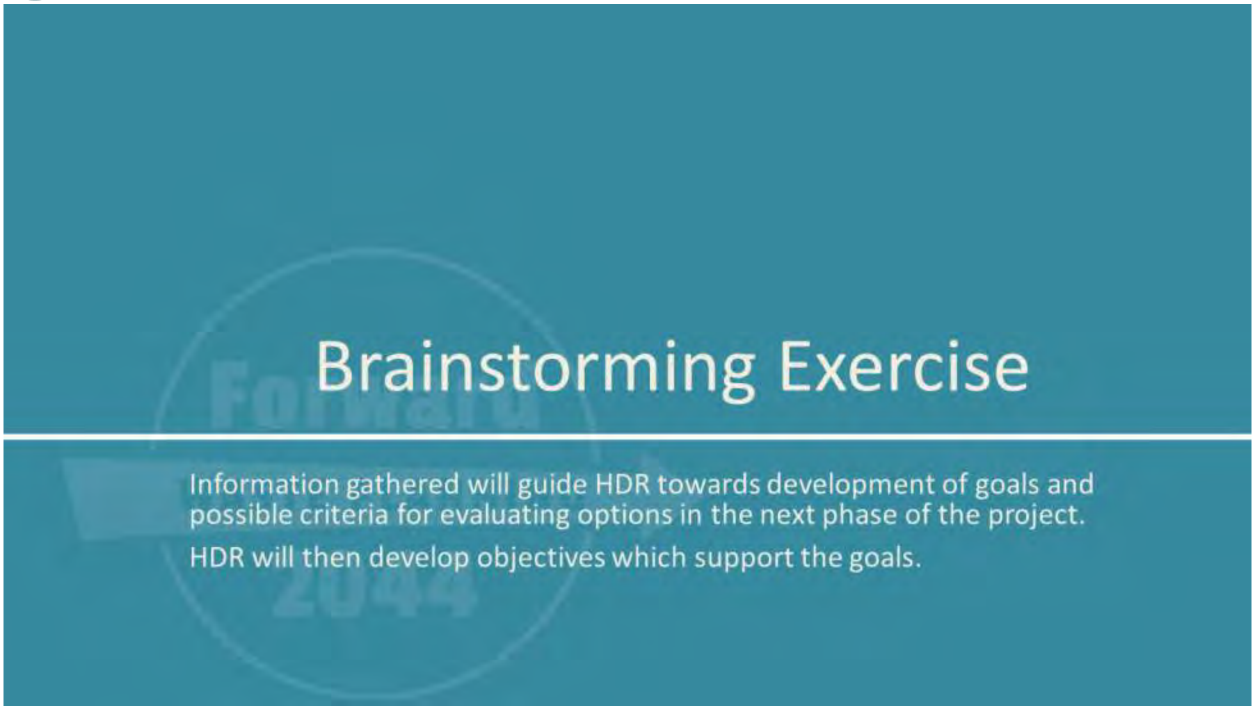



Brainstorming Exercise
Information gathered will guide HDR towards development of goals and possible criteria for evaluating options in the next phase of the project.
HDR will then develop objectives which support the goals.

Statement #1

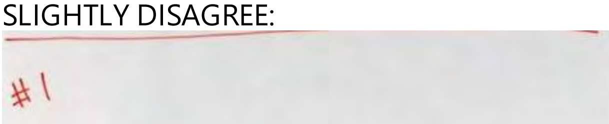
The Agency should be a leader with our decision, even if it means advancing a solution that has not been implemented in the Midwest.

Response Documentation:

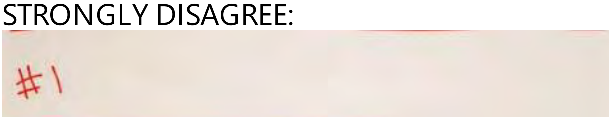
STRONGLY AGREE:

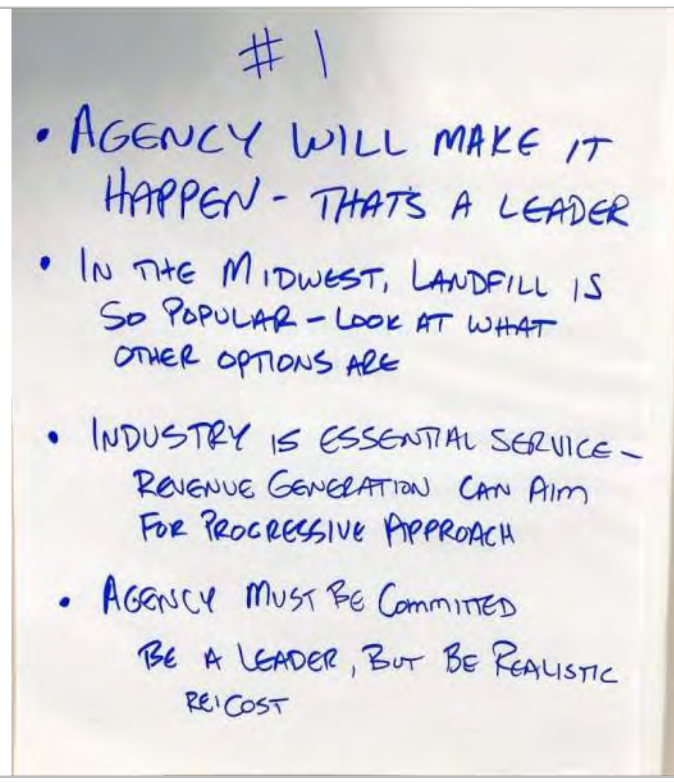
SLIGHTLY AGREE:

SLIGHTLY DISAGREE:



STRONGLY DISAGREE:





Statement #2

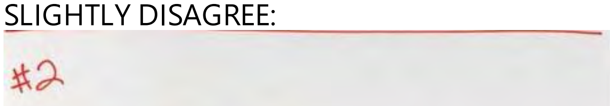
Agency Board members should support local waste diversion policy changes to make alternative technology options more economically realistic.

Response Documentation:

STRONGLY AGREE:

SLIGHTLY AGREE:

SLIGHTLY DISAGREE:



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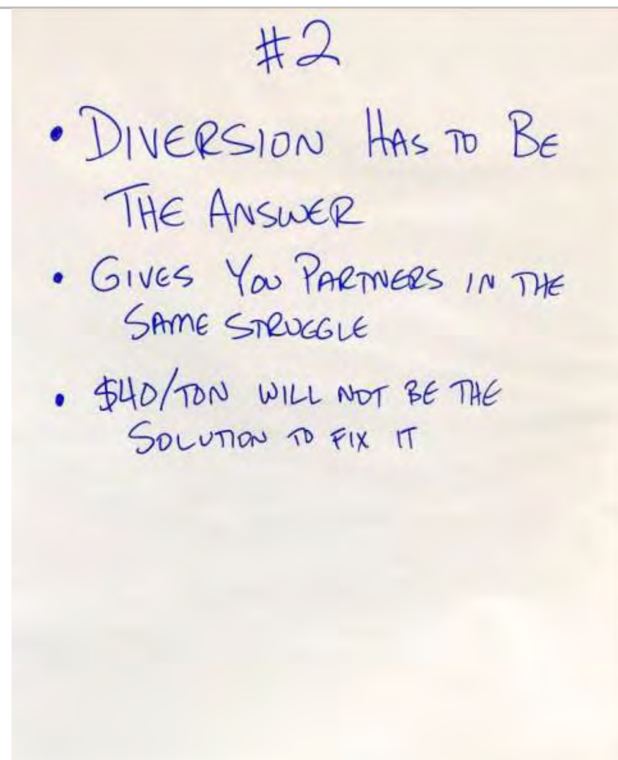


Statement #3

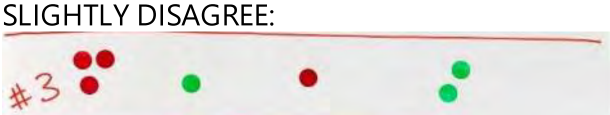
If the solution requires new waste management infrastructure, funding would best be accomplished through bonding.

Response Documentation:

STRONGLY AGREE:

SLIGHTLY AGREE:

SLIGHTLY DISAGREE:



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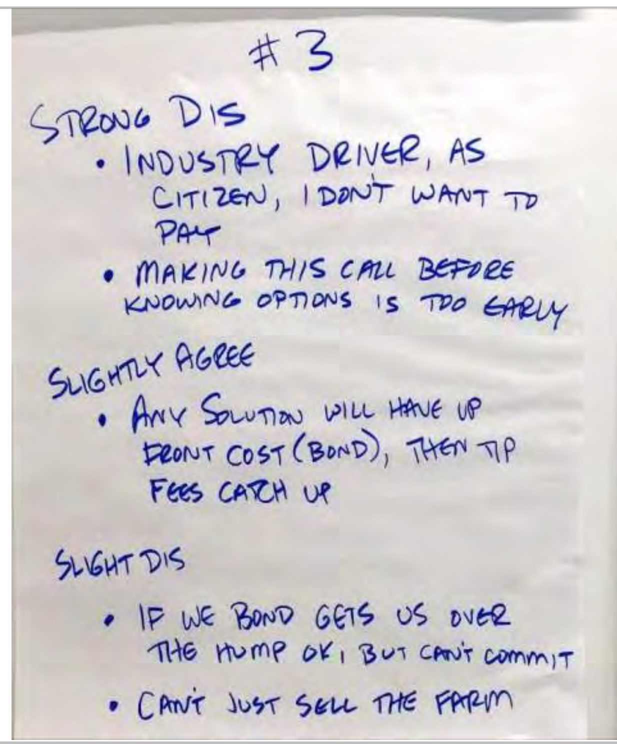


Statement #4

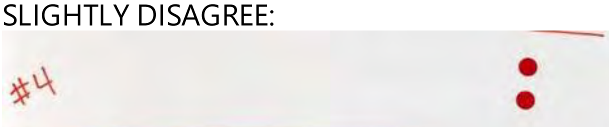
With national policies focusing on environmental justice, siting potential management solutions is a large concern for my community.

Response Documentation:

STRONGLY AGREE:

SLIGHTLY AGREE:

SLIGHTLY DISAGREE:



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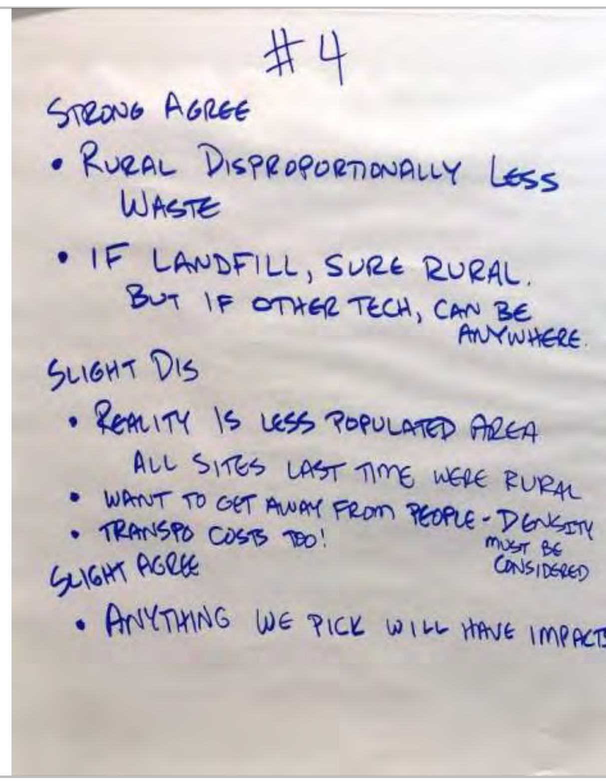
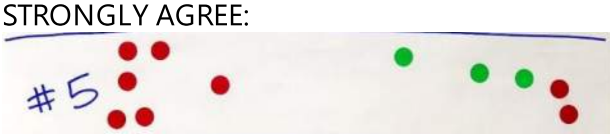


Statement #5

The Agency should consider partnering with other regional 28E agencies if doing so makes more waste management solutions viable.

Response Documentation:

STRONGLY AGREE:



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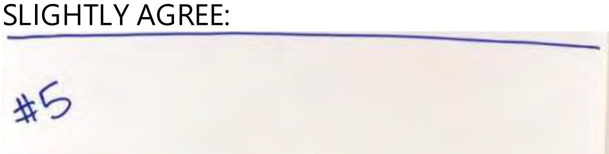

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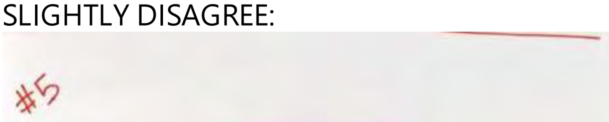

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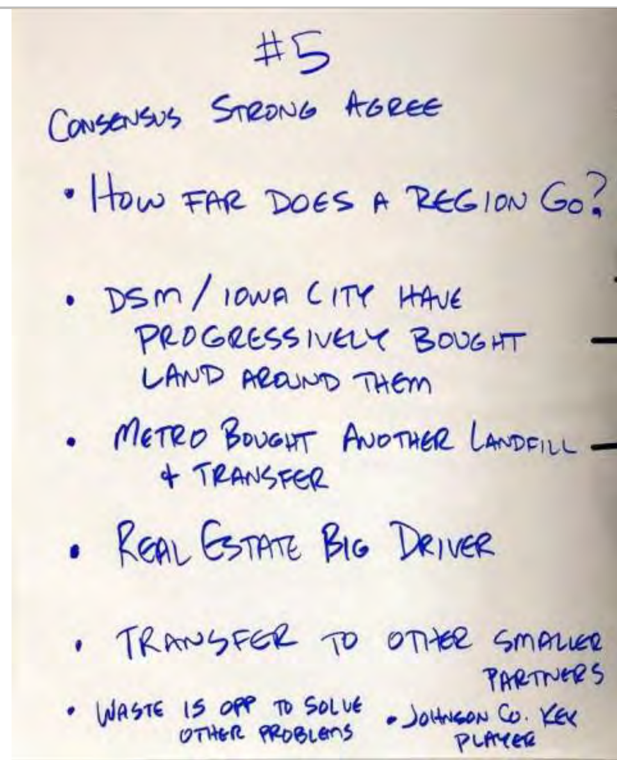
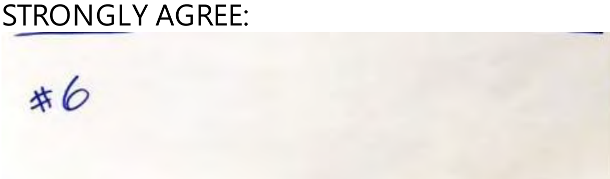


Statement #6

The Agency's obligations to manage the waste of the future will be best done through partnership with proven private entities.

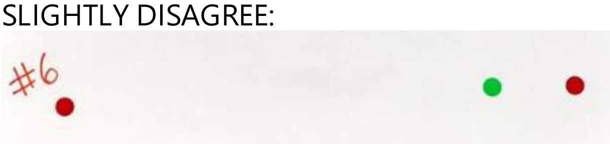
Response Documentation:

STRONGLY AGREE:



SLIGHTLY AGREE:

SLIGHTLY DISAGREE:



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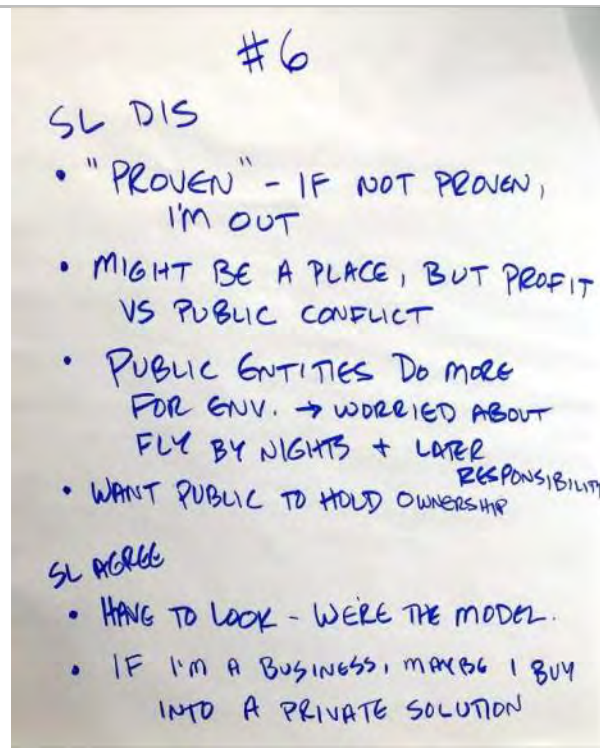
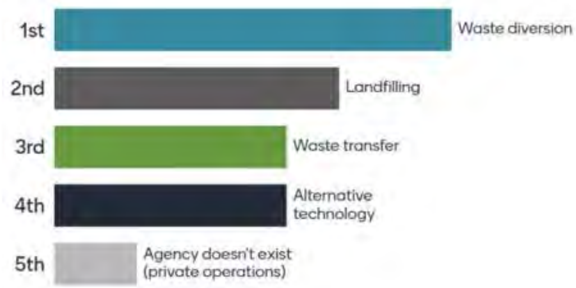


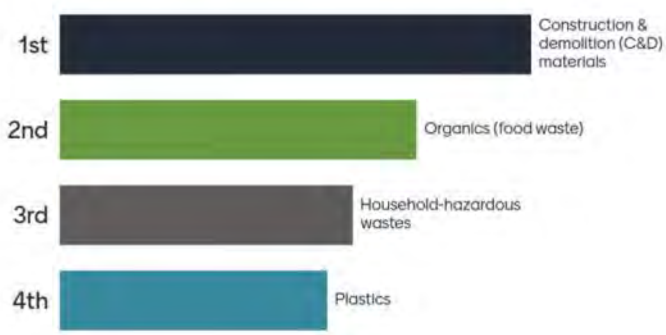
Go to **www.menti.com** and use the code **8053 5843**

Recognizing that a combination of waste management solutions is likely in Linn County after 2044, rank which would best benefit your community?



Go to **www.menti.com** and use the code **8053 5843**

Which portion of the waste stream would you like to reduce the most through alternative technology?



Wrap-up!

Memorandum

Date:	Monday, June 14, 2021
Project:	Long-Term Waste Management (LTWM) System Evaluation
To:	Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) Karmin McShane, Executive Director
From:	HDR Engineering, Inc. (HDR) Dan Bacehowski, Morgan Mays, and Wendy Mifflin
Subject:	Task 1 - **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. Individual solid waste projections for CRLCSWA, Black Hawk County Solid Waste Management Commission (Black Hawk County), City of Iowa City Landfill and Recycling Center (Iowa City), and Dubuque Metropolitan Area Solid Waste Agency (Dubuque) will be provided as background for consideration of potential cooperative opportunities.

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 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 waste stream included in the following tables also accounts for debris managed from natural disasters, including tornadoes, floods, fires, and winter storms.

Table 1 – Detailed Solid Waste Volumes – CRLCSWA Facilities[1] (In Tons)					
CRLCSWA Facilities Waste Stream (In Tons)		**Fiscal Year[2]**			
		FY2017	**FY2018**	**FY2019**	**FY2020**
Solid Waste	MSW	149,886	153,468	167,404	160,086
	Disaster Debris	934	0	0	0
	Special Waste	19,320	15,118	21,253	16,612
	C&D	13,498	11,937	12,337	25,960
	Shingles	323	491	1,309	9,091
Total Disposed – Landfill		**183,961**	**181,014**	**202,303**	**211,749**
Organics	Organics	35,376	30,298	28,781	29,710
	Subtotal	**35,376**	**30,298**	**28,781**	**29,710**
Recyclables	Glass	587	613	625	601
	OCC	452	403	451	536
	Single Stream Sort	4,143	2,422	2,978	2,389
	City of Cedar Rapids[3]	8,163	8,061	8,170	8,346
	Metal	437	517	480	454
	White Goods	531	538	521	422
	Subtotal	**14,313**	**12,554**	**13,225**	**12,748**
Total Recycled/Recovered		**49,689**	**42,852**	**42,006**	**42,458**
Total Materials to Facilities		**233,650**	**223,866**	**244,309**	**254,207**

[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.

CRLCSWA Per Capita Waste Generation Rates

The primary purpose of the per-capita waste generation measurement is to forecast waste generation volumes for use in evaluating future programs and infrastructure development options. Table 2 summarizes the per capita generation rate, in tons per year and pounds per day, based on population by waste stream.

Table 2 – CRLCSWA Annual Per Capita Waste Generation Rates (In Tons)					
	FY2017	**FY2018**	**FY2019**	**FY2020**	**4-Year Median**
Linn County Population[1]	**224,380**	**225,770**	**226,700**	**228,600**	**N/A**
Material Disposed (in tons/yr per capita)					
MSW	0.67	0.68	0.74	0.70	0.70
Disaster Debris	0.01	0.00	0.00	0.00	0.01[2]
Special Waste	0.09	0.07	0.09	0.07	0.08
C & D	0.06	0.05	0.05	0.11	0.07
Shingles	0.00	0.00	0.01	0.04	0.01
Materials Recycled/Recovered (in tons/yr per capita)					
Organics	0.16	0.13	0.13	0.13	0.14
Single Stream/Drop Box/City	0.06	0.05	0.05	0.05	0.05
Scrap Metal/White Goods	0.01	0.01	0.01	0.01	0.01
Total Annual Per Capita Generation Rate (in tons)	**1.06**	**0.99**	**1.08**	**1.11**	**1.06**
Total Annual Per Capita Generation Rate (in lbs/day)	**5.71**	**5.43**	**5.90**	**6.10**	**5.79**
Total Annual Per Capita Disposal Rate (in tons)	**0.82**	**0.80**	**0.89**	**0.92**	**0.87**
Total Annual Per Capita Disposal Rate (in lbs/day)	**4.49**	**4.38**	**4.88**	**5.10**	**4.77**
Total Annual Per Capita Disposal Rate (in lbs/yr)	**1,638.85**	**1,598.70**	**1,781.20**	**1,861.50**	**1,741.05**

[1]Population from U.S. Census Bureau.
[2]Conservative estimate utilized in 4-year average.

Table 2 is used to determine the individual per capita rates for waste disposal and recycling. As such, the waste disposal per capita 4-year average rate for CRLCSWA was calculated to be 0.87 ton per person, per year, while the recycling per capita 3-year average rate is 0.20 ton per person, per year. Tonnages recycled outside of CRLCSWA are not included in Table 2. In addition, household hazardous waste and brown goods have not been included while calculating the recycling rate.

Disposal Per Capita Comparison

Table 3 provides information for comparison on per capita generation rates in tons per person, per year, based on population by waste stream for CRLCSWA, Black Hawk County, Dubuque, and Iowa City. Fiscal year 2019 was used for comparison as that is the most recent disposal volume data available for the comparison locations.

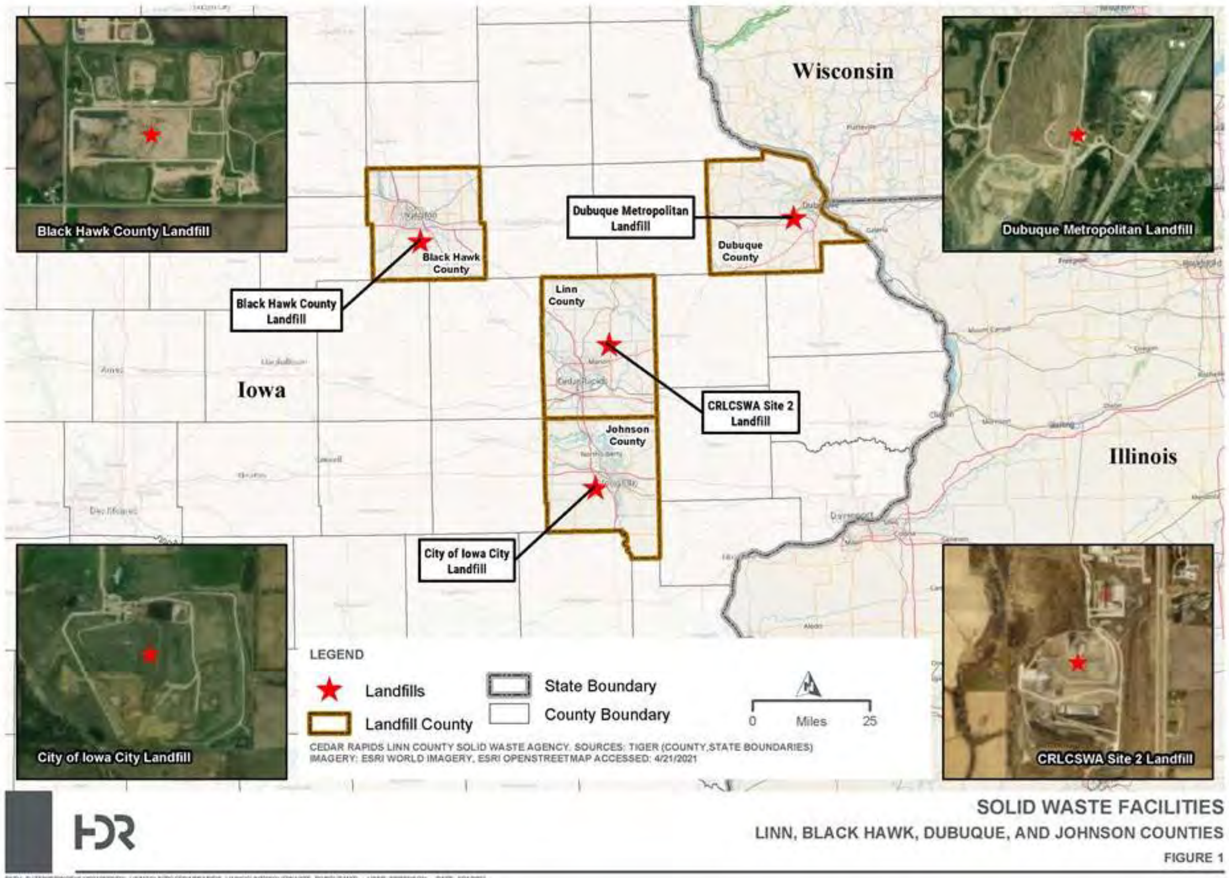
Table 3 – Disposal Per Capita Comparison (FY2019)

	CRLCSWA Site 2 Landfill	Black Hawk County Landfill	Dubuque Metropolitan Landfill	Iowa City Landfill
Population Served	**226,700**	**186,990**	**151,520**	**154,775**
MSW (In Tons)	202,303	189,064	145,420	127,587
Total Annual Per Capita Disposal Rate (In Tons)	**0.89**	**1.01**	**0.96**	**0.82**

Sources: Population projections - Woods and Poole Economics, Inc. Historical tonnage information – Iowa Department of Natural Resources, Solid Waste Section, Historical Landfill tonnages. Available at: https://www.iowadnr.gov/Environmental-Protection/Land-Quality/Solid-Waste#:~:text=Iowans%20generate%202.8%20million%20tons,managed%20by%20cities%20and%20counties.

Figure 1 presents location of landfill sites used for comparison purposes.

Figure 1 – Disposal per Capita Comparison Landfill Sites



For comparison purposes, the Black Hawk County Service Area includes:

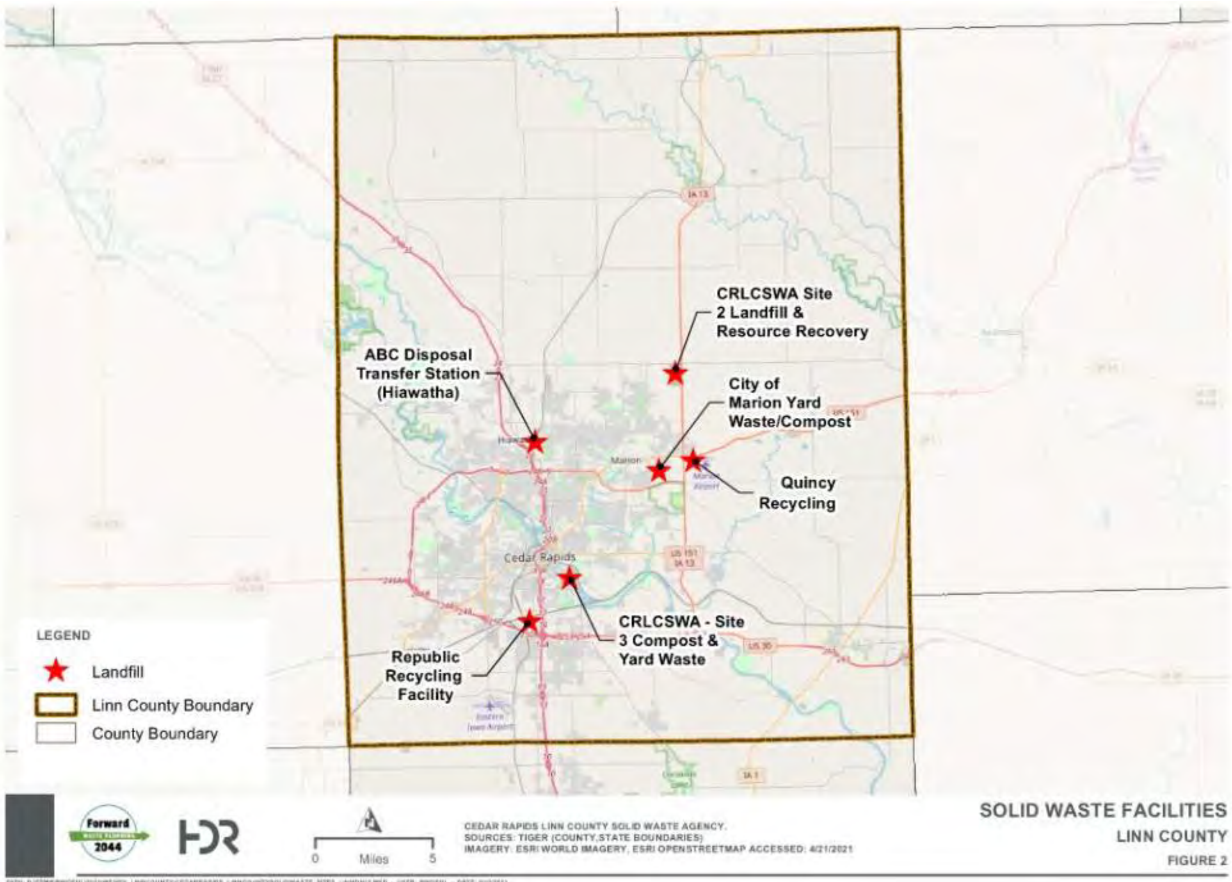
- All cities and the unincorporated area in Black Hawk County
- All cities and the unincorporated area in Bremer County
- All cities and the unincorporated area in Fayette County
- Within the cities of Jesup and Fairbank in Buchanan County
- Within the cities of Dike, Grundy Center, Morrison, Reinbeck, and Stout in Grundy County

Dubuque Metropolitan Landfill is a regional facility that services not only Dubuque County but also Delaware County, portions of Jackson and Clayton Counties, Grant County in Wisconsin, and Jo Daviess County in Illinois.

The Iowa City Landfill and Recycling Center serves Kalona, Riverside, and Johnson County in Iowa.

Figure 2 presents the locations of waste management and recycling facilities in Linn County.

Figure 2 – Solid Waste Facilities in Linn County



Waste management facilities in Linn County include the following:

- CRLCSWA – Site 2 Landfill and Resource Recovery Center
- CRLCSWA – Site 3 Compost and Yard Waste Facility
- ABC Disposal – Transfer Station
- Quincy – Material Recycling Facility
- Republic – Material Recycling Facility
- City of Marion – Yard Waste Drop Off Facility

Material-Handling Projections

Material-handling projections are presented in Table 4. Material-handling projections for years 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. Population projections are calculated using the Woods and Poole Economics, Inc., projections 2025 through 2040 for an average of 0.8 percent per year and extrapolated to 2050. The 2050 population projection is not currently available.

Table 4 – CRLCSWA Material Handling Projections (In Tons)

Material	Fiscal Year			
	FY2020	FY2030[1]	FY2040[1]	FY2050[1]
Population	**228,600**	**254,900[2]**	**276,800[2]**	**298,900**
Materials Landfilled				
MSW	160,086	178,430	193,760	209,230
Disaster Debris	0	2,549[3]	2,768[3]	2,989[3]
Special Waste	16, 612	20,392	22,144	23,912
C&D	25,960	17,843	19,376	20,923
Shingles	9,091	2,549	2,768	2,989
Subtotal Materials Landfilled	**211,749**	**221,763**	**240,816**	**260,043**
Materials Recycled				
Organics	29,710	35,686	38,752	41,846
Single Stream/Drop Box/City	11,872	12,745	13,840	14,945
Scrap Metal/White Goods	876	1,098	1,193	1,288
Subtotal Materials Recycled	**42,458**	**49,529**	**53,785**	**58,079**
Total Materials	**254,207**	**271,292**	**294,601**	**318,122**

[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.

[3] Conservative estimate derived from 4-year average.

Considerations

The following are items for CRLCSWA to consider that will assist with quantifying solid waste volumes:

- **Disaster Debris** – Disaster debris disposal is occurring on a fluctuating basis and has the potential to significantly affect tonnages handled for disposal. This tonnage fluctuation is not accurately presented in the tables above, as limited disaster debris was handled during the time frame used for this memorandum. This memorandum provides information from FY2017 through FY2020, which ended June 30, 2020. Disaster debris disposal as a result of flooding (2008 and 2016 events), hailstorms, and the August 2020 derecho event can cause tonnage fluctuations in the disposal system that significantly shorten the life of the landfill. Developing a method for CRLCSWA to measure and account for disaster debris would assist in maintaining consistent data.

- **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.
- **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.
- **Waste Stream Changes** – Waste streams continue to change and evolve, not only through material changes but also through service disruptions such as those that occurred due to COVID-19. This memorandum provides information through FY2020, which ended June 30, 2020. As of June 30, 2020, COVID-19 had been prevalent for approximately 4 months, and effects on the waste stream, both disposed and recycled, cannot be fully understood. FY2021 tonnage reviews should be completed and the tables in this report updated to allow for future review of tonnage variances.

Memorandum

Date:	Monday, June 14, 2021
Project:	Long-Term Waste Management (LTWM) System Evaluation
To:	Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) Karmin McShane, Executive Director
From:	HDR Engineering, Inc. (HDR) Dan Bacehowski, Morgan Mays, and Wendy Mifflin
Subject:	Task 1 - Solid Waste Management Practices

Introduction

The purpose of this memorandum is to provide the Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) with a brief summary of successful management practices that may be replicated to aid in solid waste diversion and long-term financial sustainability.

The following five jurisdictions were ultimately selected for their management practices:

- Simcoe County, Ontario, Canada
- Lancaster County Solid Waste Management Authority, Pennsylvania
- Monterey Regional Waste Management District, California
- Yakima County, Washington
- Brown County, Wisconsin

These jurisdictions were selected based on a combination of factors, including:

- Population
- Annual tons of waste generated
- Disposal method
- Diversion programs
- Waste management strategy including partnership opportunities
- Funding model

The summary of practices provided in this memo, along with the Alternative Technologies memo and Summary of Solid Waste Volumes and Projections memo, is intended to lay the groundwork for the infrastructure options assessment portion of the Long-Term Waste Management (LTWM) System Evaluation.

Data Sources and Limitations

The data gathered from the benchmarked jurisdictions includes a general overview, operational and educational program descriptions, and fee structure information. The information gathered includes publicly available information from agreements, industry specific inquiries, and HDR project records. The results are discussed in the Comparison of Trends and Practices section of this memo.

Solid Waste Management Practices Municipality Overview

Table 1 – Municipality Population and Tonnage Overview

Criteria	System Overview					
	Cedar Rapids Linn County Solid Waste	Simcoe County, Ontario, Canada	Lancaster County Solid Waste Management Authority, Pennsylvania	Monterey Regional Waste Management District, California	Yakima County, Washington	Brown County, Wisconsin
Population	228,600	304,200	545,700	170,000	250,900	264,500
Total Tons Disposed	211,749	153,300	558,200	200,000	280,000	254,900
Tons Disposed per Capita per Year	0.92	0.50	1.02	1.18	1.12	0.96

The following provides a brief overview of the structure and programs for the respective solid waste systems for each municipality.

Simcoe County, Ontario, Canada

Simcoe County is located in south-central Ontario and is comprised of 16 member municipalities including Adjala-Tosorontio, Bradford West Gwillimbury, Clearview, Collingwood, Essa, Innisfil, Midland, New Tecumseth, Oro-Medonte, Penetanguishene, Ramara, Severn, Springwater, Tay, Tiny, and Wasaga Beach. Most of the population is located in settlement areas, with the remainder scattered through rural areas that make up the bulk of the land area within the County. The County is experiencing significant population growth and, as a result, increased demand for municipal services such as waste management.

Simcoe County is directly responsible for the management of all municipal solid waste (MSW) generated by the residential sector in the County, which includes all the towns within the County. The County was allocated responsibility for management of MSW generated in the entire County under the Ontario Provincial Municipal Act. No agreements are required with the towns and townships that make up the County to address responsibility for managing solid waste. The only exception is that the Cities of Barrie and Orillia are separate incorporated cities under the Provincial Municipal Act. While they are physically located within the County, they are not part of the County government and are responsible for managing their own MSW. The County provides curbside collection services across the entire County, owns and operates a few small County landfills and yard waste composting areas, operates a series of residential drop-off facilities, contracts for the collection and diversion of household hazardous waste (HHW), contracts for external recyclables and household organics processing, and is currently developing a new transfer facility coupled with new household organics processing capacity.

In 2010, the Simcoe County Council approved a comprehensive, multi-staged Solid Waste Management Strategy (SWMS) designed to guide short- and long-term diversion and waste disposal programs for 20 years. Since that time, more than 25 SWMS recommended initiatives have been implemented, allowing Simcoe County to achieve higher diversion rates, synergies and efficiencies in waste collection, and innovations in waste management.

Simcoe County is one of the top-diverting counties in Ontario. Residents make good use of a two-stream blue box recycling program, curbside diversion of source-separated household organics (food scraps and compostable paper fiber), and diversion opportunities provided at waste facilities. Waste diversion rates have been relatively stagnant, sitting at approximately 60 percent for a number of years (calculated based on the total quantity of waste diverted as a proportion of the overall waste stream that was diverted and disposed). However, waste generation rates are increasing, and the curbside organics diversion program requires improvement. As such, the 2010 SWMS was updated in 2016. The 2016 update outlines the results of implementing the first 5 years of the SWMS-recommended initiatives to increase diversion along with an implementation plan for the next 5 years. The primary focus of the new initiatives is to implement disincentives for curbside garbage, such as transitioning to a standard garbage container. The implementation of these initiatives will assist in reaching the County Council approved target of 62 percent diversion by 2020. Additional long-term targeted diversion rates will be reassessed in the future as the SWMS is updated.

Lancaster County Solid Waste Management Authority, Pennsylvania

The Lancaster County Solid Waste Management Authority (Authority) has developed an Integrated Solid Waste System (System) that allows for waste disposal by combining the resources of a comprehensive recycling program, transfer station facility, waste-to-energy (WTE) facility, HHW facility, and a landfill. As a result, the volume of waste disposed at the landfill is reduced significantly. Natural resource consumption is reduced by generating clean, renewable energy (electricity) from the waste and diverting a large portion of the waste for recycling or reuse. The Authority is taking a balanced approach to solid waste management that protects the land, air, and water by implementing the System wisely.

The Authority, a corporate and political body organized under the Municipal Authorities Act of 1945 of the Commonwealth of Pennsylvania, manages the design, financing, construction, and operation of the county's System.

Lancaster County's commissioners appoint a nine-member board of directors. Seven members of the Executive Team oversee the organization's operations, finance, technical services, energy administration, capital projects, and business development. The Authority holds no taxing powers and receives no government backing of its debt. The organization's primary source of revenue is waste disposal ("tipping") fees, as well as revenue from the sale of electricity generated by its renewable energy projects.

The System involves a combination of public and private participation. Collection services for recyclables and all types of waste are managed by the private sector. The Authority manages MSW processing and disposal from residences and businesses. Processing and recycling/disposal of construction and demolition (C&D) waste and white goods are shared between the Authority and the private sector. The Authority assists with the consolidation and shipping of mixed recyclables at its transfer station, and the private sector manages the processing and marketing of recyclables. Yard waste, biosolids, and septage are managed by a combination of private and municipal entities. Infectious and chemotherapeutic waste is managed privately.

The Authority entered into a long-term contract with Inashco North America, Inc. in April 2016 to site a metals recovery facility (MRF) next to the Frey Farm Landfill. While the Authority's WTE facilities currently use in-line metal recovery systems, only larger metals are removed. Inashco offered an advanced metals recovery system to remove pebble-sized metals present in the ash. This includes both ferrous (iron) and non-ferrous (aluminum, copper, brass, zinc, gold, silver, etc.) metals.

The Authority integrated the WTE Facility with the adjacent Perdue AgriBusiness's Soybean Processing Facility in 2018. The Authority provides 15-20 percent of the steam from the WTE Facility, which reduces the Perdue Soybean Processing Facility's environmental footprint and lowers its emissions by avoiding the need to use fossil fuels. Using steam from the WTE Facility, instead of creating steam from natural gas or fossil fuels, avoids 20,000-30,000 metric tons of CO2 annually for this project.

The Authority also provides process water, eliminating the need to use water from the Susquehanna River for the Perdue Soybean Processing Facility. The process water is returned to the WTE Facility, where it is treated and recycled yet again in a closed-loop, zero discharge system.

To ensure the tipping fee revenues that are necessary to construct, operate, and maintain the System, municipal waste generated in Lancaster County is directed to Authority facilities through a combination of waste flow ordinances and hauler agreements. This flow-control system has been in effect continually and has further evolved over the past 20 years (hauler agreements began in 1994).

Monterey Regional Waste Management District, California

The Monterey Regional Waste Management District (District) was created in 1951 in response to illegal dumping and burning of waste on nearby sand dunes. The mission was to manage the Peninsula's waste by establishing a sanitary landfill to replace the old "dumps" then in operation. Since then, numerous new technologies, systems, and strategies have been put in place to maximize efficiency, effective disposal, and resource recovery for the local jurisdictions. Today, the District is recognized as one of the "Best Solid Waste Systems in North America." Member municipalities in the District include Carmel, Del Rey Oaks, Marina, Monterey, Pacific Grove, Pebble Beach, Sand City, Seaside, and Monterey County.

The District operates the Monterey Peninsula Landfill, which has a life expectancy of 100 years at current disposal rates. In 1983, the District developed one of the first landfill gas-to-electricity energy plants in the nation. Today, the landfill gas-to-energy project has four engine generators that provide approximately 5 megawatts of electricity, providing the District's power needs and supplying surplus energy to power 4,000 homes.

The District Materials Recovery Facility (MRF) opened in April 1996. The $9.6 million facility was designed to process construction and demolition debris, as well as to complement the recycling collected from homes and businesses. The MRF diverts 50 percent of the incoming mixed waste through reuse and recycling and receives green waste and wood scraps, which are used as raw materials for making compost and wood chips for resale. The District is currently in the process of renovating the MRF to accept single-stream and commercial recyclables.

The District operates two composting systems at the site. A yard/green and food waste composting program is operated to produce an organic compost market for local agricultural demand. A separate composting operation processes biosolids from the adjacent wastewater treatment plant (WWTP). The biosolids compost is used as daily cover and landfill cover erosion control for both landfill capacity enhancement and soil erosion control purposes.

The first dry fermentation anaerobic digester (AD) in California, and only the second in the U.S., became operational at the District in March 2013. The 5,000-ton-per-year pilot demonstration project, operating in partnership with Zero Waste Energy, is effectively processing a blend of commercially generated food scraps and mulch from yard waste to produce renewable energy and compost. The AD system processes 65-ton batches of food scraps, received from restaurants in Monterey and Santa Cruz Counties, mixed with mulch to provide carbon and porosity. The "digestate" (organic mass) that is removed from the digester is then composted for 90–120 days to complete the decomposition process. The resulting compost is screened to remove contaminants and large wood pieces. The finished compost is then sold to orchards and vineyards. The success of the AD project is helping staff plan for the future of organics management within the District. Keeping organics out of the landfill with anaerobic digestion allows the energy value of the food scraps to be rapidly captured in an enclosed system and reduces greenhouse gas emissions.

The District currently owns and operates The Last Chance Mercantile (LCM), which has a resale store with an eclectic and ever-changing inventory, a convenient reusable goods drop-off area, a beverage container redemption center, electronic waste drop-off, and a bag-your-own landscape product area. Reuse was elevated to an art form with the establishment of the Artist in Residence program in 2016 in partnership with the Visual & Public Art Department at California State University Monterey Bay. The LCM also houses a drop-off/buy-back (DO/BB) center. The DO/BB center accepts electronic wastes, HHW, and source-separated recyclable commodities (e.g., beverage containers, rigid plastics, clean paper, cardboard). The LCM has been closed during the pandemic and is anticipated to be operated by a non-profit entity when re-opened.

Yakima County, Washington

Washington State law assigns primary responsibility for managing MSW and moderate risk waste (MRW) to local governments and requires local governments to maintain current solid waste and hazardous waste management plans. MRW in Washington is HHW and conditionally exempt small quantity generator waste (CESQG). The Solid Waste and Moderate Risk Waste Management Plan (Plan) for Yakima County recommends strategies to manage solid waste and MRW generated in the County. Solid waste handling includes management, storage, collection, diversion, transportation, treatment, use, processing, and final disposal. This Plan includes recommendations for MSW, MRW, diversion, recycling, education and promotion, C&D debris, organics, and special wastes.

The 14 incorporated communities in the County have signed an Interlocal Agreement that authorizes Yakima County to prepare a countywide solid waste and MRW management plan. Participating cities and towns have both the opportunity and the responsibility to participate in Plan development, to review and comment on the draft Plan, and to adopt the final Plan. The Interlocal Agreements also authorize Yakima County to manage, plan, and operate the solid waste system including disposal, rate setting, and development of educational materials. The incorporated communities have the responsibility to collect waste within their jurisdictions and guarantee delivery to Yakima County disposal facilities.

The County operates two MSW landfills, three transfer stations, three HHW facilities, three drop box recycling programs, septage lagoons, and a gravel pit. The Terrace Heights Landfill, located near the City of Yakima population center, has capacity until 2027 and the Cheyne Landfill, approximately 15 miles away, has permitted capacity until 2055 with area for expansion. In 2027, when the Terrace Heights Landfill closes, waste will be transferred from the Terrace Heights transfer station to the Cheyne Landfill facility for disposal.

The County has four public-private partnerships for recyclables and organics handling. The County delivers all paper, cardboard, and newspapers to a private facility that processes the commodities and manufactures food-grade fruit-packing trays. The County previously partnered for composting of yard waste with a privately owned and operating compost facility. This partnership was discontinued in 2019 due to apple maggot quarantine restrictions put in place by the Washington State Department of Agriculture. The County currently grinds all source-separated yard waste and utilizes it as alternate daily cover material on the landfill. In addition, the County works with private non-profit groups for recycling and provides a discounted disposal fee.

All incorporated jurisdictions within the County have mandatory garbage collection, but not recycling or yard debris collection. Residents in unincorporated areas may choose whether to subscribe to waste collection services or self-haul to disposal facilities. There are four municipal collection programs and two private haulers currently providing collection services in Yakima County. The two private haulers that operate in the County’s unincorporated areas are franchised through the Washington Utilities and Transportation Commission and have the exclusive permit to collect curbside waste within the County. Each of the cities within Yakima

County is using automated (or semi-automated) cart collection. Curbside recycling and yard debris services are available to residents in three municipalities.

Brown County, Wisconsin

Brown County is located in eastern Wisconsin on Lake Michigan and includes the county seat of Green Bay. The Brown County Resource Recovery Division of the Port & Resource Recovery Department (Department) manages a wide variety of facilities and programs with policies set by the Brown County Solid Waste Management Board (SWMB), as authorized by Wisconsin State Statute. The nine-member SWMB is appointed by the County Executive and serve as an oversight committee.

The Department participates in a three-County regional waste and recycling agreement between Brown, Outagamie, and Winnebago counties, known as the BOW. These three counties coordinate waste disposal sequentially starting with Winnebago County's landfill, which has reached capacity and closed. BOW is currently utilizing Outagamie County's landfill, which is expected to reach capacity in 2022. At that time the Brown County landfill site construction will be complete and the landfill operational. The BOW also operates a centralized single-stream recycling facility (MRF) sharing administrative and operating costs.

The three counties are currently negotiating a new long-term agreement for continued cooperative operations and partnership expansion.

The Department operates a transfer station that receives, compacts, and transports MSW to the current BOW landfill; operates a single-stream recycling transfer station that collects and transports materials to the regional MRF in Outagamie County; operates a regional Hazardous Materials Recovery Facility for residents of Brown County and Northeast Wisconsin; and coordinates various recycling and resource recovery programs.

The new South Landfill construction in Brown County will occur throughout 2021 on the 392-acre site with negotiated leachate discharge and treatment agreements and bulk excavation of over 1 million cubic yards of material. Ancillary landfill facilities and equipment acquisition are expected to be completed in 2021 as well.

The Department completed the Resource Recovery Department Strategic Plan in 2017 with goals and objectives to be accomplished. The Strategic Plan refines the Port & Resource Recovery Department's mission statement, goals, and objectives; identifies strategic issues that will affect the Department's ability to achieve its mission; identifies and evaluates options for addressing issues; and recommends an implementation plan for the selected options. These strategies and options are considered on a yearly basis for incorporation into the annual budget.

Comparison of Trends and Practices

The jurisdictions selected for comparison of their trends and practices were based on commonalities that included population, waste generation, disposal methods, funding model and diversion strategies. The ability to flow control waste and recyclable materials to facilities and funding sources implemented are similar in all jurisdictions selected. These practices ensure a stable funding source for operations and programs.

The jurisdictions selected have also implemented partnerships to complement their operations that include innovative initiatives supporting economic development and a demonstrated ability to build and sustain effective public/private partnership opportunities.

Building educational and diversion programs that eliminate materials from disposal and provide a comprehensive messaging campaign for system users were also instrumental in selection for comparison.

Table 2 presents a comparison of solid waste management trends and practices, showing criteria that include types of facilities, programs, partnerships, flow control practices, and fee models.

Based on the evaluation of similarly sized facilities with similar populations served, CRLCSWA generally manages equivalent volumes of waste, equivalent programs provided, similar partnerships, and equal to lower pricing structure. One of the primary differences between the management practices in the locations evaluated is associated with operation of waste-to-energy technologies at Lancaster County Solid Waste Management Authority and Monterey Regional Waste Management District. Additionally, the tri-county agreement between Brown County and three adjacent counties (public-public partnership) enables waste diversion programs and landfilling to occur regionally with revenue sharing between the counties.

Table 2 – Solid Waste Management Practices Comparison							
Criteria		**Cedar Rapids Linn County Solid Waste**	**Simcoe County, Ontario, Canada**	**Lancaster County SWMA, Pennsylvania**	**Monterey Regional Waste Management District, California**	**Yakima County, Washington**	**Brown County, Wisconsin**
Population		228,600	304,200	545,700	170,000	250,900	264,500
Tons Disposed		211,749	153,300	558,200	200,000	280,000	254,900
Tons Per Capita		0.92	0.50	1.02	1.18	1.12	0.96
1. Facilities							
a	Landfills	1 MSW (Public)	3 MSW (Public)	1 MSW (Public)	1 MSW (Public)	2 MSW (Public) 2 C&D (Private)	1 MSW (Public) 1 MSW – Under Construction (Public)
b	Transfer Stations	1 (Private)	5 (Public)	1 (Public)	0	2 (Private) 1 (Public)	1 (Public)

Table 2 – Solid Waste Management Practices Comparison

	Criteria	Cedar Rapids Linn County Solid Waste	Simcoe County, Ontario, Canada	Lancaster County SWMA, Pennsylvania	Monterey Regional Waste Management District, California	Yakima County, Washington	Brown County, Wisconsin
c	Recycling/ MRF	• 2 MRF (Private) • 1 Resource Recovery Building (Public) • 2 Compost (Public) • "Free Paint, Etc. Room"	• MMF/Organics (Public) • MRF (Public) • 5 Compost (Public)	• 1 C&D (Public) • 1 MRF/TS (Public) • 8 Compost (Public) • 3 Compost (Private)	• 1 MRF (Public) • 2 Compost (Public) • 1 Organics AD (Public) • Last Chance Mercantile	• 1 MRF (Private)	• 1 MRF (Public)
d	HHW	1 (Public)	4 (Public)	1 (Public)	1 (Public)	3 (Public)	1 (Public)
e	Waste to Energy	0	0	1 (Public)	0	0	0
f	Renewable Energy	Landfill Gas to Energy	Landfill Gas to Energy	0	LF Gas to Energy AD Biogas to Energy	0	1 - Future

Table 2 – Solid Waste Management Practices Comparison							
Criteria		**Cedar Rapids Linn County Solid Waste**	**Simcoe County, Ontario, Canada**	**Lancaster County SWMA, Pennsylvania**	**Monterey Regional Waste Management District, California**	**Yakima County, Washington**	**Brown County, Wisconsin**
2. Diversion Programs							
a	Types of Waste Diversion Programs	• Yard Waste • Clean Wood Waste • Organics (food waste) • Recycling • Tires • Appliance / Metal • HHW • Electronics • Batteries • Fluorescent Bulbs • Sharps	• Yard Waste • Organics (food waste) • Recycling • Tires • Appliances / Metal • HHW • Electronics • • C&D • Mattresses/Textiles	• Recycling • Tires • HHW • Electronics • Metals from Ash Recovery	• Yard Waste • Wood Waste • Recycling • Tires • Appliances / Metal • HHW • Electronics • Mattresses • Last Chance Mercantile	• Yard Waste • Wood Waste • Recycling • Tires • Appliances / Metal • HHW • Electronics • Fluorescent Bulbs	• Yard Waste • Wood Waste • Recycling • Tires • Appliances • HHW • Electronics • Pharmaceuticals • Shingles • C&D

Table 2 – Solid Waste Management Practices Comparison

	Criteria	Cedar Rapids Linn County Solid Waste	Simcoe County, Ontario, Canada	Lancaster County SWMA, Pennsylvania	Monterey Regional Waste Management District, California	Yakima County, Washington	Brown County, Wisconsin
3. Public/Private Partnerships							
a	Types of Public/ Private Partnerships	• Sale of Generated Electricity • Hauler Agreements • Composting • Metal Recovery	Non-Profit	• Sale of Generated Electricity • WTE Operations • Hauler Agreements • Composting • Sale of Water • Metal Recovery	AD Facility CNG Facility	Non-Profit	• Sale of Generated Electricity • Composting • Metal Recovery

Table 2 – Solid Waste Management Practices Comparison

	Criteria	Cedar Rapids Linn County Solid Waste	Simcoe County, Ontario, Canada	Lancaster County SWMA, Pennsylvania	Monterey Regional Waste Management District, California	Yakima County, Washington	Brown County, Wisconsin
4. Flow Control Practices							
a	Flow Control Model	N/A	Flow Control through the Provincial Municipal Act for residential No Flow control for commercial/ industrial	Flow Control through Solid Waste Management Authority Hauler Agreements and Ordinances	N/A	Flow Control through Interlocal Agreements with all 14 Municipalities	Agreements with communities and businesses
5. Interlocal Agreements							
a	Type of Agreement	N/A	N/A	Solid Waste Management Authority with Board of Directors	N/A	Interlocal Agreements with all 14 Municipalities	Regional tri-County solid waste agreement

Table 2 – Solid Waste Management Practices Comparison

Criteria		Cedar Rapids Linn County Solid Waste	Simcoe County, Ontario, Canada	Lancaster County SWMA, Pennsylvania	Monterey Regional Waste Management District, California	Yakima County, Washington	Brown County, Wisconsin
6. Funding Model							
a	Type of Fund	User-Fee	Enterprise	Enterprise	Enterprise	Enterprise	Enterprise
b	Model	MSW $40/ton YW $24/ton Compost $24/ton Electronics $15/unit Tires $3/tire Appliances $9/unit Fluorescent $1/bulb Special Waste $48/ton	MSW $155/ton YW Free System funded through recovery of net costs (after revenue sources like the sale of recyclables) through municipal property taxes	MSW $78/ton YW $30/ton Tires $5/tire Appliances $15/unit C&D $60/ton	MSW $65/ton YW $42/ton Tires $5/tire Appliances $20/unit Special Waste $95/ton Liquid Waste $45/ton	MSW $38/ton YW $19/ton Tires $2/tire Appliances $6/unit	MSW $52/ton YW $37.22/ton Tires $325/ton Appliances $5/unit Shingles $16/ton

Considerations

The following summarizes criteria that will be considered for enhancement by CRLCSWA as potential solid waste management practices and initiatives:

- **Flow Control –** Flow-control practices vary by jurisdictions based on the needs and objectives of each entity and are enacted through agreements and/or ordinances.
- **Planning –** All municipalities have comprehensive waste-planning strategies, which are inclusive of other municipalities within their boundaries.
- **Partnerships –** Successful public/private and public/public partnerships are executed in many of the municipalities that include private non-profit agreements, recycling, and other facility operational agreements.
- **Funding –** The comparison municipalities use enterprise funds to account for revenues and expenditures. Tip fees are the most relied-upon funding source, with additional funds from sale of materials, household taxes, property taxes, and/or grants.
- **Diversion Programs –** The municipalities have comprehensive diversion programs to eliminate waste from their landfills or WTE facilities. The more aggressive diversion programs saw a per capita reduction in waste flowing to landfills, in particular for yard debris, C&D debris, and food waste.

These management practices, along with the Alternative Technologies memo and Summary of Solid Waste Volumes and Projections memo, are intended to lay the groundwork for the Infrastructure Options assessment portion of the Long-Term Waste Management (LTWM) System Evaluation.

May
2021

SolidWaste Agency

Cedar Rapids Linn County

living. together. green

Alternative Technologies

Technical Memorandum

Cedar Rapids Linn County Solid Waste Agency

Cedar Rapids, Iowa

May 2021

HDR

Table of Contents

Acronyms/Abbreviations:

ACI = activated carbon injection
AD = anaerobic digestion
APC = air pollution control
CH_4 = methane
C&D = construction and demolition
CNG = compressed natural gas
CO = carbon monoxide
CO_2 = carbon dioxide
CRLCSWA = Cedar Rapids Linn County Solid Waste Agency
DWRF = Drake Water Reclamation Facility
ECS = eddy current separators
EU = European Union
FB = filter baghouse
FT = Fischer-Tropsch
H_2 = hydrogen
HCl = hydrogen chloride
HDPE = high density polyethylene
HRSG = heat recovery steam generator
H_2S = hydrogen sulfide
IGCC = integrated gasification combined cycle
IRBF = Indian River Biofuels Facility
IW = industrial waste
MBT = mechanical biological treatment
MRF = materials recovery facility
MSW = municipal solid waste
MWPF = Mixed Waste Processing Facility
N_2 = nitrogen
NHSM = Non-Hazardous Secondary Material
NO_x = nitrogen oxide
PAG = plasma arc gasification
PET = polyethylene terephthalate
PVC = polyvinyl chloride
RDF = refuse-derived fuel
Region = Linn County and the regional area
SCR = selective catalytic reduction
SDA = spray dryer absorbers
SNCR = selective non-catalytic reduction
SRF = solid recovered fuel
SO_x = sulfur oxide
tpd = tons per-day
WTE = waste-to-energy
WWTP = wastewater treatment plant

1 Introduction & Purpose

The Cedar Rapids and Linn County Solid Waste Agency (CRLCSWA) is researching relevant existing information to form the basis for evaluating infrastructure related options to address current and future solid waste demands within Linn County and the regional area (Region). This technical memorandum addresses Task 1, Alternative Technologies, Management Practices, and Industry Trends. CRLCSWA will review alternative technologies, often called conversion technologies, that may use waste generated within the Region as an acceptable and achievable resource. HDR has prepared this report based on our recent, relevant experience and research into these technologies. This includes site tours and inspections where some of these technologies are in use around North America and the world, specifically Europe, Asia (Japan), the Middle East, and Australia. Conversion technologies are a rapidly developing and evolving industry. HDR provides an overview of these technologies and current applications at the time of this report; however, this report does not represent or cover all the technologies that may be in development now or in the near future.

The technology development process can provide improved waste utilization instead of simply landfilling what cannot be recycled. The process may be completed in multiple ways, by more than one development team, using varying technologies at various stages of development. Broadly, a technology goes through three developmental stages: laboratory or emerging, pilot or demonstration, and commercial. Passing from one developmental stage in the process to the next is often hard to define as development may be on a continuum or have various sub-steps along the way.

Technologies begin the emerging process often as a small-scale operation of a technology concept. Initial development is completed in a laboratory setting and does not have demonstrated facilities that have been operated on a commercial basis as a full-scale, complete process. The technology may work well in a laboratory setting or for a select waste material, but it has not been demonstrated with mixed waste or even select portions of municipal solid waste (MSW) that can be separated readily from the remaining waste. It is likely the laboratory model will not have a fuel preparation or energy recovery process, even if these technologies are off the shelf systems.

Pilot scale or demonstration level technologies have advanced far enough that they may have a test facility where the development team will make test runs of varying and increasingly more complex waste mixtures. Initially, the pilot facility may not have all the waste preparation, energy recovery, and pollution control equipment fully integrated, but the process begins to gradually look and perform as a complete system. The development may go through several stages and increase in size and complexity as the technology advances. The demonstration facility will look very similar to a commercial facility toward the end of this stage.

The commercial stage means at least one fully integrated facility has been built and has been in continuous operation for long enough to have gone through several operation cycles and proven it can reliably achieve the anticipated level of performance. It often takes several years for a technology to be considered commercial. This allows time for planned and unplanned outages to occur, waste materials to pass through short term and seasonal changes, and a better understanding of the operational and maintenance costs and limitations to develop. Sometimes other innovators will have similar processes along the development curve, but not all related technologies will become commercial at the same time. While development risk is never fully eliminated, risk of technology failure drops substantially once commercial operation is reached.

The alternative technologies CRLCSWA considered for this analysis needed to be economically viable and technically commercial for operation in Linn County. In support of this technical memorandum, HDR looked at the full spectrum of potential technologies. From this list of technologies, those that were not developed commercially were screened out leaving those that are developed and, ultimately, those that could be implemented given reasonable conditions with the waste streams in Linn County, Iowa.

General Description

Waste processing and conversion technology options can be grouped into the following technology classes:

- Thermal technologies
  - Direct combustion (various forms of traditional waste-to-energy [WTE])
  - Gasification
  - Plasma arc gasification (PAG)
  - Pyrolysis
- Biological technologies
  - Aerobic composting
  - Anaerobic digestion with biogas production for electricity or fuel generation
- Chemical technologies
  - Hydrolysis
  - Catalytic and thermal depolymerization
- Mechanical technologies
  - Autoclave/Steam classification
  - Mixed waste processing
  - Refuse-derived fuel (RDF) production

It is important to note that there are waste conversion technologies that are a combination of two or more technology classes. For example, mechanical biological treatment (MBT) technologies combine mechanical separation and treatment with biological processing, while waste-to-fuel technologies combine mechanical pre-processing with thermal and chemical conversion processes, sometimes including a biological component like anaerobic digestion. Each vendor promoting their technology will have unique features and approaches that may differ slightly from the descriptions provided below. For example, gasification may employ a two-stage gasification process or a single chamber where the waste fuel is gasified, and one technology may require more or less fuel preparation than another gasification technology.

2 Conversion Technology Processes and Methodologies

Thermal Technologies

Thermal technologies are designed to use high temperatures from combustion, gasification, or pyrolysis to convert the carbonaceous combustible materials in MSW feedstocks into a gas and other solid by-products (ash/char). The caloric energy contained in the waste may be recovered to produce an energy product, or the gases produced from the exothermic reaction that breaks down the waste may be further refined into a synthesis gas (syngas) or chemical. Traditional thermal processes, such as incineration or WTE technologies, produce electrical power or steam by using a boiler to recover the latent heat in the exhaust gas formed from combusting the waste. The steam produced is then sent to a turbine generator to generate electricity. Some thermal facilities may also sell the steam or hot water directly to a commercial/industrial user or send it to a district energy system.

Thermal processes that convert waste to a liquid fuel and/or syngas (i.e. gasification, PAG, and pyrolysis) may be designed to either combust that gas and/or liquid directly in a boiler to make steam and electricity (similar to a traditional WTE technology), or the process may be designed to clean and refine the gas and/or liquid to be combusted in an engine or gas turbine to make electricity. In addition, there are technologies designed to use gasification or pyrolysis to produce a syngas and/or liquid that is cleaned and further refined through a chemical or catalytic process to produce commercial grade chemicals or liquid synthetic fuel for fixed or mobile internal combustion engines, fixed turbines, or commercial airliners. The gas produced by gasification technologies is composed mostly of hydrogen (H_2) and carbon monoxide (CO), and there are some technologies that attempt to further refine and capture the H_2 gas for reuse. Gasification and other similar technologies can be highly complex, may only be effective on a limited fraction of the waste stream, and are generally less commercially developed than traditional WTE technologies.

Regardless of the specific thermal process used, direct waste combustion or gasification produces certain types of impurities and constituent air emissions. The quantities vary depending on the type of technology and must be controlled or removed through refining or cleaning. In theory, the emissions from gasification and pyrolysis technologies are lower than traditional WTE technologies that directly combust the waste with an oxygen-rich environment; however, modern emission control systems are required to reduce emissions from both types of technologies below any regulatory emission standards.

Thermal technologies can yield gases such as carbon dioxide (CO_2), water vapor, nitrogen oxide (NO_x), sulfur oxide (SO_x); hydrogen chloride (HCl); particulate and particulate-related emissions (such as heavy metals); and trace amounts of products of incomplete combustion, such as CO, dioxins and furans. New thermal technologies are expected to use modern air pollution control (APC) devices for emissions clean-up. The array of APC equipment available for use in minimizing air emissions is quite diverse and includes but may not be limited to: selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) for NO_x emissions reduction; spray dryer absorbers (SDA), wet scrubbers, and sorbent injection for acid gas reduction; activated carbon injection (ACI) for mercury and dioxins reduction; and a fabric filter baghouse (FB) for particulate and heavy metals removal. Combustion control techniques are used to control CO and optimize the other APC equipment. Continuous emission monitoring systems, specific operating parameters, and periodic compliance testing are used to demonstrate emission compliance. The complexity of the optimal APC and gas cleanup systems may vary depending on the thermal technology used and the desired end use of the gases and/or liquids produced by the process.

Direct Combustion

Direct combustion technologies with energy recovery, such as mass burn technology and RDF combustion, have been used since the 1950s and continue to be constructed and operated around the world. This technology was first introduced in the US in the early to mid-1970s and many of the facilities operating currently have been on-line for 25 to 40 years. Direct combustion, referred to herein as traditional WTE or Energy from Waste, is the most widely demonstrated and commercially viable of the thermal conversion technologies available with approximately 4,000 installations worldwide.

The majority of the 70+ thermal waste conversion facilities operating in North America use direct combustion technology. Significant construction of traditional WTE facilities in North America stopped in the mid-1990s, but several existing WTE facilities in Minnesota, Florida, and Hawaii have undergone recent expansions. Two new greenfield facilities have been constructed using modern WTE combustion technology. These include a 3,000 tons per day (tpd) mass burn facility in West Palm Beach, Florida (2015) and a 480 tpd mass burn facility in Clarington, Ontario, Canada (Durham York Region), shown in Figure 1. The Hennepin County Facility in Minneapolis offers a representative WTE facility that could be visited to see firsthand how the technology works. There are several other waste facilities in the Midwest region as well. Additional exploratory expansion work is also underway at a number of facilities in the US and the early siting study and funding are being prepared for a greenfield facility in Canada.

Figure 1: Durham York Energy Centre (Ontario, Canada)

Direct combustion of waste involves the complete oxidation of a fuel by combustion under controlled conditions using more than stoichiometric levels of oxygen (also known as excess air combustion). The latent heat generated from the combustion process is recovered in a boiler to generate steam, which can be used directly for heating/industrial purposes or passed through a steam turbine-generator to create electricity. There are several types of direct combustion technologies used on a commercial scale in North America, Europe, and Asia. The most common include:

1) Mass burn with a grate system,
2) RDF stoker-fired boilers,
3) Modular starved air systems, and
4) RDF fluidized bed combustion.

RDF processing is further discussed below. Mass burn combustion technology can be divided into two main types:

1) Grate-based, waterwall boiler field erected installations, and
2) Modular, shop-fabricated combustion units with waste heat recovery boilers.

The modular units are typically limited to less than 200 tpd and were historically used in facilities where the total throughput is under 500 tpd. All direct combustion technologies require advanced APC to reduce or remove air emissions before the flue gas is discharged to the atmosphere. The most common examples of APC equipment used at traditional WTE facilities include SCR, or SNCR for NO_x emissions reduction, SDA, or dry sorbent scrubbers for acid gas reduction, ACI for mercury and dioxins reduction, and a fabric FB for particulate and heavy metals removal.

The larger mass burn combustion units with waterwall boilers are generally sized at 200 tpd up to as large as 1,000 tpd with facilities generally sized at 400 tpd to 3,000 tpd or more. MSW is fed directly into a boiler system with little to no pre-processing, other than the removal of large bulky items such as furniture and white goods. The MSW is typically pushed onto a grate by a ram connected to hydraulic cylinders where it is combusted. Air is admitted under the grates, into the bed of material, and additional air is supplied above the grates to thoroughly complete MSW combustion. The resulting flue gases pass through the boiler and the heat energy is recovered in the boiler tubes to generate steam. This creates three streams of material: steam, flue gases, and ash.

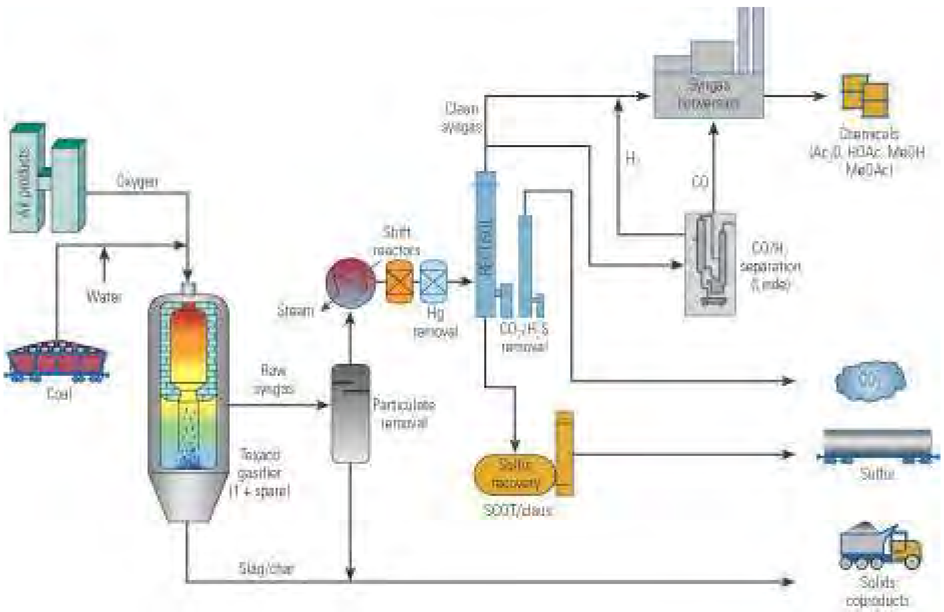
In the smaller modular mass burn systems, MSW is fed into a refractory lined combustor where the waste is combusted on refractory lined hearths or within a refractory lined oscillating combustor. Typically, there is no heat recovery in the refractory combustors. Instead, the flue gases exit the combustors and enter a heat recovery steam generator (HRSG), or waste heat boiler, where steam is generated by the heat in the flue gas, resulting again in steam, flue gases, and ash.

RDF combustion technologies prepare MSW by shredding, screening, and removing non-combustible materials prior to thermal conversion. The goal of this technology is to derive a better, more homogenous fuel (uniform in size and composition) that can be used in a more conventional solid-fuel boiler as compared to a mass-burn combustion waterwall boiler. RDF is blown or fed into a boiler for semi-suspension firing. Combustion is completed on a traveling grate. Thermal recovery occurs in an integral boiler. The APC equipment arrangement for an RDF facility would be similar to a mass-burn combustion system.

Gasification

Gasification has been used for over two hundred years. In the 1790s "coal gas" was used for factory lighting. In the 1940s, during World War II, Germany used wood and coal gasification to synthesize fuels for vehicles and aircraft. Starting in the 1970s and continuing to the present-day, the fuel gas produced from the gasification of coal (shown in Figure 2) and various types of biomass (e.g. wood and woody wastes) has been used on a smaller scale to fire stationary internal combustion engines or as a building block to produce liquid fuels.

Figure 2: Typical Gasification Process Utilizing Coal



The gasification process is similar for waste facilities and involves the conversion of carbonaceous material (such as MSW) into a raw gas, often called a producer gas, that contains principally CO, H_2, methane (CH_4), other light hydrocarbons, water, CO_2, and nitrogen (N_2), depending on the specific process. The conversion of the feedstock using gasification typically occurs in a reducing environment (i.e. in the presence of limited or substoichiometric amounts of oxygen) under high temperatures. In some cases, steam is added to the process to alter the ratio of the combustible gases. The relative concentration of producer gas components depends upon the composition of the feedstock and process operating conditions.

Gasification is a thermochemical process that performs more consistently when converting homogenous or uniform feedstock. As a result, the feedstock for most gasification technologies must be prepared from the incoming MSW through shredding and pre-sorting to pull out bulky materials, hazardous household waste, as well as recyclables and inert materials such as dirt, glass/grit, and metals. These materials must be separated and removed to prevent slag formations that can cause process upsets or potential operating issues.

Syngas can be derived from the producer gas by removing impurities and contaminants through appropriate cleaning and reforming processes to produce a gas composed primarily of CO and H_2. The relative concentration of syngas components depends on the composition of the feedstock and process operating conditions (temperature, air, oxygen, or steam injection, pressure, etc.). The typical breakdown of syngas components for gasification technologies that process MSW streams is provided in Table 1. Many gasification technologies are sensitive to the composition of materials they process and will adapt the fuel preparation steps based on their experience. The outputs provided in Table 1 are heavily dependent on the waste being used as feedstock.

Table 1: Typical Syngas Composition

Constituents	Output by % Volume	Output in m^3/kg-waste processed	Energy output in Btu/lb-waste processed
Hydrogen (H_2)	30%-50%	0.25-0.50	1,360
Carbon Monoxide (CO)	25%-70%	0.25-0.60	1,940
Carbon Dioxide (CO_2)	0%-35%	0.05-0.25	0.00
Methane (CH_4)	0%-10%	0.00-0.15	425

Note:
Syngas composition data based on available data from technology vendors including, but not limited to, Thermoselect, Ebara, Taylor, and Sierra Energy. Data is provided as dry percentages.

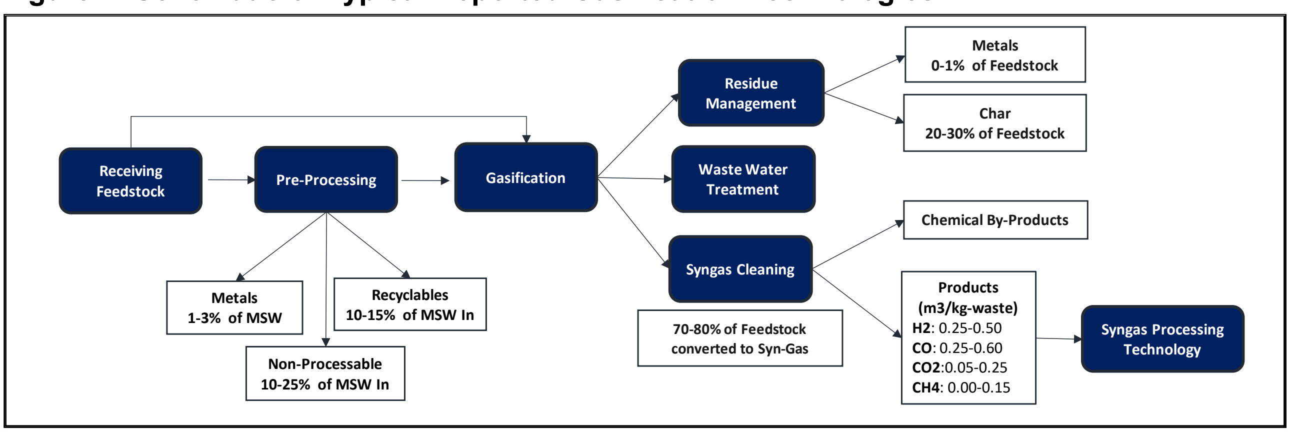
The latent heat in the raw producer gas or syngas could be recovered in a boiler or HRSG to create steam that can be used to generate electricity through a steam condensing turbine (similar to the traditional WTE technology described above). Some systems could be designed to use the syngas as a fuel to generate electricity directly in a combustion turbine or internal combustion engine (similar to a landfill gas-to-energy system). The generated syngas could also be used as a chemical building block in a catalytic or Fischer-Tropsch (FT) process for the synthesis of chemicals and liquid fuels (e.g. methanol, ethanol) but only after considerable gas cleanup.

Gasification with waste fuels has had a long developmental run but remains in the developmental pilot phase, at least in the US. There are a wide variety of technology designs that can be defined as gasification, but these facilities have generally been smaller than most direct combustion facilities. Figure 3 shows a representative facility in Japan. Some modular combustors operate on the principles of gasification through a two-stage combustion process in which the first (primary) chamber operates in a low-oxygen or starved air reducing environment and burnout of the combustion gases produced is completed in a secondary chamber before passing on to a waste heat boiler. Some systems are designed to vitrify the ash into slag that can be recovered as road base material or certain other aggregate products, potentially reducing waste volume by more than 95 percent.

Figure 3: Homan Gasification Plant (Fukuoka, Japan)

Figure 4 provides a gasification technology schematic with a range of values for the typical reported outputs.

Figure 4: Schematic of Typical Reported Gasification Technologies



Note:
Projected syngas products are equivalent to those indicated in Table 1 above.

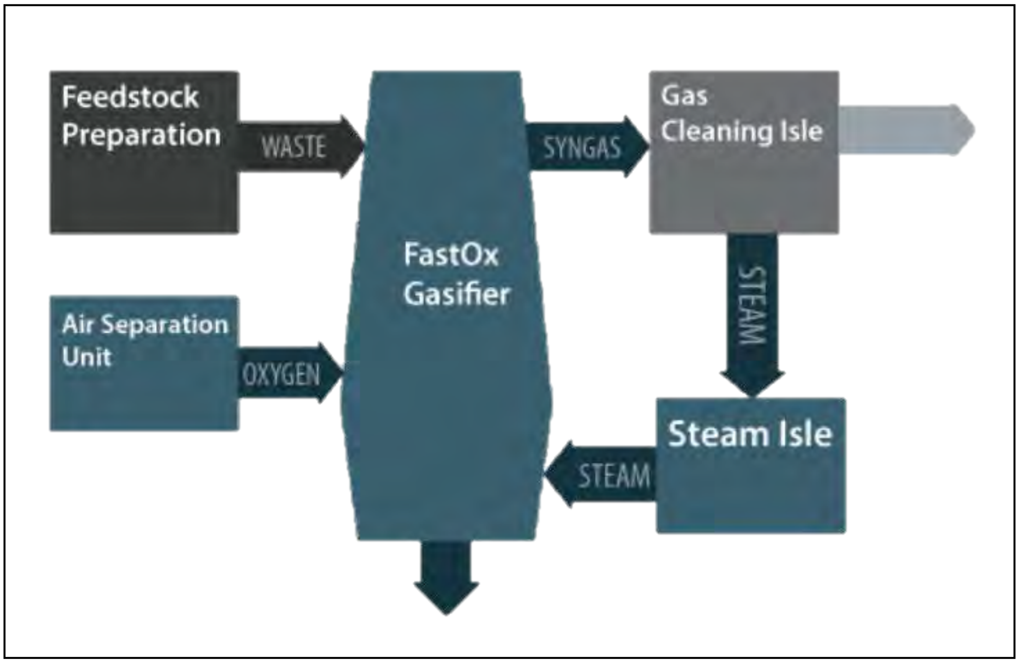
Gasification facilities that combust the syngas generated by the process will have similar air emissions as traditional WTE facilities. However, the volume and concentration of these air pollutants should theoretically be lower. If the syngas is conditioned for use elsewhere (e.g. as part of a catalytic process to generate a liquid fuel), then additional gas cleaning and conditioning equipment is required. These technologies also produce char or ash in quantities similar to or less than tradition WTE technologies (less than 90 percent by volume and less than 20 percent by weight). Other metals and inert materials can remain with the char and ash and may be recovered after processing.

There are several commercial-scale gasification facilities in operation overseas, some of which have been operating for several decades. Most of these facilities are located in Asia, particularly in Japan, and a few in the European Union (EU). The facilities generally process feedstock materials using units sized from approximately 100 tpd to 275 tpd. Some gasification facilities in Japan utilize feedstocks with high energy content, such as select industrial waste (IW) or a combination of these feedstocks and MSW. The drivers for the use of gasification in Japan are largely related to the lack of available landfill capacity and very stringent emission standards, which favor the use of this technology. In addition, it is important to understand that waste tipping fees in Japan are much higher compared to the US (more than $250/ton USD), which makes these facilities more financially viable. In addition, one goal of the process is to generate a stabilized, and in some cases vitrified, ash product that can be reused beneficially as an aggregate in the construction industry to limit the amount of material being diverted to scarce landfills. However, the use and marketability of this material in the US is not demonstrated.

Thermal MSW and IW gasification has been attempted for many years, particularly in North America, but many of these facilities experienced difficulties scaling-up to commercial operations. Currently, gasification technologies in North America are mostly limited to demonstration or pilot scale operations with limited operational history. This is due partially to economics driven by low electricity prices and lower landfill tipping fees in the United States. It is also due to the costs and difficulty associated with front-end MSW processing to achieve a homogenized and higher Btu-content MSW feedstock suitable for some gasification technologies. In addition, many of the gasification facilities are having issues consistently meeting the gas quality and energy content of the syngas to allow the engines or other power operating equipment to efficiently produce electricity.

More recent projects in North America are currently under development. Ways2H is a Japanese technology that claims to produce H_2 gas as a transportation fuel from MSW using their gasification technology. The technology has been tested in Japan on a small scale and a project in Kern County, California is under development. The Sierra Energy FastOx technology—Monterey, California—is a fixed-bed gasification system that feeds MSW into the top of the gasifier vessel through an airlock chamber and purified oxygen and steam are injected into the base of the vessel. As the waste travels down the reaction vessel, it passes through several reaction zones reaching the hottest area at the base of the vessel where the gasification reaction is designed to occur at temperatures of approximately 2,200°C (4,000°F). The FastOx system includes equipment for feedstock preparation, gasification, syngas conditioning, and final product conversion to fuels or energy. Figure 1 provides a schematic of the FastOx process. Sierra Energy claims that the FastOx gasification system can accept most wastes, with the exception of radioactive and explosive materials. This includes MSW and IW (including hazardous wastes), as well as biomass, construction and demolition waste, and medical wastes. The syngas produced via FastOx gasification is designed to be converted into a wide range of sustainable and marketable energy products, including electricity, diesel, H_2, and ammonia. Sierra Energy is currently operating a small, 20-tpd unit for the US Army and Department of Defense at Fort Hunter Liggett in California. The facility is designed to process MSW and biomass to produce electricity and biodiesel. They are currently developing a commercial-scale version of the FastOx gasifier, called the Pathfinder, which will be designed to process 50-tpd per unit.

Figure 5: Sierra Energy FastOx Process Schematic



Source: Sierra Energy.

Plasma Arc Gasification

PAG is considered a subset of thermal gasification. Plasma arc melting technology has been used in the metal industry since the late 19th century. PAG technology has been used more recently, mostly overseas, as a disposal option for a range of industrial and other disposal applications, such as the gasification of hazardous waste, auto shredder fluff, and other types of homogeneous wastes and ash treatment. This technology has only been considered a possible source of MSW feed stock disposal and conversion at demonstration and pilot-scale level applications within the last 15 to 20 years.

Plasma arc technology uses carbon electrodes to produce a very-high-temperature arc ranging between 5,000 and 12,000-degrees Fahrenheit that “vaporizes” the feedstock. The high-energy electric arc that is struck between the two carbon electrodes creates a high temperature ionized gas (or plasma). The intense heat of the plasma breaks MSW and other organic materials fed to the reaction chamber into basic elemental compounds. As the feedstock gasifies, a low-Btu syngas is generated, similar to other gasification technologies, that could be suitable for combustion, and the heat is recovered in a boiler. In theory, the high temperatures produced by a PAG technology produces a cleaner (i.e. lower in tars or other impurities) and higher quality syngas than other technologies that can be more easily cleaned and combusted directly in an internal combustion engine or gas turbine to produce electricity and/or thermal energy (i.e. steam, hot water). The gas can also be cleaned and used for a chemical process. The inorganic fractions (glass, metals, etc.) of the MSW stream in a PAG system are melted to form a liquid slag material that vitrifies to encapsulate toxic metals when cooled. The systems may be designed to recover recyclable and other materials through a pre-processing system. Metals may be recovered from both feedstock pre-processing and from post-processing the solid slag material.

Similar to other gasification processes, the MSW feedstock requires pre-processing to shred and homogenize the size of the feedstocks, as well as to remove materials that may cause potential operating issues. Vendors of this technology claim the energy efficiencies capable with PAG systems are higher than direct combustion and other gasification technologies. These higher efficiencies are theoretically possible if an integrated gasification combined cycle (IGCC) power system is incorporated to harness the energy in the syngas; however, this has not been proven for PAG systems on a commercial scale.

Vendors of this technology claim to achieve lower emission concentrations than more conventional technologies like direct combustion. However, air pollution control equipment is still required to clean the gas from the syngas combustion as these facilities generally have similar air emissions issues as other gasification, pyrolysis, and direct combustion facilities. Mercury and other, more volatile metals are expected be driven off with the gas and will need to be removed from the gas combustion device's exhaust.

Individual units in Japan and around the world are sized anywhere from approximately 20 tpd to 200 tpd and are sometimes combined in multi-unit configurations when developing a facility to create an overall capacity of 400 tpd or greater. Although Japan has approximately 10 to 15 years of operating experience, their facilities are mainly used for ash melting (as described below), IW, or MSW with high plastics content that increases the Btu value. Several facilities operate in Japan, most notably three developed by Hitachi Metals, in Yoshii, Utashinai, and Mihama-Mikata. These facilities are referred to as plasma direct melting reactors. The name is significant due to the desire in Japan to vitrify ash from mass burn WTE facilities.

Many gasification facilities in Japan also accept ash from conventional WTE facilities for vitrification. In many cases, the primary function of these facilities is ash vitrification rather than energy recovery. The benefit of the vitrified ash is it binds potentially hazardous elements thereby rendering the ash inert. Most facilities in Japan use this vitrified ash as an aggregate product. Because of the high MSW tipping fees and other economic drivers in Japan, and the fact that the PAG facilities operate only about 9 months per year, any data from these facilities is difficult to correlate to conditions in the United States.

There are few commercial PAG facilities around the world, but none are currently processing MSW in the US. There have been some recent attempts at applying PAG technology commercially in North America and in the UK. However, these attempts have met financial hurdles. In April 2012, after 5 years of planning, construction of a large scale PAG facility in Saint Lucie County, Florida was cancelled. An NRG/Adaptive Arc was in the permitting/approvals phase for a facility in Atlantic County, NJ, but was eventually canceled. A demonstration project located in Ottawa, Ontario, Canada (i.e. the 110-tpd Plasco Trail Road Facility) also utilized PAG principles on a mixed MSW waste stream. However, after almost 8 years of sporadic operations and design issues, the facility ultimately closed due to funding issues. The 1,000 tpd Tees Valley 1 and 2 projects in the United Kingdom are shown in Figure 6. However, both projects ran into technical issues and also failed to achieve commercial operation. The project was canceled at a loss of almost $1 billion USD for the project sponsor, Air Products.

Figure 6: Alter NRG 1,000-TPD Plasma Gasification Reactor Tees Valley, England, UK

There were some demonstration facilities in North America that utilized PAG technology, which included a 10-tpd demonstration PAG unit (manufactured by Pyrogenesis based out of Quebec, Canada). This facility processed small amounts of a manually separated MSW from the Hurlburt Field Air Force Base in Florida. That demonstration facility has since been shut down. However, Pyrogenesis continues to manufacturer their plasma torches and has constructed PAG waste processing systems for onboard sailor waste for the US Navy, specifically the U.S.S. Gerald Ford, and for commercial cruise lines.

Pyrolysis

Pyrolysis technologies are closely related to gasification and some facilities could fall into either technology category depending on how they are operated. Pyrolysis is the process of heating material to high temperatures (700 to 1500°F) in an oxygen-free environment and driving off the volatile hydrocarbons to produce a combustible gas and liquid product (i.e. pyrolytic oils). The remaining fixed carbon forms a carbon-rich solid residue with the remaining ash and metals materials. This is similar to the process to produce coke from coal or charcoal from wood. The feedstock used in pyrolysis technologies has typically been more homogeneous than mixed municipal waste, using materials such as coal, biomass (woody wastes), or even waste tires. Torrefaction is a similar pyrolytic process, most often used with wood or biomass, that has been proposed for some facility designs. In some pyrolysis operations, pre-processing mixed MSW has been used to obtain RDF, which is a relatively more homogeneous feedstock, as the primary or another feedstock for the pyrolysis facility.

Similar to gasification, the pyrolysis process can be designed to optimize the production of gases or liquids. A pilot project, shown in Figure 7, is under development by Ways2H in Kern County, CA. This is sometimes classified as gasification and is a waste-to-fuel technology. It uses a pyrolysis technology to generate a syngas that is then further refined in a waste-to-fuels project (discussed below) to generate H_2. For other pyrolysis facilities, syngas can be produced and used as fuel in boilers or, theoretically, in internal combustion units or gas turbines, provided that the gas is adequately cleaned. As discussed, the pyrolysis process is performed in an air- or oxygen-free environment. Therefore, the system must usually have a complex design and control system to prevent air or oxygen from intruding into the process, or a provision must be incorporated into the design to purge air from the reaction chamber. However, some pyrolysis processes allow very small amounts of air/oxygen into the system. This allows the feedstock to combust partially and supplement the heating process. Other designs may use some or all of the volatile gases to heat the feedstock. This would drive off more gases and liquids and produce the fixed carbon char.

Figure 7: Ways2H Pyrolysis Facility Kern County, CA

Photo courtesy of Ways2H

Air emissions from pyrolysis systems are primarily those discharged from combustion of the producer gas or syngas (and possibly char). The treatment of syngas produced from MSW pyrolytic processing for use in energy conversion equipment and emissions control of syngas constituents has little history but is similar to the gasification process described above. Facilities using the pyrolytic oil and other products as fuel could have some of the same air emissions issues as direct combustion. Less SO_x might be generated in the gas or oil, because most of the sulfur is expected to stay with the char. However, the sulfur could be released to form SO_x if the char is combusted. HCl will also need to be addressed in the exhaust gases. Units that heat the feedstock in an oxygen-deficient environment would produce fewer emissions. Mercury would be expected to be largely driven off with the gas and the gas combustion device exhaust would have to be addressed. Other metals and particulate could remain with the char and could be largely separated from the char prior to combustion with a suitable processing system. These emissions can theoretically be controlled using modern air pollution control devices to meet local, state, and national regulatory standards.

Biological Technologies

Biological technologies are designed to use bacteria as part of the technology employed to consume the putrescible content of the feedstock. This typically occurs in low temperature environments employing either aerobic bacteria or anaerobic bacteria. The volatile solids contained in the waste are consumed by the bacteria and converted to CO_2 (for aerobic processes) or a blend of CH_4, alcohols, CO_2, and other gases (for anaerobic processes). Aerobic processes are exothermic and, if managed properly, produce enough excess heat to kill pathogens contained in the feedstock. Anaerobic process typically require heat and may require subsequent processes to kill pathogens contained in the feedstock.

Aerobic Composting

Aerobic composting has been employed successfully on source separated organics such as food waste, yard/agricultural waste, and wastewater biosolids. Some facilities are permitted and designed to accept compostable paper and plastic and some operations have attempted to process other compostable solid waste. Aerobic composting can include a number of different processes. The two most common are aerobic windrow composting, also called turned windrow composting (see Figure 8) and forced aerated static pile composting. Windrow style composting is the most commonly used in the US, treating predominantly yard/agricultural waste, and is usually conducted outdoors. Forced aerated static pile composting is typically constrained to higher quantities of putrescible material, such as food waste or biosolids, and is often covered or indoors. However, some forced aerated static pile composting is conducted outdoors and employs the use of biofiltration to minimize odor emissions. Aerated static pile composting can also include a variety of cover systems, including specially designed tarps or fabric covers, organic covers such as finished compost, or a specially-equipped bag system to contain the materials.

Figure 8: Example of a Windrow Aerobic Composting Facility

In windrow composting, the materials (generally green material) are placed in elongated piles called windrows. The windrows are aerated naturally through a “chimney effect” or by mechanically turning the piles with a machine or forced aeration, which improves porosity. Usually, a bulking agent such as wood chips or other green waste is used to allow proper air flow through the pile to help prevent pockets of the material from becoming oxygen deficient and the composting process from becoming a localized, odiferous, anaerobic process. Frequent pile turning introduces oxygen, accelerates physical degradation of feedstocks, and provides an opportunity to adjust the moisture content and temperature to optimum levels. This technology can be particularly odorous if food waste or other MSW is included in the feedstock. The average time required for active composting is 8 to 12 weeks for windrowing, but bag and static pile composting (see Figure 9) can achieve faster composting if managed carefully.

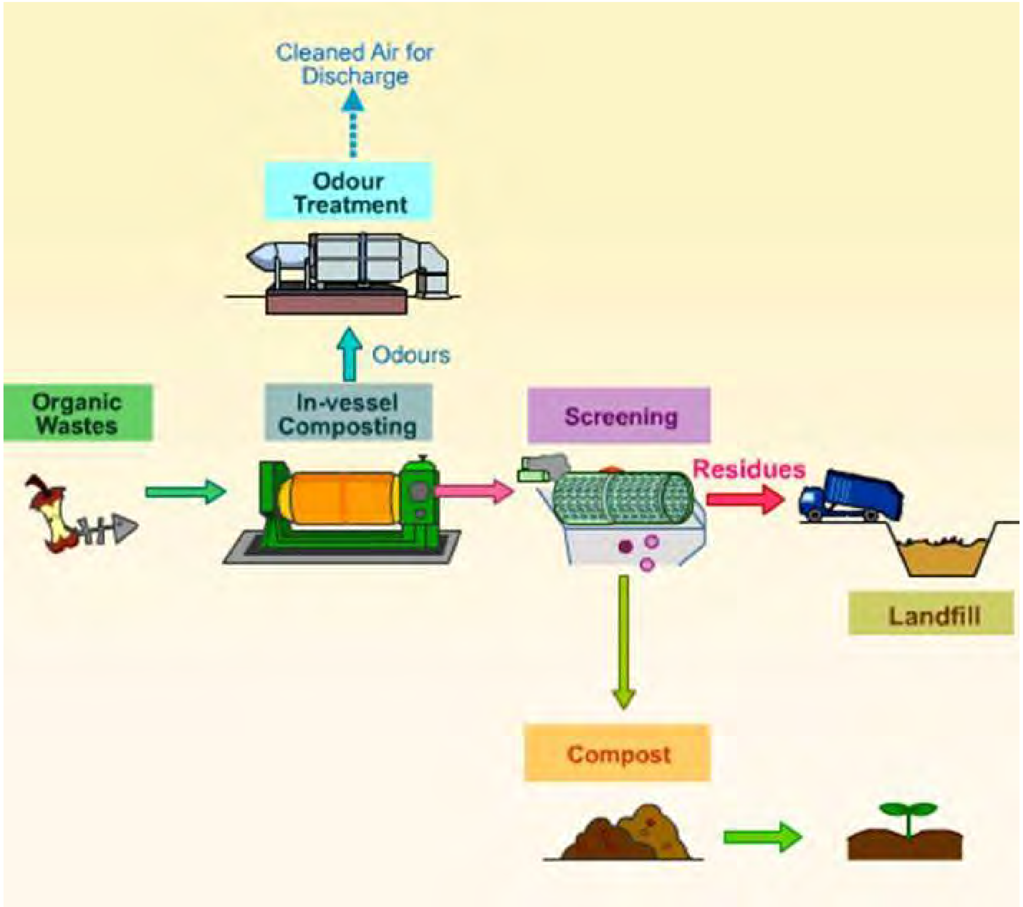
Figure 9: Example of a Fabric Covered Aerobic Static Composting Facility, Issaquah, WA

The aerated composting process refers to any of several systems used to biodegrade organic material without physical manipulation during primary composting. It may be in windrows, bunkers, or mass beds and be open, covered, or in closed containers (in-vessel). Figure 10 shows an aerated static pile operation located in a covered setting and Figure 11 shows a bunker arrangement. Figure 12 shows a schematic flow diagram for an in-vessel composting system. The steps required for in-vessel composting are similar to other processes. In an aerated static pile composting technology, fresh air is either forced into the pile or drawn from the pile to maintain high levels of oxygen. This process accelerates the bacterial consumption of the organic material. Without the added fresh air, the denser putrescible material would naturally default to an anaerobic condition and lose aerobic bacteria. This method is suited to producing large volumes of compost in relatively smaller areas. This technology can be particularly odorous if the composting pile is allowed to have pockets of anaerobic activity. The blended mixture is usually placed on perforated piping or trenches, providing air circulation for controlled aeration. Moisture levels are managed, and material temperatures are monitored for best operation.

Figure 10: Example of a Covered Aerobic Static Composting Facility, Olympia, WA

Figure 11: Example of a Bunker Aerobic Static Composting Facility, Stanwood, WA

Figure 12: Example of a Windrow Aerobic Composting Facility



In negatively aeriated types of aerated compost processes, a series of perforated pipes draws air down through the windrows to an air collection manifold that runs under the windrows. The compost air can be drawn through the compost using a blower system that then pushes the air through a biofilter that acts as an emission and odor control system. Alternatively, in positive aerated systems, air can be injected into the windrows to maintain proper oxygen levels. The key in either of these systems is the appropriate use of best management practices that include the initial mix of putrescible material and bulking material (typically mulch or chipped wood) in the correct proportions to assure the porosity and moisture content needed to maintain proper aerobic bacterial health throughout the process.

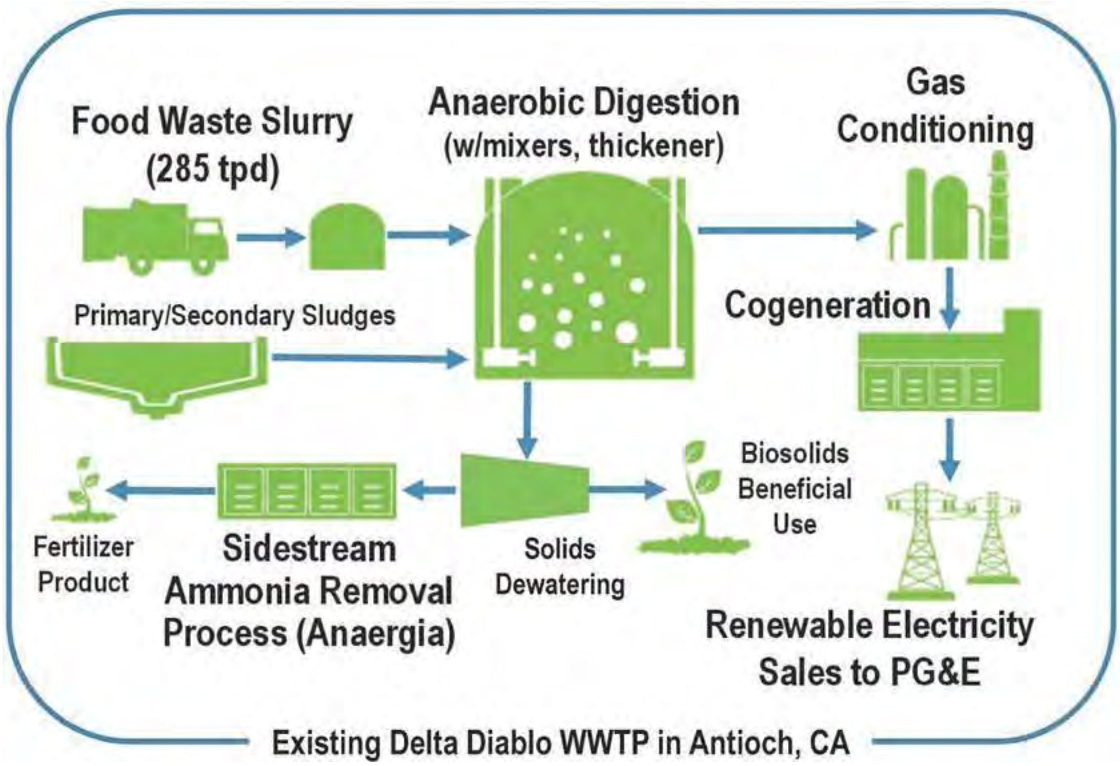
In-vessel food waste aerobic composting can also take place in highly controlled, automated equipment using a combination of agitation and temperature/moisture control to convert food scraps into compost in just a few days. Current models on the market have modest capacity. Larger units are able to process up to 1.5 tpd. This technology is most efficient for use with small food waste generators such as schools, hotels/conference centers, malls/food courts, cruise ships, hospitals, amusement parks, and sports stadiums. Some larger facilities use bags or other enclosures. Managing odors is a key concern.

Compostable paper and compostable plastic materials in the compost are often a challenge. While many of materials can eventually break down under ideal time and temperature conditions, most commercial compost facilities do not successfully accomplish this in a single process. Often these materials require additional screening processes to remove them from the final compost and either return them to the compost system for additional biological degradation or dispose of them as a residue. Also, it is difficult to differentiate between compostable and non-compostable plastics. This results in an abundance of non-compostable materials at the end of the compost process. Facilities that have accepted post-consumer food waste with compostable service ware, or other MSW materials, have had to install robust screening/cleanup measures to remove glass, plastic, metal, and other foreign materials from the compost products. These facilities often have operational issues, such as odor generation, and have had difficulty producing marketable products. Finally, composters attempt to produce the highest quality compost possible to secure the best price for their compost. The highest quality compost is a certified organic compost. However, the presence of foreign materials that derive from non-compostable feedstocks will prevent the compost from obtaining certified organic compost grades.

Anaerobic Digestion

Anaerobic digestion (AD) is commonly used to treat wastewater biosolids and industrial/agricultural wastewater. It has also been used to treat the organic fraction of the MSW waste stream, such as food wastes and, in a few cases, additional portions of the MSW waste stream. A representative flow diagram for the Delta Diablo wastewater treatment plant (WWTP) AD system in Antioch, California, is shown in Figure 13. The processes that mechanically separate the organic fraction of MSW for use in an AD process were first employed in the 1980s under the term MBT. A few facilities were developed in the US using these AD and MBT technologies, but they ceased to operate years ago due mostly to a variety of technical and financial issues. However, evolution of the technology in parts of Europe, particularly in Germany, Spain, France, Italy, and the UK, has renewed interest in this technology in North America. AD facilities using source separated organics, and even in a few cases mixed MSW, are successfully operating in Europe due to landfill ban policies, high tipping fees, and high prices paid for energy. In parts of California, Canada, and more recently in other parts of the US, processing food and source separated organic waste streams with the use of AD in combination with aerobic composting to bio-stabilize the process residue has been developed on a commercial scale. These systems require separate collection of the targeted organic waste streams with high purity, increasing collection costs.

Figure 13: Typical Flow Diagram for an AD Plant, Delta Diablo WWTP, CA



Curtesy of Delta Diablo WWTP

The attraction to use an AD process is that the anaerobic digestion of material produces a CH_4 rich biogas that can be refined into a variety of beneficial fuels including renewable natural gas and compressed natural gas (CNG). It can also be used in low-grade conditions to fuel an engine generator. The AD process occurs when organic matter is decomposed using bacteria in the absence of oxygen. By consuming the organic materials, the bacteria produce a biogas (primarily CH_4 and CO_2). Feedstocks for AD vary according to the type of technology but, in broad terms, could include MSW-derived organics, manure, food waste, grass clippings, yard waste, brush, and wastewater treatment plant biosolids. Biologically inert materials that might be contained in the digestion feedstock, such as metals, glass, and plastics, are undesirable and considered contamination and either must be removed prior to digestion (for wet type systems) or be screened out during or after digestion (for dry type systems). If not managed properly, the gases produced by an AD system are highly odorous and explosive. Since the AD process occurs inside a vessel, odors from these types of facilities are typically attributed to mismanagement of either the arriving feedstock or the residual digestate that has not been returned to an aerobic phase. Both of these systems should be included in a properly designed and operating AD facility. Also, with the high levels of proteins in food waste, the formation of odorous trace gases, such as hydrogen sulfide (H_2S), have been problematic for mixed MSW systems. Again, these gases can and should be managed within the gas management system of a properly designed AD facility.

There are several factors that influence AD system design and performance. Some of these factors include: the concentration and composition of nutrients in the feedstock, temperature of the digesting mass, retention time of the material in the reactor, pH, acid concentration, and oxygen level.

Three basic approaches are used for AD systems based largely on the nature of the feedstocks:

- Wet low solids for dilute feedstock materials with very little to no contamination
- High solids for thick but pumpable materials that contain some contamination
- Dry or stacked for stackable feedstock blends with higher levels of contamination

Wet low solids AD systems, as shown in Figure 14 and Figure 15, have a more dilute process that requires careful pre-processing of food waste and other feedstocks to remove any grit and other contaminants. The wet low solids systems can include a WWTP type, in which case it could be a co-digestion system that includes both biosolids and dilute putrescible (food waste or similar) material. Generally, this is a large, tank-based system with a mixing system included in the process.

Figure 14: Low Solids AD Plant, Sacramento, CA

Figure 15: Low Solids (POTW) AD Plant, Renton, WA

High solids AD systems use a vessel designed for higher viscosity, or thicker material, using a plug flow or similar process. They may be horizontal, as shown in Figure 16, or vertical tank arrangements, as shown in Figure 17 and Figure 18, and can accept a more diverse feedstock including some level of contamination. However, they typically require some level of pre-processing to manage the material. Further compost post-processing is required for this design.

Figure 16: High Solids Horizontal AD Plant, San Luis Obispo, CA

Photo courtesy of Hitachi Zosen Inova

Figure 17: High Solids AD Plant, Perris, CA

Photo courtesy of CRR

Figure 18: Vertical High Solids AD Plant, Perris, CA

Photo courtesy of CRR

Dry or stackable AD systems are designed to treat material that remains stationary throughout the digestion process. These systems use enclosed tunnels or bunkers where the feedstock is placed for several weeks or they use percolate bunkers to stack and store drier feedstock for fermentation, as shown in Figure 19 and Figure 20. The feedstock must be somewhat porous and have a higher solids content so it can be stacked and enable the percolate to drain through the media. Consequently, yard/greenwaste is often included as a feedstock in this type of system. The tunnel or bunker is oriented horizontally. Biologically rich water is sprayed on the material and, after percolating through the material, is collected and recycled through the feedstock controlling moisture levels. The resultant digestate requires post-processing to convert from an anaerobic to an aerobic condition.

Figure 19: Zero Waste Energy Development Co. AD Plant, San Jose, CA

Photo courtesy of ZWED, San Jose CA

Figure 20: Interior of Zero Waste Energy Development Co. AD Plant, San Jose, CA

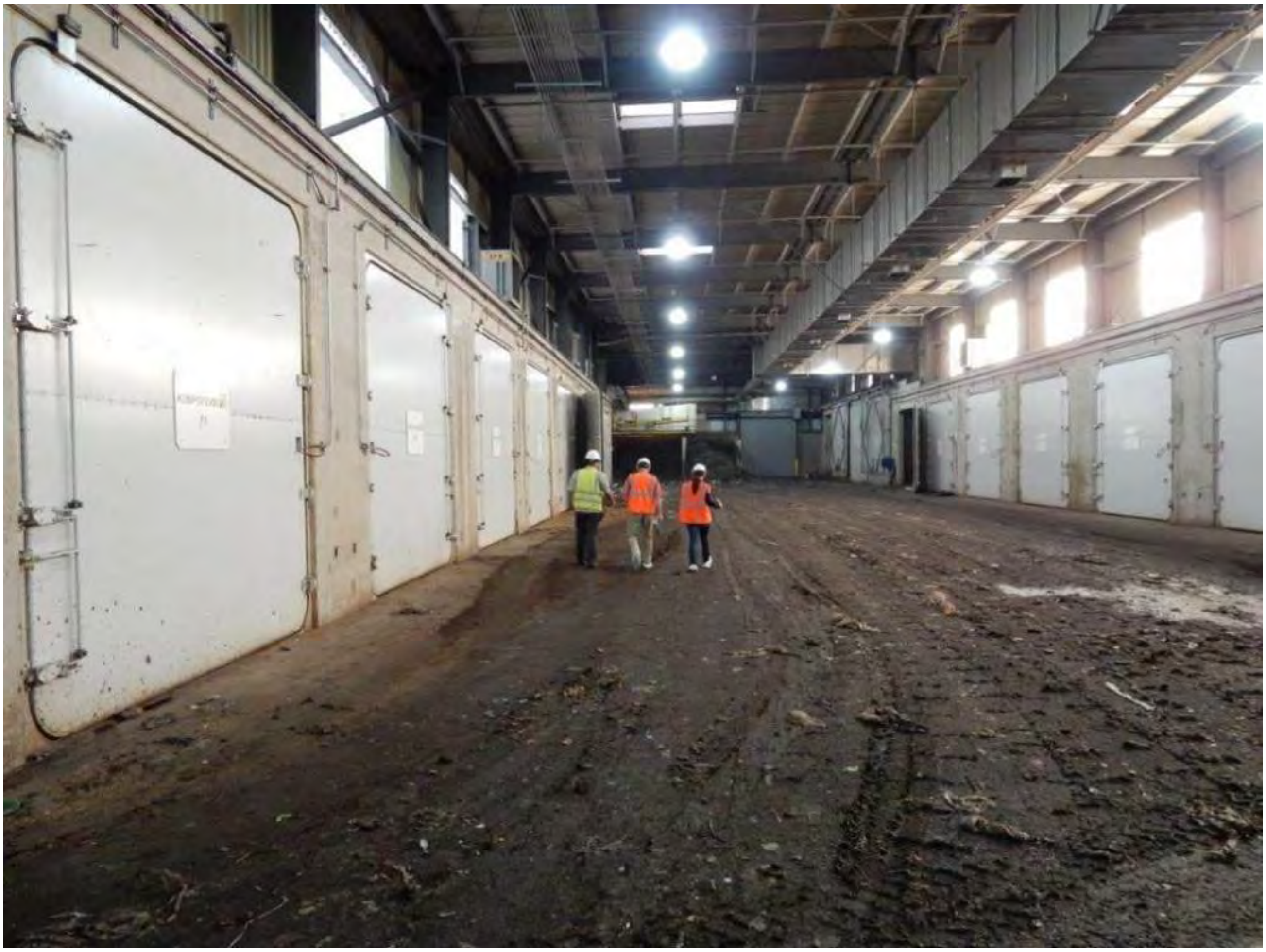


Photo courtesy of ZWED, San Jose CA

The Drake Water Reclamation Facility (DWRF) in the City of Fort Collins, Colorado currently uses AD to convert volatile organic solids from wastewater into a biogas that is used to heat the facility. A multi-year pilot project experimented with introducing source separated organics directly into its biodigesters to increase biogas output. DWRF has designed and partially funded a co-generation system that will convert biogas into electricity – dependent on increased throughput of food scraps as feedstock. There are other municipal wastewater treatment plants in the county that may be a resource in developing similar AD facilities that convert diverted food waste organics to energy.

Mechanical Biological Treatment

As described above, MBT is a composting and materials recovery variation that incorporates a multi-stage mechanical and biological treatment process. In North America, MBT is sometimes referred to as mixed waste processing with organics recovery, but the approach and desired end products are generally the same. This technology is designed to process a fully mixed MSW stream. It is an effective waste-management method and can be built in various sizes. While there are a number of facilities in the EU, the technology has not established itself in the US. There is only one commercial scale facility–discussed below–that has been in operation in the US for approximately one year. If this facility remains in operation and other potential applications develop, this technology may be considered commercial.

The order of mechanical separating, shredding, and composting can vary. Different system suppliers offer unique arrangements, but the processes generally use the following steps. During the mechanical stages, the entire feedstock is sorted to recover recyclables and remove bulky objects, non-processible items, and other contaminants. Then shredding or grinding takes place to reduce the size of the materials prior to the biological stage. Materials derived from the process usually include marketable metals, glass, containers, and other recyclables. Some processes may have the ability to recover select paper products when economics favor recycling.

The biological stage includes a digestion step in an enclosed vessel. This digestion generates a biogas that may be used to produce energy. In addition, the heat produced dries the feedstock thereby making it ready for processing into an RDF product. Limited composting is used to break down MSW and dry the fuel. The biological process also generates heat, which naturally reduces moisture. Moisture level controls may be used to manage this stage. In most cases, the digestion step is not allowed to progress as long or complete as an AD system but rather allows for easier feedstock break down. As with other composting and digestion systems, the process must be designed to manage potential odor issues.

RDF produced by an MBT process can either be landfilled or converted into energy via a thermal conversion process. RDF is then available as a solid fuel substitute for coal, wood, or other fuels at cement kilns or other industrial solid fuel facilities. In Europe, it is common for RDF and the residue produced by an MBT process to be fired directly in a boiler at a traditional WTE combustion facility or sold directly to a third party (e.g. cement kiln). If no fuel markets are available, the product could be further composted to render the material inert for landfilling. Consequently, similar to RDF, the MBT process produces compost and fuel products that are dependent on the sale of that product for economic viability. Since the compost is produced from mixed waste, the quality is low, the potential for beneficial use is limited, and it usually must be landfilled. One facility is reported to be in operation in Martinsburg, West Virginia. It is reported to provide its fuel product to a cement kiln, but limited information is available regarding the facility's operational performance.

In 2019, Entsorga, an Italy-based provider of MBT technology, started commercial operations of the HEBioT MBT Facility in Martinsburg, West Virginia. The facility is claimed to be able to recover biomass, plastics, and other carbon-based materials from MSW, compost the materials, and then convert them into a solid recovered fuel (SRF) that is used by a nearby cement manufacturer. Other recyclable commodities found in the MSW stream, such as metals and glass, are placed in the local municipality recycling stream to be recycled properly.

Chemical Technologies

Chemical technologies are designed to use physical chemistry processes as part of the technology employed to break down or transform various components of the processed waste infeed into building blocks that can be used for chemical feedstock, transportation fuels, or thermal energy. The potential value in these technologies is the possibility of producing transportation fuels such as diesel fuel, ethanol, or kerosene and industrial chemicals, which are usually much more valuable than the thermal energy produced that can only be turned into electricity or steam. In some cases, oil refineries may be willing to buy the fuels to blend with their fuels. Solvents (including water or potentially other solvents such as alcohol, acids, and caustic solutions), catalysts, and heat may be used as part of the chemical process to break down wastes into usable materials. Thermal depolymerization uses heat and pressure to break down hydrocarbon molecules. These processes may require emission controls for certain pollutants or have certain process residual wastes that may require management.

The feedstock for these processes usually requires extensive presorting and preparation to minimize undesirable materials and contamination. In many cases, chemical technologies are combined with mechanical, thermal, and/or biological technologies to begin the transformation process to the desired products. The other technologies are used to clean, size, sort, produce, or otherwise provide the input materials for the final chemical process to produce the desired products. Chemical technologies may only address certain types of waste materials, such as cellulosic wastes or plastics, oils, and grease, and the other technologies may be used to make the feedstock for the chemical process. Some processes may only use certain types of plastics because other types, such as polyvinyl chloride (PVC) or polyethylene terephthalate (PET), may not be suitable for the process. Sometimes multiple chemical processing steps may be necessary to produce the desired products. Long chain molecules, such as waxes or a synthetic crude oil, formed first as an intermediate product may then crack or break additional chemical bonds into shorter molecules to form products such as diesel fuel or alcohols that are more valuable. Alternatively, desired chemicals such as methanol or ethanol may be built up from syngas first produced by a thermal reaction or other process.

Hydrolysis

There is much interest and development in cellulosic ethanol technology, which aims to move from corn-based ethanol production to the use of more abundant cellulosic materials. However, there are no facilities in the US or elsewhere that are considered commercial at this time. Hydrolysis is part of that development. Hydrolysis is a solvolytic reaction. Solvolysis is a chemical reaction that uses a solvent such as alcohol or water. The solvent breaks down material at elevated temperatures or in association with strong acids or bases. The hydrolysis process involves the reaction of water and cellulose fractions in a feedstock (e.g., paper, yard waste, etc.) with a strong acid (e.g., sulfuric acid) to produce sugars. Next, these sugars are fermented to produce an organic alcohol. This alcohol is then distilled to produce a fuel-grade ethanol solution that can be burned in energy conversion devices such as heaters and engines.

Hydrolysis is a multi-step process that includes four major steps: pre-treatment, hydrolysis, fermentation, and distillation. The pre-treatment step for MSW includes separating the feedstock stream as necessary to remove any inorganic/inert materials (glass, plastic, metal, rock, etc.) from the organic materials (yard waste, food waste, paper, etc.). Feedstock materials that are appropriate for hydrolysis/fermentation of the MSW cellulosic components include wood, green waste, and paper. This process does not handle or convert mixed MSW directly and is best suited for clean source-separated cellulosic waste components. The organic material is shredded to reduce the size and to make the feedstock more homogenous. The shredded organic material is placed into a reactor where it is introduced to the acid catalyst and the cellulose in the organic material is converted into simple sugars. These sugars are fermented and converted into an organic alcohol. The organic alcohol is then distilled into fuel-grade ethanol. The by-products from this process are CO_2 (from the fermentation step), gypsum (from the hydrolysis step) and lignin (non-cellulose material from the hydrolysis step). Since the acid acts only as a catalyst, it can usually be extracted and recycled back into the process.

Catalytic and Thermal Depolymerization

As for hydrolysis, while there is much interest in developing catalytic and thermal depolymerization processes, there are no current facilities fully advanced to a commercial level. The depolymerization, or cracking, process converts long-chain hydrocarbon polymers present in some waste materials into intermediate products that can be processed into fuels such as diesel and gasoline. Pressure and heat are used to decompose long-chain H_2, oxygen, and carbon polymers into shorter chains of petroleum-like feedstock. This process is somewhat similar to the process used to convert crude oil into usable products, including the use of distillation to segregate the desired hydrocarbon liquids (such as diesel fuel). The typical feedstocks proposed for depolymerization are plastics, waste oils, grease, and offal (i.e., processed animal soft tissue), although some of the technology vendors are claiming that this technology can theoretically use MSW and biomass as feedstocks.

In some cases, plastics may be divided by classification. This will separate certain types of plastics that are not as useful with an economic decision regarding which materials are used as feedstock and which may be sold in traditional recycling markets. Generally, PET (or plastic type No. 1) is less useful and PVC (or plastic type No. 3) is generally not suitable for the depolymerization processes and must be separated from suitable feedstock. High density polyethylene (HDPE or plastic type No. 2) is suitable for depolymerization. However, it may be more valuable recycled as a No. 2 plastic and not mixed with other types of plastics for fuel production. These depolymerization technologies have not been shown to be feasible except at small scale.

There are two depolymerization methods that can be used to convert organic materials into fuel: thermal and catalytic. Thermal depolymerization utilizes temperature (temperature ranges from 1,000 to 1,400°F) and pressure to crack the large hydrocarbon molecules within the feedstock. These processes are similar to pyrolytic processes but are usually applied to a more refined or pure plastic feedstock and not mixed waste. The plastics must be adequately cleaned and purified to reduce contamination rates from higher levels found in plastic feedstocks (approximately 10 to 25 percent contamination) to levels suitable for processing (sometimes less than 5 percent contamination). Once the hydrocarbon molecules are broken into shorter chains, additional refining steps are required to separate fixed carbon and lighter molecules to convert the heavier molecules into commercial grade diesel. The high temperature and additional refining steps in the thermal process require a significant amount of energy compared to the catalytic depolymerization approach. There are some thermal pilot-scale plants in development that are using pyrolytic or gasification processes on plastic wastes to produce a fuel or H_2. However, the energy balance data for thermal depolymerization of waste-derived organic materials are lacking and are not fully developed regarding commercial scale processing.

The catalytic depolymerization process uses lower temperatures (ranging from 500 to 700°F) and lower pressures than thermal depolymerization. In order to achieve adequate product yields and qualities at the lower temperatures and pressures, a catalyst is employed to aid in breaking down or cracking the large molecules efficiently. Zeolite, silica-alumina, and bauxite are common catalysts used in the process. In a catalytic depolymerization process, the plastics, synthetic-fiber components, and water in the feedstock react with a catalyst under pressure and heat to produce a crude oil. This crude oil can then be distilled to produce a synthetic gasoline or fuel-grade diesel. Some technology vendors claim to meet diesel fuel or other fuel standards suitable for use in commercial vehicles, as discussed below.

Waste-to-Fuel Technologies

Waste-to-Fuel technologies typically involve four main steps:

1) Pre-processing and preparation of the feedstock material (e.g. woody biomass or MSW),
2) Converting the feedstock to generate a syngas through a thermal conversion process (e.g. gasification or another technology),
3) Cleaning and conditioning the syngas of impurities and other contaminants, and
4) Passing the syngas through a catalytic process, such as an FT process to synthesize a liquid fuel.

Refer to Figure 7 above for an example of a Ways2H's pyrolytic waste to H_2 pilot project. The use of woody biomass and some agricultural wastes as feedstock for these technologies has some long-term operating track record. There are also some demonstration/pilot projects that are attempting to use MSW or other feedstocks, which are described in more detail below. However, the long-term operating and financial viability of using an MSW feedstock to produce a liquid fuel is still unknown.

The waste-to-fuel process for mixed MSW starts with a sophisticated processing system. Generally, the MSW is sorted to remove and recover the metals, glass, inorganic materials, other undesirable materials, and select traditional recyclables. Depending on the downstream processing system needs, the sorting process may selectively separate paper and cellulose containing materials and select plastics, as shown in Figure 21, or may use both types of materials. The selected fuel material is generally shredded for easier handling and to develop a more uniform feedstock. The more uniform feedstock simplifies downstream processing issues.

Figure 21: Plastics to Fuels Demonstration Project

Once a relatively uniform feedstock is produced, there are several proposed methodologies to convert MSW into fuels. First, the majority of MSW-to-fuel technologies require a process that generates a syngas, typically a thermal conversion process such as gasification or pyrolysis. The next and most important step in this process is to take the syngas produced and clean it to remove impurities (tars, hydrocarbons, contaminants, etc.) that can impact the catalytic process. The syngas has a lower Btu (energy) content compared to natural gas, and the downstream process may require water removal to concentrate the H_2 and CO.

The next step involves a catalytic process, such as an FT-type process, that converts the syngas into a liquid fuel. The FT process is defined as a series of chemical reactions that use a metal-based catalyst (cobalt, iron, or others) to convert a mixture of CO, H_2, and sometimes steam into liquid hydrocarbons under elevated and controlled temperature and pressure conditions. The FT process has been around for almost 100-years and is used most to convert coal, biomass, or even CH_4 into synthetic liquid fuels. The purity of the syngas used can be critical to the success of the FT process, which makes syngas produced from MSW gasification challenging because of the contaminants present in the MSW feedstock and the relatively low ratios of H_2 to CO. The chemical reactions produce a variety of hydrocarbon molecules with the more useful reactions producing alkanes. Most of the alkanes produced tend to be straight chain, which are suitable as diesel fuel. Use of the proper catalyst in the FT process is essential to garner the highest quality fuel while not deteriorating the catalyst. In this technical industry there are many forms of catalyst including cobalt and ferrous based. Syngas from MSW gasification is having the greatest issues in this area because of the contaminants in the MSW syngas and the low of ratios of H_2 to CO. Even with the extensive waste processing, the small variations in the gases produced during the FT process may cause disruptions.

The FT process is usually followed by a hydrocracking process. Hydrocracking is required to break up the long-chained hydrocarbons. The long-chained hydrocarbons are waxes, which are solid at room temperature. Therefore, to produce liquid transportation fuels it is usually necessary to crack some of the FT products.

As mentioned, FT is one of the most popular types of chemical catalytic processes used to synthesize syngas into a liquid fuel. In addition to FT synthesis, there is methanol synthesis, mixed alcohol synthesis, or syngas fermentation. Each process features different reaction pressures and temperatures, requires different syngas compositions, and uses different catalysts. Alternatives to the FT process include a bio-catalytic process where biological organisms are used to break down the elemental components in the syngas into a biofuel. The Indian River Biofules Facility (IRBF) in Vero Beach, Florida employed this technology to convert mostly agricultural wastes into ethanol, but this facility is no longer operating.

Feedstock preparation, gasification, syngas clean-up, and fuel synthesis are commercially viable using select feedstock materials such as biomass, coal, or petroleum-based materials. However, the catalysts and FT process used to produce the biofuels are very sensitive to the quality and composition of the syngas produced by the thermal/gasification component of these technologies. Using MSW or other heterogenous and mixed feedstocks in these systems is still in the development or demonstration stage.

Generating liquid fuels from wastes is an evolving technology. The use of biomass, organic wastes, and plastics as feedstocks appear to be advancing in demonstration/pilot projects with a couple projects moving toward commercialization. However, the use of a mixed MSW feedstock is still being tested in laboratories and demonstration/pilot projects. Some examples of commercial-scale waste-to-fuel technologies that are in commercial development include the Enerkem, Fulcrum Bioenergy, and INEOS Biofuel technologies. In June 2014, Enerkem Alberta Biofuels in Edmonton, Alberta, Canada opened a 10 million gallons per year methanol facility designed to help Edmonton reach a 90 percent MSW diversion goal by accepting up to 100,000 metric tons of MSW (the city already diverts 60 percent of the MSW stream). The Enerkem facility, shown in Figure 22, is a commercial-scale waste-to-fuel facility. The Enerkem facility is currently in operation and utilizes an MSW gasification-to-liquid fuels technology that uses an FT-type catalytic process to generate liquid methanol. Enerkem hopes to ultimately use the methanol to produce ethanol on a commercial scale. Information on the performance of the Enerkem facility’s ethanol production is not readily available. Therefore, the facility is not considered fully commercial at this time.

In addition, Fulcrum Bioenergy is developing the Sierra Biofuels Facility in Storey County, Nevada. This facility will use a combination of gasification and FT. Fulcrum Bioenergy is also planning another, similar facility in the United Kingdom. Neither of these facilities are operating on a commercial scale at the present time.

Figure 22: Enerkem Alberta Biofuels Facility, Edmonton, Alberta, Canada

Photo Curtesy of Enerkem

Fulcrum Bioenergy is also developing another commercial-scale project in Nevada. An MSW processing facility has been in operation processing mixed waste to recover recyclables and generate a waste fuel feedstock from suitable materials for a separate biorefinery. Construction of the biorefinery is anticipated to be complete in 2021 and the facility will proceed into a commissioning phase. The anticipated fuel product will be jet fuel suitable for commercial applications. The fuel may be blended with conventionally refined jet fuel.

Ineos Biofuels developed the IRBF, a waste-to-fuel technology facility located in Vero Beach, Florida (see Figure 23). This 300-tpd IRBF (2 units producing 150 tpd each) facility cost approximately $130-million and started operations in late 2012 using woody biomass wastes as a feedstock. The technology was designed to use a thermal gasification process to generate a syngas that was then passed through a fermentation reactor where biological organisms converted the H_2 and CO in the syngas directly to ethanol. IRBF is permitted to receive waste, but to HDR's knowledge it never processed any MSW feedstocks. IBRF had some operational issues and challenges since startup, particularly with certain contaminants in the syngas that affected or killed off the biological organisms and eventually resulted in the facility being taken offline.

Figure 23: Indian River Biofuels Facility in Vero Beach, Florida

Mechanical Technologies

Mechanical technologies use equipment and external heat from steam or hot air (not heat produced from combustion or partial oxidation of the waste feedstock) to divide waste into usable products and residue. Most processes produce ancillary products, including recyclables, that can be marketed like those produced from a materials recovery facility (MRF) or the process may start with MRF residual materials as the feedstock. The arrangement of the equipment and overall separation processes can vary widely by facility and produce a wide range of output products. Wastes may be subdivided into plastics, paper (fiber), metals, glass, and other inert materials. Some processes may produce a low-grade cellulose product that can be used for cardboard production or for thermal, certain chemical, and biological processes. Feedstock may be cleaned to reduce chlorine content and otherwise processed to improve its fuel properties. Usually a fuel or feedstock is produced that is designed to be used by another process or another facility, potentially to offset other solid fossil fuels. Often the ultimate fuel use facility is not part of the fuel production facility and may likely be an existing cement kiln or solid fuel boiler that is willing to contract for the fuel produced to offset coal or other fossil fuels. If a suitable use for the waste fuel is not identified, the fuel may require landfilling so a long-term fuel supply contract is usually necessary for a viable operation that pays for the fuel production operating and maintenance costs. Process residues are generally produced that, in most cases, must be landfilled.

Autoclave/Steam Classification

Autoclaving is classified as a mechanical process that uses heat and pressure in a mechanical, rotating cylinder that can be used to separate cellulosic and organic material from other portions of the MSW stream. As an example, basic autoclave technology has been used to sterilize hospital wastes and equipment for many years. Autoclaves are generally anticipated to be applied as a step in the management of waste materials; however, HDR is not aware of commercially operating facilities using autoclaving or steam classification.

Autoclaves used for MSW processing are large rotating vessels that have steam injected and kept at a certain temperature and pressure over a controlled period, up to 2–4 hours, to convert the MSW. Most autoclaves are currently operating in batch mode accepting between approximately 1 and 25 tons per batch (2-3 hour), although at least one facility was designed for continuous feeding. The autoclave process has the potential for a 40 to 60 percent reduction in waste volume with the cellulose recovery having the potential to be used as feedstock for paper production, ethanol production feedstock, compost feedstock, or digester feedstock for CH_4 production.

Like AD and chemical technologies, autoclaving may be best applied when it addresses only a portion of the waste stream, namely the cellulose-fiber-containing portion, which is usually 40 to 60 percent of the total MSW input stream. However, this technology can accept mixed MSW that contains a large organic fraction to be used as a front-end separation system for many of the other alternative technologies such as hydrolysis for fuel product production, gasification or pyrolysis for energy generation, anaerobic digestion for energy and compost production, or fiber recovery for the pulp/paper industry. A trommel screen is usually used after the autoclave to separate the fibrous organic materials produced from autoclaving and other materials (inorganic materials, plastics, and recyclables such as glass and metals). If the goal for the autoclaving technology is recovery for paper production, because the fibers are a mixed grade, the main product that can be produced is a lower-grade cardboard. Plastics generally will melt and form small balls of material. While the fiber and plastic portions of the MSW are lower quality, mixed grade materials with fines are often very clean. Fines usually consist of material two inches in diameter or smaller that include organic material such as paper, dirt, and food particles as well as inorganics such as glass, plastics, and metals. Labels, paint, and other coatings are generally removed.

Mixed Waste Processing

There are several types of MRFs in operation in the US and around the world. Most can be classified into two groups: those that accept and process source separated recyclables, sometimes referred to clean MRFs, and those that take a mixed MSW stream, referred to as a Mixed Waste Processing Facility (MWPF), a dirty MRF, or an advanced materials recovery system. The purpose of this section is to describe MWPFs and their potential commercial applications. These facilities are often used to capture select materials, depending on the feedstock and established markets, and may not recover all the materials noted below. MWPF yields are usually much lower than conventional MRFs due to the nature of the feedstock, but they can provide significant landfill diversion.

A MWPF begins with mixed solid waste from residential and/or commercial collection vehicles being off-loaded onto a tipping floor. Materials are first sorted on the floor using mobile and fixed equipment with some manual labor to remove or break up larger or bulky items such as appliances, dimensional wood, metal, or large pieces of plastics that might clog or interrupt processing system operations. Loaders or grapples then load a conveyor or surge hopper to convey the material to the sort lines and mechanical equipment for separation. In most cases, either a mechanical device or manual labor is used to open bags and containers prior to screening and sorting. Systems can be adapted to construction and demolition (C&D) wastes or certain other mixed waste materials.

Material is usually processed through multi-stage screens to separate fiber (cardboard, newspaper, and mixed paper), plastic, metal and glass containers, and small contaminants. This is usually accomplished using mechanical, optical, or pneumatic screening equipment and/or labor to separate materials into size classifications and/or lighter versus heavier materials. Fiber is usually sorted optically or by hand off elevated conveyor platforms into commodities and dropped into bunkers. Containers are processed through ferrous magnets, optical sorters, robotic sorters, hand sorting, and eddy current separators (ECS). The fines, usually less than two inches and consisting of dirt, rocks, broken glass, ceramics, bottle caps, etc., may be further processed by magnets, ECS, and pneumatic sorting steps to recover metals, fiber, and a glass-rich stream.

Sorted material is moved from bunkers and baled (fiber, plastic, metal) or loaded directly into roll-off bins (glass, wood, scrap metal). Some MWPFs also isolate the organic fraction of the MSW stream to be used in a composting or AD process. The remaining residue material from a MWPF is shipped to a local landfill or used for another appropriate waste reduction application. The main purpose of this type of MWPF is to remove recyclable materials and organics from the mixed MSW. These types of facilities usually recover about 10 to 25 percent, although some facilities have reported recovery of up to 50 percent or more. There is a wide range of MWPF capacities operating throughout the world. The optimal capacity is between 200 tpd and 1,500 tpd using multiple sort lines and operating additional shifts. MWPFs can have a useful operating life of 20 to 30 years if proper maintenance is provided. Many MWPFs are retrofitted throughout their life with new processing equipment, as applicable.

There have been several commercial scale MWPFs implemented in North America. The most notable examples are in Montgomery County, Alabama; San Jose, California; and Edmonton, Alberta, Canada. It should be noted that the current downward trend in commodity pricing and acceptance of the processing approach has impacted the financial viability of some of these projects. The Montgomery County Facility went through an ownership change with the County acquiring the facility and hiring a new operator. Numerous upgrades and modifications were made to the facility with the current facility accepting more tradition single stream materials but is capable of handling other types of feedstock such as mixed fiber, commercial, and industrial materials and has the potential to produce a fuel material. The Newby Island Resource Recovery Park in San Jose, shown in Figure 24, has infeed lines for residential single stream, commercial single stream, commercial wet recyclables, and a common container line that accepts materials from all of the other streams. Incoming material can be characterized in this manner and routed to the appropriate processing system.

Figure 24: Newby Island Resource Recovery Park, California

Refuse Derived Fuel Production

An RDF processing system prepares MSW using separation, shredding, screening, air classifying, and other equipment to produce a fuel product, such as coarse shred, fluff, or pellets, for either on-site thermal processing, off-site thermal processing, or use in another conversion technology that requires a prepared feedstock. The goal of this technology is to derive a more homogeneous fuel product that can be used in specified thermal equipment or as a supplement to coal-fired power generating facilities, and even cement kilns in some cases. The fuel goes by various names but is generally categorized as RDF.

The RDF process typically results in a fuel yield in the 80 to 90 percent range (i.e., 80 to 90 percent of the incoming MSW is converted to RDF). The remaining 10 to 20 percent of the incoming waste that is not converted to RDF is composed of either recovered ferrous and nonferrous metals (1 to 5 percent) which can be sold to market, or process residue (15 to 19 percent) that must be disposed of in a landfill. In most cases, the fuel is used at the same facility where it is processed, although this does not have to be the case.

Non-recovered discards from an MRF can be processed using this technology. Facilities can range in size from several hundred tpd to more than 3,000 tpd. Recycling processes can also be built into an RDF facility, such as in a MRF or MWPF. Metals can usually be sorted and removed by magnets and ECS. In some cases, other recyclables such as cardboard, glass, or even plastic containers may be recycled. An RDF facility strives to develop a consistently sized fuel with a relatively constant heating value for thermal technologies. These facilities can employ multiple shredding stages, large trommel screens or other types of screens for sizing, several magnet stages, and possibly air separation, optical sorters, and ECS. The product would typically have a nominal particle size of 3 to 4 inches (although the sizing of final product RDF can be controlled for a specific technology), have the grit and metals largely removed, and be ready to market.

EPA has encouraged processors to produce a Non-Hazardous Secondary Material (NHSM) for use in industrial boilers or other applications that are subject to Section 112 of the Clean Air Act as opposed to Section 129, which waste combustors must follow. The fuel must meet the requirements for NHSM as defined by the US EPA in 40 CFR Section 241.3 of the Clean Air Act. These processing facilities require more processing and ongoing sampling to meet more restrictive requirements for residual chlorine content, chlorine to sulfur ratio, heating value, moisture, and ash content in the resultant fuel than are required for combustion of waste or RDF in a waste boiler. Refer to Section 5 for additional discussion of the NHSM program.

Many of the existing RDF combustion facilities in the US (e.g. Miami-Dade, FL; West Palm Beach, FL; Detroit, MI; Honolulu, HI; Norfolk, VA; Ames, IA; etc.) employ these practices to process the fuel. Some RDF facilities can be classified as shred and burn style facilities. These facilities shred the material and magnetically remove ferrous metals without removing fines. Some RDF facilities have converted to shred and burn through blanking the small holes in trommels. The purpose for this change is to reduce the overall amount of residue (fines) landfilled and simplify the fuel production process. An example of a shred and burn facility is the SEMASS facility in West Wareham, Massachusetts. This facility has recently replaced its high-speed hammermill shredders with high torque shredders for safety and operational reasons.

There are also RDF technologies that, after removal of recyclable, bulky, and inert materials, form the remaining MSW stream into a pellet or briquette. The intended use of these pellets or briquettes varies by technology developer and regulation, but some examples include use as a supplement to coal at a conventional fossil fuel power plant or cement kiln. Some technology providers also offer the pellets for use as a soil amendment in greenhouses. However, the quality and integrity of the pellets or briquettes produced, and the willingness of the local market to accept this product, factor significantly into the economic viability of the project. A commercial-scale MSW pelletizer facility in York Region, Ontario, Canada (just north of the City of Toronto) was constructed in 2008 but was later shutdown due to operating issues and limited available markets for the pellets. The WastAway facility in Morrison, TN may produce either an RDF fluff material or compress the fluff into pellets depending on the target market.

3 Comparison of Technology Options

The following table presents a comparison of direct combustion, gasification, and PAG. It shows criteria including commercial viability, capability of processing feedstock, technology capacity level, diversion potential, marketability of end products and bi-products, useful operating life, environmental benefits and drawbacks, local economic benefits, range of operating and capital costs (high, medium, low), and any necessary support facilities for the technology for complete waste management.

	Criteria	Direct Combustion	Gasification	Plasma Arc Gasification
1. Commercial Viability (Development Stage)				
a	Status of technology in North America	Commercial	Demo/Pilot on MSW. Example commercial facilities in development: Ways2H, Kern County, CA Sierra Energy, Monterey, CA	Demo/Pilot on MSW. Some facilities were shutdown:: Geoplasma, St. Lucie County, Fl NRG, Atlantic County, NJ Plasco, Ottawa, Ontario
b	Years of commercial operating history in North America	30 plus years	Limited to none on MSW	Limited to none on MSW
c	Number of commercial continuously operating facilities in North America	70 plus facilities	Limited on MSW No commercial facilities in North America	Limited on MSW No commercial facilities in North America
d	Status of technology worldwide	Commercial, hundreds of plants	Commercial (mostly in Asia <50)	Limited commercial on MSW in Asia (<6)
2. Capability of Processing Feedstock				
a	Type of MSW processed	Handle entire MSW stream	Handle entire MSW stream or select materials	Ideal for hazardous and high carbon fraction (e.g. plastics) of MSW stream
3. Technology Capacity Level				
a	Processing unit capacity (tpd)	200 to more than 1000 tpd Modular less than 500 tpd	Typically, 100-250 tpd and less than 500 tpd	50 to 1,000 tpd (claimed)

	Criteria	Direct Combustion	Gasification	Plasma Arc Gasification
4. Diversion Potential of Technology				
a	Potential landfill diversion (weight percent)	70%-90%	Claimed greater than 90%	Claimed greater than 90%
5. Marketability of End- and By-Products				
a	Availability and feasibility of markets for recovered materials	Good for metals and mixed ash for LF cover (as permitted); potential aggregate re-use	Unknown markets for chemicals and vitrified ash/slag for aggregate	Unknown for vitrified ash/slag for aggregate
b	Availability and feasibility of markets for energy produced	Good	Good	Good
c	Undesired by-products	Fly ash if not mixed with bottom ash	Ash/Slag if not sold/given away as aggregate	Ash/Slag if not sold/given away as aggregate
6. Useful Operating Life				
a	Facility life (yrs)	Greater than 25 years	Anticipated about 20 years	Anticipated about 10 to 15 years
7. Typical Environment Benefits/Drawbacks				
a	Benefits	Produces energy, metals for market and ash for cover (mixed), possible aggregates where permitted	Produces energy, possible aggregates from slag (need mkts)	Produces energy, possible aggregates from slag (need mkts)
b	Drawbacks	Air emissions to be mitigated by APC equipment	Air emissions to be mitigated by APC equipment	Air emissions to be mitigated by APC equipment
8. Local Economic Benefits				
a	Permanent full-time Jobs	40 to 80 permanent jobs	40 to 80 permanent jobs	40 to 80 permanent jobs

	Criteria	Direct Combustion	Gasification	Plasma Arc Gasification
9. Financial				
a	Range of capital and operating unit cost	Moderate to high Typically $80 - $120 per ton	Moderate to high Expected $100 - $180 per ton	High Expected $120 - $200 per ton
10. Necessity of Support Facilities for Complete Waste Management				
a	Front-end processing	Not required other than large bulky wastes	Generally necessary	Generally necessary
b	Supplemental facility	Included	Boiler, engine, or other fuel consumer required	Boiler, engine, or other fuel consumer required

The following table presents a comparison of pyrolysis, aerobic composting, and anaerobic digestion. Criteria include commercial viability, feedstock processing capability, technology capacity level, diversion potential, end product and bi-product marketability, useful operating life, environmental benefits and drawbacks, local economic benefits, range of operating and capital costs (high, medium, low), and any necessary support facilities for the technology for complete waste management.

	Criteria	Pyrolysis	Aerobic Composting	Anaerobic Digestion
1. Commercial Viability (Development Stage)				
a	Status of technology in North America	Demo/Pilot on MSW. Some commercial facilities in development on select waste streams: Ways2H, Kern County, CA	Commercial (particularly for source separated organic streams)	Commercial (particularly for source separated organic streams). Example: Delta Diablo, Antioch, CA ZWED, San Jose, CA Kompogas SLO, San Luis Obispo, CA No commercial facilities processing mixed MSW.
b	Years of commercial operating history in North America	Limited on MSW	More than 30 years on green/yard waste feedstock	More than ten years

	Criteria	Pyrolysis	Aerobic Composting	Anaerobic Digestion
c	Number of commercial operating facilities in North America	Limited on MSW No commercial facilities in North America	Thousands of operating facilities	More than 20 operating processing organic streams such as food waste (More under development)
d	Status of technology worldwide	Demo/Pilot on MSW; one commercial plant in Germany	Commercial	Commercial, >25
2. Feedstock Processing Capability				
a	Type of MSW processed	Handle entire MSW stream	Ideally suited to process green/yard waste and food waste portions of MSW	Can treat only organic portion of MSW typically food waste; green waste; fats, oils, and grease; sewage sludge; and manure
3. Technology Capacity Level				
a	Processing unit capacity (tpd)	Under development; Approximately 10 to 100 tpd	Can range from very small to over 3,000 tpd. Usually 200 to 400 tpd	Wide range from 5-10 tpd to 300 tpd
4. Diversion Potential of Technology				
a	Potential landfill diversion (weight percent)	Not known	Linn County's total organics is about 40% according to Wasteshed Study (2020)	For wet low solids and high solids AD food waste typically ranges from 15-20% of the overall waste system, Linn County's total organics is about 40% according to Wasteshed Study (2020)
5. Marketability of End- and By-Products				
a	Availability and feasibility of markets for recovered materials	Depends if gases, liquids, and char can be used	Properly processed compost is marketable to a wide range of customers (agricultural, commercial, residential)	Biogas from AD can be used to produce electricity or processed into renewable or pipeline grade natural gas or CNG. Digestate after process can sometimes be turned to compost

	Criteria	Pyrolysis	Aerobic Composting	Anaerobic Digestion
b	Availability and feasibility of markets for energy produced	Depends if gases, liquids and char can be combusted	N/A	Biogas can be used to create energy and/or fuels
c	Undesired by-products	Liquids, tars, chars, and other by-products	Screened overs, such as bottle caps, glass, and other small objects	Digestate must be assessed if compostable
6. Useful Operating Life				
a	Facility life (yrs)	One small facility operating in Germany since the 1980s	Life is 30+ years depending on equipment replacement	Operating internationally since the 1980s. Co-digestion using WWTPs in the US have been operating for decades
7. Typical Environment Benefits/Drawbacks				
a	Benefits	Potentially create energy and useful by-products	Create useable compost	Create renewable energy and/or fuels and potentially useable compost
b	Drawbacks	Air emissions to be mitigated by APC equipment	Can create odor, noise and dust	Designs must include proper management of feedstock and digestate to control odors
8. Local Economic Benefits				
a	Permanent full-time jobs	Not known	About 2 to 10 jobs, depending on the size of the operation	About 10 to 25 jobs, depending on the size of the operation. More jobs required if a MWPF is required for mixed MSW stream.
9. Financial				
a	Range of capital and operating unit cost	High Expected $120 - $180 per ton	Low Typically $30 - $75 per ton	Medium to high Typically $90 - $130 per ton
10. Necessity of Support Facilities for Complete Waste Management				

	Criteria	Pyrolysis	Aerobic Composting	Anaerobic Digestion
a	Front-end processing	Technology dependent	Shredder for greenwaste if not part of process	Generally necessary for de-packaging, removal of contaminants and for sizing/extraction
b	Supplemental facility	Boiler, engine or other fuel consumer required	Compost screening, cleanup if not part of process	Biogas refinement or boiler, engine generator

The following table presents a comparison between MBT, hydrolysis, catalytic and thermal depolymerization, and waste-to-fuels. Criteria include commercial viability, feedstock processing capability, technology capacity level, diversion potential, marketability of end products and bi-products, useful operating life, environmental benefits and drawbacks, local economic benefits, range of operating and capital costs (high, medium, low), and any necessary support facilities for the technology for complete waste management.

	Criteria	Mechanical Biological Treatment	Hydrolysis	Catalytic & Thermal Depolymerization	Waste-to-Fuels
1. Commercial Viability (Development Stage)					
a	Status of technology in North America	Commercial Scale[1] Example: Entsorga, Martinsburg, WV	Demo/Pilot No commercial facilities in North America	Demo/Pilot No commercial facilities in North America	One plant commercial. Enerkem, Edmonton Alberta, Can. Demo/Pilot on MSW: Ways2H, Kern County, CA FulcrumStorey County, NV
b	Years of commercial operating history in North America	More than one year	None commercialized	None commercialized	None fully commercialized
c	Number of commercial operating facilities in North America	At least one commercial scale	None commercialized	None commercialized	Several facilities in startup and commissioning

	Criteria	Mechanical Biological Treatment	Hydrolysis	Catalytic & Thermal Depolymerization	Waste-to-Fuels
					stages. One facility recently shutdown.
d	Status of technology worldwide	Commercial, >25	Demo/Pilot	Demo/Pilot; one facility claimed in Spain	R&D/pilot on MSW
2. Feedstock Processing Capability					
a	Type of MSW processed	Entire waste stream or select	Wood, green waste and paper	Plastics & oils	Entire or biomass portion of MSW
3. Technology Capacity Level					
a	Processing unit capacity (tpd)	Less than 250 tpd	Needs more research	Needs more research	Needs more research
4. Diversion Potential of Technology					
a	Potential landfill diversion (weight percent)	This is a feedstock pre-process; recover recyclables	Estimated 25%-30%	Estimated 10%-12%	If gasification is used, can be up to 90%
5. Marketability of End- and By-Products					
a	Availability and feasibility of markets for recovered materials	Markets for recyclables and possibly fuel product	Markets for gypsum & lignin will need to be established	Needs more information on the biodiesel created	Needs more information on the liquid fuel created
b	Availability and feasibility of markets for energy produced	There are markets for the potential biogas produced; possibly for solid fuel	A market for this fuel has not been established	A market for this fuel has not been established	A market for this fuel has not been established
c	Undesired by-products	None known if markets are available for fuel	Potentially the CO_2, gypsum, and lignin	Needs more research	Needs more research
6. Useful Operating Life					
a	Facility life (yrs)	Most probably 15 to 25 years	Needs more research	Needs more research	Needs more research

	Criteria	Mechanical Biological Treatment	Hydrolysis	Catalytic & Thermal Depolymerization	Waste-to-Fuels
7. Typical Environment Benefits/Drawbacks					
a	Benefits	Separates feedstock for recycling, digestion, and thermal	May be able to produce a fuel with more research	May be able to produce a fuel with more research	May be able to produce a fuel with more research
b	Drawbacks	Odors, dust & noise	Methane emissions and possible chemical spills	Hydrocarbons and fixed carbon could be emitted; catalysts or solvents needed	Hydrocarbons and fixed carbon could be emitted; catalysts or solvents needed
8. Local Economic Benefits					
a	Permanent full-time jobs	20 to 40 jobs	Not known	Not known	Not known
9. Financial					
a	Range of capital and operating unit cost	Medium Expected $45 - $100 per ton	Medium	Medium	Medium/High
10. Necessity of Support Facilities for Complete Waste Management					
a	Front-end processing	MRF and shredding system	Generally necessary to remove contaminants and for sizing/extraction	Generally necessary to remove contaminants and for sizing/extraction	Generally necessary to remove contaminants and for sizing/extraction
b	Supplemental facility	Boiler, cement kiln, or other fuel consumer required	Fuel consumer	Fuel consumer	Fuel consumer

Note:
[1] MBT is on the verge of being considered commercial. A number of commercial facilities exist in Europe. One commercial scale facility is known to exist in the US and is reported in operation. Within in a few years, particularly if more MBT facilities are brought into commercial operation, it will be an accepted technology in North America.

The following table presents a comparison between autoclave, mixed waste processing, and RDF processing, showing criteria including commercial viability, feedstock processing capability, technology capacity level, diversion potential, marketability of end products and bi-products, useful operating life, environmental benefits and drawbacks, local economic benefits, range of operating and capital costs (high, medium, low), and any necessary support facilities for the technology for complete waste management.

	Criteria	Autoclave	Mixed Waste Processing	RDF Processing
1. Commercial Viability (Development Stage)				
a	Status of technology in North America	Demo/Pilot on MSW components No commercial facilities in North America	Commercial Examples: Newby Island, San Jose, CA Edmonton, Alberta, Can. RePower, Montgomery, AL	Commercial Examples: Covanta, Miami-Dade County FL Wheelabrator SPSA, Norfolk, VA City of Ames, IA Covanta H-POWER, Honolulu, HI
b	Years of commercial operating history in North America	Limited on MSW components No commercial operations	30 + years	30 + years under MWC EPA requirements; about 5 + years under Boiler MACT EPA requirements[1]
c	Number of commercial operating facilities in North America	Limited on MSW components None active	Half dozen to a dozen	Approximately 20
d	Status of technology worldwide	Demo/Pilot on MSW components	Commercial, >25	Commercial, >50
2. Feedstock Processing Capability				
a	Type of MSW processed	System dependent but can process entire MSW stream	Handle entire MSW stream	MWC handle entire MSW stream; NHSM cannot handle chlorine containing materials
3. Technology Capacity Level				
a	Processing unit capacity (tpd)	At this time only smaller 100-300 tpd available	Approximately 200 to 1,500 tpd	Up to about 1,000 tpd
4. Diversion Potential of Technology				

	Criteria	Autoclave	Mixed Waste Processing	RDF Processing
a	Potential Landfill diversion (weight percent)	Approximately 35-40% of the MSW possibly more if combined with other technologies	Approximately 10-25% of the MSW possibly more if combined with fuel production	Approximately 60-90% of the MSW depending on the process
5. Marketability of End- and By-Products				
a	Availability and feasibility of markets for recovered materials	Metals and glass can be marketed. Fiber product may only be used for low grade cardboard. Market needs to be developed for plastics	Recyclables can be marketed; potentially fuel	Recyclables can be marketed. Markets are project specific if pellets or briquettes are produced. Possible use as soil amendment but no clear markets available.
b	Availability and feasibility of markets for energy produced	Market needs to be developed for fuel	N/A unless a fuel product is produced which needs a market developed	RDF can be converted to energy under either MWC or boiler rules or market need for fuel product.
c	Undesired by-products	Non-fiber unless a market can be developed for plastics	Grit/ fines, trash, low grade plastics and glass unless markets are available	Bulky items, grit/glass; for NHSM PVC and other chlorine containing materials
6. Useful Operating Life				
a	Facility life (yrs)	Not known at this time	20 to 30 years with periodic equipment upgrades	20 to 30 + years
7. Typical Environment Benefits/Drawbacks				
a	Benefits	Possibly create low grade fiber or fuel product; recover metals; output materials are sterilized	Recover recyclables; possibly produce fuel	Preparation of feedstock for other processes; NHSM can be processed in industrial boilers

	Criteria	Autoclave	Mixed Waste Processing	RDF Processing
b	Drawbacks	Risks of autoclaving are not known; fiber product is low quality	Odors, noise & dust to be mitigated	Odors, noise & dust to be mitigated; NHSM must meet strict fuel requirements and sampling
8. Local Economic Benefits				
a	Permanent Full-time Jobs	Not known at this time	20 to 60 jobs	20 to 100 jobs
9. Financial				
a	Range of Capital and Operating unit costs	Medium Insufficient data	Medium Typically $35-$75 per ton (Processing facility only)	Medium; NHSM produced for a boiler costs are higher than for RDF production for an MWC facility, however the boiler costs are lower. Expected $35 - $100 (Processing facility only)
10. Necessity of Support Facilities for Complete Waste Management				
a	Front-end Processing	May require material sizing and sorting	Technology is only a processing technology	Technology is only a processing technology
b	Supplemental Facility	Sorting and screening. Boiler, engine or other fuel consumer required	If fuel product boiler, engine or other fuel consumer required	Boiler, engine or other fuel consumer required

Note:
Solid Recovered Fuel (SRF) production as a NHSM where the fuel is combusted in an Industrial Boiler subject to 40 CFR Section 112 of the Clean Air Act has been completed commercially in the US only in the last few years. Refer to Section 5 for further discussion of SRF. Municipal Solid Waste (MWC) facilities combusting RDF are subject to 40 CFR Section 129.

4 Benefits and Obstacles

Thermal Technologies

Direct Combustion

Direct combustion technologies have a long history of reliable commercial-scale operation and are flexible enough to handle a variety of feedstocks with little to no pre-processing requirements. Benefits of this technology are the local energy production and potential uses of the by-products, which include ferrous metals, nonferrous metals, and in some cases may include use of ash as landfill cover. Developing the technology can create a number of construction jobs over the one to three years of construction and 40 to 80 permanent jobs over the life of the project. This technology generally requires a large waste stream (200,000 tons per year or more) to be economically beneficial. Normally the feedstock is MSW, but most combustible wastes can be processed. In addition, although the technology recycles and re-uses water on-site, it also requires a moderate use of water. However, high capital and operating costs, particularly for smaller scale facilities, and strong opposition from environmental groups, due to a perception by the public that this technology is not environmentally friendly, make implementing projects very difficult. The current low pricing for electricity and natural gas makes the energy produced from these technologies (steam and/or electricity) of low value. This technology produces an ash residue stream of approximately 15 to 30 percent by weight of the incoming waste stream; however, development efforts are underway to utilize portions of the ash stream. Volume reduction of the ash residuals is approximately 90 percent before any ash reuse resulting in significant savings in landfill space.

Gasification

Gasification operators assert that one of the benefits of many gasification technologies is that very high diversion levels (above 90 percent) can be achieved because the slag is not leachable and can be sold as aggregate to industrial users. Other benefits include energy production, or a liquid fuel if the syngas produced is further cleaned and passed through a catalytic process (e.g. Fischer-Tropsch). Potential uses of ferrous metal and ash by-products are as landfill cover or as an aggregate in the construction industry. Local benefits include the creation of construction jobs over the one to three years of construction and 25 to 75 permanent jobs over the life of the project. The technology may be more suitable for small or medium sized plants than direct combustion and has been developed most frequently in Japan and South Korea. However, these benefits have not been reliably demonstrated as commercial facilities in the US.

Theoretically the emissions should be lower for most vendors than that from direct combustion, and the vendors of this technology claim this is true. However, to date, actual emissions from operating facilities have been difficult to obtain or verify due to the lack of commercial-scale facilities using mixed MSW in North America. In some cases, facilities that used to be defined as two-stage direct combustion may now identify as gasification processes since the primary chamber is intended to operate in a reducing environment and burnout of gases produced is completed in a secondary chamber. The technology may have some applicability processing a specific subset of waste materials (not just MSW) such as wood waste, tires, carpet, scrap plastic, or other waste streams.

A large number of equipment suppliers are working on gasification processes. Some technologies may require extensive pre-processing, shredding, and other fuel preparation, which increases capital and operating costs. This remains one of the most difficult tasks in the process. It involves significant mechanical processing and close supervision, which greatly impacts operating costs and can account for as much as 40 percent of the total plant capital costs. The capital cost of the 220 tpd Thermiska TPS plant in Italy was approximately $170m USD with the RDF plant making up about $63m (37 percent) of that cost. The current low pricing for electricity and natural gas makes the energy produced from these technologies (steam and/or electricity) of low value. Research and development by technology vendors, such as Sierra, may improve economics if production of H_2 and other useful by-products is successfully demonstrated.

Plasma Arc Gasification

Similar to the gasification and pyrolysis processes, no commercial PAG facilities are operating in the US. For plasma arc systems, the MSW feedstock will need to be pre-processed to remove the larger, bulky waste, household hazardous waste, dirt, glass/grit, and metals to prevent these materials from forming slag and causing potential operating issues. Benefits include a claimed over 95 percent diversion of waste from landfills, energy production, and potential use of ferrous metal by-products and the slag formed and marketed as aggregate (although no markets currently exist for this product). The slag that is produced is vitrified, locking up trace metals, and is not leachable. Vendors of this technology claim efficiencies that are higher than direct combustion and other gasification technologies. These higher efficiencies may be possible if a combined cycle power system is proposed; however, little operating experience and no commercial experience in North America are available for this technology. A local benefit is the creation of construction jobs over the one to three years of construction and 25 to 60 permanent jobs over the life of the project.

Vendors of this technology claim to achieve lower emissions concentrations than traditional mass burn technology. However, similar to other thermal technologies, APC equipment would still be required for the clean-up from the combustion of the syngas as these facilities generally have similar air emissions issues as other gasification, pyrolysis, and direct combustion facilities. Mercury and some other more volatile metals are expected be driven off with the gas and would have to be dealt with from the exhaust of the gas combustion device. It should be noted that although the technology recycles and re-uses water on-site, it requires a moderate amount of make-up water. Although there are some commercial scale facilities operating on sorted MSW in Europe and Asia, there has been very limited commercial application using mixed MSW in North America. In the past few years several significant setbacks occurred at facilities. In North America the shutdown or termination of development of a nearly commercial scale facility occurred and in England shutdown of the largest plasma arc facility constructed to date occurred due to design and operational difficulties and costs. The 1,000 tpd, 50MW, Tees Valley Westinghouse Plasma Gasification Facility units in the United Kingdom (efforts to commission and test have been discontinued) each had a total capital investment of $500,000,000. Annual potential operating costs are unknown but are assumed to be as high, if not higher, than other gasification technologies.

Pyrolysis

MSW pyrolysis has had limited operational history and no commercial success to date; therefore, there is little information regarding long-term operating experience. As there are not many pyrolysis units functioning at a high level of capacity using MSW as a feedstock, the industry needs more time developing this technology. Some development is underway for select waste streams, such as hard to recycle plastics.

Benefits include a claim of over 90 percent diversion of waste from landfills, energy production, and potential uses of the by-products, if marketable. The liquid fuels produced may be higher value and suitable for internal combustion engines and combustion turbines. Other local benefits include the creation of construction jobs over the one to three years of construction and a certain amount of permanent jobs over the life of the project. This figure cannot be estimated as the technology requires additional development.

Biological Technologies

Aerobic Composting
Benefits include diversion of yard/green waste, the possibility of including food waste from being landfilled, and the local production of beneficial use compost and mulch that can be used in the community. In addition, local benefits include the creation of construction jobs over the short period of construction and approximately 2-10 permanent jobs over the life of the project, depending on the size and complexity of the facility. The main drawback is the potential for creating odors, noise, and dust. This process also requires more land than AD. This can be mitigated with proper operations and facility siting (which is generally in agricultural lands away from urban development). Aerobic composting also only addresses certain segments of the waste stream. The technology can be used to manage storm debris, such as derecho wastes; however, those waste streams must be handled separately and kept free of miscellaneous trash and other contaminants.

Anaerobic Digestion
There are a number of anaerobic digestion systems of varying types in operation in the US. Generally, however, the systems are in operation where tipping fees are higher than in the Midwest or where other special circumstances exist. Potentially, the agribusiness firms in CRLCSWA's service area could be leveraged in a public-private partnership arrangement to develop a project. Benefits of this technology include diversion of putrescible waste (food, biosolids, wet organics) from landfill, the production of renewable energy and or renewable fuels, and potential uses of the by-products as compost. In addition, other local benefits include the creation of construction jobs over the year or so of construction and approximately 10 to 25 permanent jobs over the life of the project, depending on the size and complexity of the facility. The biogas produced can also be cleaned and compressed into CNG for vehicles or cleaned and sold directly to a natural gas pipeline. The drawbacks of AD technology include the limitation of the technology to process only the feedstock appropriate for the technology (putrescible organics), as well as the potential for creating odors, noise, and dust. Wet systems are most sensitive to the types of waste utilized with plug systems being somewhat more tolerable. Dry systems are able to accept a wide range of feedstocks that are generally similar to compost (stackable). All AD systems have the potential for odor problems. The management of odors, noise, and dust can be mitigated with proper operations and facility siting. However, they can be quite challenging for facilities that process a wider range of feedstock.

Mechanical Biological Treatment
A benefit is the post-collection separation of feedstocks to divert recyclables from landfill while preparing a feedstock for digestion and thermal consumption. Some processes may produce a fuel suitable for use in industrial boilers and cement kilns. Another benefit is the creation of construction jobs over the construction period and approximately 10 to 50 permanent jobs over the life of the project. The primary drawback is the necessity for the process to rely upon the sale of the fuel product

for economic viability. As much as 40-50 percent of the incoming waste stream winds up as non-digestible residue that either requires processing from another thermal technology and/or landfilling. Without a firm contract for the fuel product, an MBT is economically viable and, in almost all cases, the cost of producing the fuel is more expensive than conventional fuels. Some facilities have high capital and/or operating costs. Other operating drawbacks include the potential for creating odors, noise, and dust. This can be mitigated with proper operations and facility siting. The opening of the Entsorga HEBioT MBT facility has helped demonstrate the potential for this technology to deliver a fuel product that is commercially viable.

Chemical Technologies

Hydrolysis

The process of chemical hydrolysis is well established for some organic feedstocks, such as in the conversion of wood to paper pulp, but has only been applied to MSW-derived organics on a conceptual basis or has been limited to laboratory- or pilot-scale. There has been no sustained commercial application of this technology using MSW as a feedstock in North America and little information is available from abroad.

Similarly, the environmental risks are not well defined. In addition to the environmental risks of any associated technology, there would be some emissions risks related to CH_4 emissions or issues dealing with potential chemical spills. It is also expected that significant quantities of water and significant wastewater capacity would be required.

Benefits include the diversion of organic waste from landfill, the production of a cellulosic ethanol that can be used as a fuel product, the creation of construction jobs over the construction period, and the creation of a certain number of permanent jobs over the life of the project. This figure cannot be estimated as the technology requires additional development.

Catalytic and Thermal Depolymerization

Benefits include the diversion of plastic and oil waste from landfill, the production of an oil or fuel product that can be used as fuel (possibly a transportation fuel), the creation of construction jobs over the construction period, and the creation of a certain amount of permanent jobs over the life of the project. This figure cannot be estimated as the technology requires additional development. A major drawback is that the environmental risks are not well defined. Catalytic cracking could emit some hydrocarbons from the process. There could also be some other risks resulting from the handling of the catalysts or solvents and related compounds that might be required for the process. Water and wastewater use are also not known.

Waste-to-Fuel Technologies

Given the emerging status of this technology with MSW, there is minimal information available on this technology. There are no commercial projects in operation in the US, although a few firms are trying to develop projects. This is a two-step process:

1) Producer gas will need to be generated through gasification or another technology, and
2) The producer gas will then need to be cleaned and conditioned with the proper chemical catalytic process used to synthesize the syngas into a liquid fuel.

Benefits include the potential production of an ethanol-based fuel, the creation of construction jobs over the construction period, and the creation of a certain amount of permanent jobs over the life of the project. Drawbacks include air emissions impacts associated with the thermal gasification and syngas conditioning processes and the potential for only being able to produce fuel from a biomass only feedstock. In addition, there are solid and liquid wastes associated with this technology. The current low oil pricing in the US also makes the sale of the liquid fuel less valuable and may impact the financial viability of the project.

Mechanical Technologies

Autoclave/Steam Classification
Benefits include the potential diversion of materials from landfill, the production of cellulose and plastic products that can be used as feedstock for many of the technologies, the creation of construction jobs over the construction period, and the creation of a certain amount of permanent jobs over the life of the project. This figure cannot be estimated as the technology requires additional development and no commercial projects exist in the US. A drawback is that the environmental risks of autoclaving are not known. This technology could be used primarily as a front-end system to prepare materials for other processes, such as fiber recovery and thermal technologies. However, it relies on additive technology for the most diversion potential and thus struggles economically. Water and wastewater use are also not known.

Mixed Waste Processing
Benefits include the diversion of recyclables from landfill; preparation of feedstock for thermal, chemical, or biological processes; the creation of construction jobs over the one to two year construction period; and the creation of approximately 20 to 60 permanent jobs, depending on the size and complexity of the project. A drawback is that certain environmental impacts must be mitigated, such as noise, dust, and odor. The diversion rate for this technology alone is lower unless coupled with another technology for management of the non-recyclable materials. Currently, onlay a few facilities in the US are used to pre-screen MSW before processing in another technology, such as direct combustion. In addition, some of the commodities recovered from a MRF of this type may be more contaminated than a “clean” MRF. Current commodity pricing also impacts the financial viability of these projects and some of the commodities that are readily recoverable, such as wood and concrete, are low value.

Refuse Derived Fuel Production
Benefits include the preparation of the MSW into a feedstock that is acceptable by other processes allowing them to be more effective and efficient, removal of recyclable and reusable materials for beneficial use; the creation of construction jobs over the one to two year construction period, and the creation of approximately 10 to 100 permanent jobs, depending on the size and complexity of the project. A drawback is that RDF facilities will have some air emissions directly from the processing (dust) as well as from the combustion of the RDF (discussed in the thermal technologies section). An economic drawback of RDF is that it produces a solid fuel similar to coal. An example may be partnership with an ethanol or agribusiness facility that can us the steam, hot water, and/or electricity produced from RDF processed in a solid fuel boiler. As a result, production of the RDF product presumes a local appetite for a coal-substitute to be economically viable. For most plants looking for a coal substitute, the fuel produced must also achieve the requirements for an NHSM if the plant

wants to be regulated under Section 112 of the Clean Air Act. To distinguish this application from RDF production for a MWC combustion unit, processing required for a boiler subject to Section 112 is called SRF in this report. Refer to Section 5 for further discussion. Fugitive particulates from the process must be controlled. In addition, other environmental impacts, such as noise and odor, must be mitigated. Costs for this type of facility are based greatly on the amount of revenues garnered from sale of the RDF product.

Infrastructure Options

Refinement of Options for Detailed Analysis

8/23/21

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EXECUTIVE SUMMARY

The Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) has provided collaborative feedback during the early stages of the Forward 2044 Waste Management System Evaluation to enable the refinement of future options. The refinement of options is based on information captured in the Alternative Technologies, Waste Volumes, and Management Practices memos. The combination of future options (scenarios) captured in this memo will be further evaluated in the Infrastructure Options Analysis. The quantity and types of wastes managed by the specific technologies identified in each scenario will be evaluated to determine the landfill diversion potential, thus determining the size range for the potential facility and landfill. These steps will provide enough information to begin to refine and compare the capital, operating and maintenance costs at a macro level. The scenarios will be evaluated for economic viability, environmental soundness, social acceptability, and social benefits through the Sustainable Return on Investment (SROI) process.

A project specific CRLCSWA Board Workshop was held on June 23, 2021. Based on the feedback received, the following criteria were developed to guide the next steps. The criteria were used to analyze infrastructure options and develop scenarios as part of the Forward 2044 Waste Management System Evaluation.

Criteria:

A. Cost to Plan, Permit, Construct and Startup – Options should limit the need for bonding to finance facility planning, permitting, construction and startup.

B. Timeline to Plan, Permit, Construct and Startup – The most recent airspace calculation at Site 2 indicates availability through 2038; therefore, technologies and facilities considered need to meet a timeline to plan, permit, construct, and startup of 15 years or less.

C. Proven Technologies – Technologies and facilities must be commercially operational (5 years of successful, at-scale operation) in the United States (US) to be considered.

D. Waste Processed – Technologies and facilities must be able to manage the materials that make up the largest portions of CRLCSWA's or region's waste stream to be considered.

E. Waste Volume Alignment - Technologies/facilities to be considered can manage the projected volumes (Agency or regionally) of the waste stream for which that program or technology is dedicated.

REFINEMENT

Based on the criteria, along with HDR's findings, some technologies do not have projects that are adequately developed or suitable for further consideration at this time, mostly due to the level of commercial development with respect to being capable of processing MSW as feedstock, economic feasibility, or both. **This status will change in some cases as the technologies advance, but the rate of advancement is unknown.** To meet the need of a disposal solution specific to Linn County, Cedar Rapids, and the surrounding area, a developed technology is necessary. The technologies that currently do not have fully developed commercial facilities, and therefore are not recommended for further consideration, include:

- Plasma Arc Gasification
- Pyrolysis
- Hydrolysis
- Catalytic and Thermal Depolymerization
- Autoclaving

Some of the remaining technologies are considered to have limitations with respect to the types and quantities of feedstock they can process. There are technology categories where some suppliers may have developed a technology, but the process is not viable due to the elevated cost for development and operation in the range of several hundred dollars per ton processed. Further investigation or technology development specific to CRLCSWA would be required for the following technologies to determine if an application might be appropriate:

- Gasification
- Mechanical Biological Treatment
- Waste-to-Fuels

Based on the criteria described above and the feedback received during the project workshop with the CRLCSWA Executive Board of Directors on June 23, 2021, the alternative technologies that represent viable systems that meet CRLCSWA's future needs include:

- Direct Combustion (Waste-to-Energy)
- Aerobic Composting
- Anaerobic Digestion
- Mixed Waste Processing
- RDF Processing [also known as Process Engineered Fuels (PEF)]

The following table presents the alternative technology refinement, as discussed above, where the technologies are evaluated based on the selection criteria developed by the Board. A further discussion on the consideration and refinement process can be found in Section 3.

Alternative Technology Refinement

Selection Criteria	Alternative Technologies												
	Plasma Arc Gasification	Pyrolysis	Hydrolysis	Catalytic and Thermal Depolymerization	Autoclaving	Gasification	Mechanical Biological Treatment	Waste-to-Fuels	Direct Combustion	Aerobic Composting	Anaerobic Digestion	Mixed Waste Processing	Refuse Derived Fuel Processing
Cost to Plan, Permit, Construct and Startup – Limit Need for Bonding										X	X	X	X
Timeline to Plan, Permit, Construct and Startup – <15yrs								X	X	X	X	X	X
Proven Technologies – Commercial >5yrs in US									X	X	X	X	X
Waste Processed – Primary Waste Streams		X				X	X	X	X	X	X	X	X
Waste Volume Alignment – Linn County and/or Region	X					X	X		X	X	X	X	X

The viable technologies that meet many of the selection criteria also have the potential for significant solid waste diversion and the ability to provide a long-term financial solution. The viable technologies are incorporated into scenarios for evaluation in the next step of the Forward 2044 Planning project.

The following table lays out scenarios, incorporating combinations of the viable technologies, with CRLCSWA assuming responsibility for its waste in Scenarios 1 through 5 and a Partner / Regional approach for Scenarios 6 through 8. A further discussion on the decision points that will be required to adequately consider the scenarios can be found in Section 2.

WASTE SOLUTION SCENARIOS

Waste Solution Scenarios						Partner / Regional Approach		
	1	2	3	4	5	6	7	8
New Landfill (CRLCSWA Owned)	X		X	X	X			
Partner Landfill		X				X	X	X
Waste Transfer		X				X	X	X
HHM	X	X	X	X	X	X	X	X
Resource Recovery Center (RRC)	X	X	X	X	X	X	X	X
Aerobic Organics Composting	X	X	X	X	X	X	X	X
Anaerobic Digestion (Green Waste/Food)				X			X	
RDF (mixed waste) Processing			X			X		
Direct Combustion (WTE)					X			X

For these long-term management scenarios to be viable, the current 28E agreement will need to be revised, amended, or an entirely new agreement drafted to incorporate the future site locations, partners, etc., included in the preferred approach.

NEXT STEPS

These scenarios will be further evaluated along with the waste composition and quantity data developed in the Analysis of Infrastructure Options and technical memorandum will be prepared summarizing the findings for next step determination upon completion. The following activities and timelines are planned for the remainder of the project.

- Infrastructure Options Analysis – Sep 2021 through Jan 2022 (Routine Board Updates)
- Facility Tours – Sep/Oct 2021
- Stakeholder Engagement Meetings – Sep 2021 through Apr 2022

1 Introduction & Purpose

The Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) is researching relevant existing information to form the basis for evaluating infrastructure related options to address current and future solid waste demands within Linn County and the regional area (Region). As of June 30, 2044, Site #2, where the current landfill operations, household hazardous waste program, and acceptance of recyclables occur, can no longer be used for anything other than post-closure activities[1]. This technical memorandum addresses the setup for the detailed Infrastructure Options Analysis on the path toward better long-term management of waste resources beyond that date. For these long-term management scenarios to be viable, the current 28E agreement will need to be revised, amended, or an entirely new agreement drafted to incorporate the future site locations, partners, etc., included in the preferred approach.

This Infrastructure Options Analysis builds on the analysis of the potential alternative technologies that could be used or are in development for managing CRLCSWA's and the Region's waste and applies the information to the potential infrastructure. Section 3 provides a brief overview explaining why some potential technologies are no longer recommended for consideration at this point in the technology development curve and identifies those that may play a role in future waste management for CRLCSWA and the Region.

2 Infrastructure Options Analysis Criteria

Iowa's waste management hierarchy, as set out in Iowa Code 455B.301a, was used as the initial basis to determine CRLCSWA options. This includes:

- Volume reduction at the source
- Recycling and reuse
- Waste conversion technologies
- Combustion with energy recovery
- Other approved solid waste management techniques including but not limited to combustion for waste disposal and disposal in sanitary landfills

To support CRLCSWA's goals and objectives, the following criteria were developed from the feedback received at the CRLCSWA Board Workshop on June 23, 2021. The criteria were used to analyze infrastructure options as part of the Forward 2044 Waste Management System Evaluation.

[1] CRLCSWA 28E Agreement and 2005 Settlement Agreement with City of Marion

Criteria:

A. Cost to Plan, Permit, Construct and Startup – Options should limit the need for bonding to finance facility planning, permitting, construction and startup.
B. Timeline to Plan, Permit, Construct and Startup – The most recent existing airspace calculation at Site 2 indicates availability through 2038; therefore, technologies and facilities considered need to meet a timeline to plan, permit, construct, and startup of 15 years or less.
C. Proven Technologies – Technologies and facilities must be commercially operational (5 years of successful, at-scale operation) in the United States (US) to be considered.
D. Waste Processed – Technologies and facilities must be able to manage the materials that make up the largest portions of CRLCSWA's waste stream to be considered, which primarily include municipal solid waste (MSW), organics, and construction and demolition (C&D) debris.
E. Waste Volume Alignment - Technologies and facilities must be able to manage the projected volumes of the waste stream for which that program or technology is dedicated to being considered.

A series of scenarios with CRLCSWA assuming responsibility for its waste are outlined below in Scenarios 1 through 5 and a Partner / Regional approach for Scenarios 6 through 8. It is important to understand several decision points that should be made prior to consideration of the scenarios.

Future of Site #2 (Marion Facility)

As of June 30, 2044, Site #2, where the current active Landfill and the Resource Recovery Building (RRB) is located, can no longer be used for anything other than post-closure activities[2]. As a result, the scenarios assume a new waste sustainability campus will need to be sited, permitted, and constructed to continue accepting MSW. A new Resource Recovery Center (RRC) will be evaluated for the management of household hazardous materials[3] and recyclables[4] in a similar manner as today. The management of hazardous materials is particularly critical to the safety and protection of people and natural resources.

Yard Waste and Landscape Debris (Green Waste) Management

CRLCSWA will continue to be responsible for managing yard waste and landscape debris (green waste). Natural disasters such as the 2020 Derecho have only exacerbated this need. All scenarios below assume CRLCSWA will continue to provide access for composting yard waste and leaves. Aerated (turned) windrow composting is assumed to be used where only green waste is

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[2] CRLCSWA 28E Agreement and 2005 Settlement Agreement with City of Marion
[3] https://www.solidwasteagency.org/hazardous-materials
[4] https://www.solidwasteagency.org/recycling

composted. Aerated windrow composting or aerated static pile (ASP) composting is assumed to be used if food scraps or digestate from anerobic digestion operating practices are managed.

Currently, CRLCSWA uses Site 3 for aerated (turned) windrow composting. According to the US Environmental Protection Agency (EPA), turned composting involves forming organic waste into rows of long piles called "windrows" and aerating them periodically by either manually or mechanically turning the piles. The Agency currently uses bulking agents (wood chips, etc.) to increase aeration of the compost material. An additional option is ASP composting. According to the EPA, ASP composting involves organic waste mixed in a large pile. To aerate the pile, layers of loosely piled bulking agents (e.g. shredded newspaper or wood chips) are added so that air can pass from the bottom to the top of the pile. The piles can often be placed over a network of pipes that deliver air into or draw air out of the pile.[5] These options will be further explored to determine which operation/technology best fits the composting needs of Linn County.

TABLE 1. WASTE SOLUTION SCENARIOS

Waste Solution Scenarios								
						Partner / Regional Approach		
	1	2	3	4	5	6	7	8
New Landfill (CRLCSWA Owned)	X		X	X	X			
Partner Landfill		X				X	X	X
Waste Transfer		X				X	X	X
HHM	X	X	X	X	X	X	X	X
Resource Recovery Center (RRC)	X	X	X	X	X	X	X	X
Aerobic Organics Composting	X	X	X	X	X	X	X	X
Anaerobic Digestion (Green Waste/Food)				X			X	
RDF (mixed waste) Processing			X			X		
Direct Combustion (WTE)					X			X

Scenario 1 – New Landfill (CRLCSWA Owned)

Scenario 1 evaluates the opening of a new landfill campus (CRLCSWA owned) due to the closure of the current Site #2 landfill and all associated facilities. A new landfill campus including a new RRC and composting facility would need to be sited, permitted, and constructed. Scenario 1

[5] https://www.epa.gov/sustainable-management-food/types-composting-and-understanding-process

aerobic composting facility (turned windrow or ASP) capable of composting green waste, food waste and other organics that are collected and processed separately from mixed waste.

Scenario 2 – Transfer to a Landfill Not Owned by CRLCSWA

Scenario 2 evaluates the transfer of waste to a landfill that is not owned and operated by CRLCSWA, due to the closure of the current Site #2 landfill and all associated facilities. This scenario would include siting, permitting and design of a transfer station and a new RRC facility owned and operated by CRLCSWA. MSW would be transferred to a landfill under contract and a potential 28E agreement would need to be negotiated between CRLCSWA and the other landfill for waste disposal. Scenario 2 assumes an aerobic composting facility (turned windrow or ASP), at the existing Site #3, that is capable of composting green waste, food waste and other organics that are collected and processed separately from mixed waste.

Scenario 3 – Mixed Waste Processing with New Landfill (CRLCSWA Owned)

Scenario 3 evaluates the addition of mixed waste processing (MWP) or production of Refuse-Derived Fuel (RDF) to sustainably manage the majority of the waste stream. This scenario will require the opening of a new landfill to manage MWP residue and non-processable materials, due to the closure of the current Site #2 landfill and all associated facilities. The materials processed and the products produced can be evaluated based upon the maximum potential landfill diversion. A new sustainable waste campus including the MWP system, new RRC, and composting facility would need to be sited, permitted, and constructed. Scenario 3 assumes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste, food waste and other organics that are collected and processed separately from mixed waste is sited, permitted, and operated.

Scenario 4 – Anaerobic Digestion with New Landfill (CRLCSWA Owned)

Scenario 4 evaluates the addition of anaerobic digestion (AD) of food scraps and other highly organic materials and the opening of a new landfill campus, due to the closure of the current Site #2 landfill with all associated facilities. A new sustainable waste campus including the AD facility, landfill, new RRC, and composting facility would need to be sited, permitted, and constructed. Scenario 4 assumes the current windrow composting facility at Site #3 closes. Scenario 4 includes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste and food waste that are collected and processed separately from mixed waste as well as digestate from AD.

Scenario 5 – Direct Combustion with New Landfill (CRLCSWA Owned)

Scenario 5 evaluate the addition of direct combustion of waste-to-energy generation and the opening of a new landfill for ash from combustion and non-processable materials, due to the closure of the current Site #2 landfill and all associated facilities. A new sustainable waste campus including the direct combustion facility, landfill, new RRC, and composting facility would need to be sited, permitted, and constructed. Scenario 5 assumes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste, food waste and other organics that are collected and processed separately from mixed waste.

Partner / Regionalization

The following scenarios all consider a regional service area resulting in a partnership with additional municipalities and a separate 28E agreement. In this manner, the partners can share in the benefits of the facility and reduce costs for all participants. CRLCSWA may lose some level of control with these scenarios.

Scenario 6 – Mixed Waste Processing with Regional Landfill

Scenario 6 evaluates the addition of mixed waste processing (MWP) or production of Refuse-Derived Fuel (RDF) to sustainably manage the majority of the waste stream. This scenario will include the transfer of MWP residue and non-processable materials to a regional partner landfill, due to the closure of the current Site #2 landfill and all associated facilities. A new sustainable waste campus including the MWP system, co-located transfer station, new RRC, and composting facility would need to be sited, permitted, and constructed; owned and operated by CRLCSWA. The by-product and non-processable materials would be transferred to a landfill under contract and a potential 28E agreement would need to be negotiated between CRLCSWA and the other landfill for disposal. Scenario 6 assumes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste, food waste and other organics that are collected and processed separately from mixed waste is sited, permitted, and operated.

Scenario 7 – Anaerobic Digestion with Regional Landfill

Scenario 7 evaluates the addition of anaerobic digestion (AD) of food scraps and other highly organic materials and the transfer of remaining waste materials to a regional partner landfill, due to the closure of the current Site #2 landfill and all associated facilities. The non-organic material would be transferred to a landfill under contract and a potential 28E agreement would need to be negotiated between CRLCSWA and the other landfill for disposal. A new sustainable waste campus including the AD facility, co-located transfer station, new RRC, and composting facility would need to be sited, permitted, and constructed; owned and operated by CRLCSWA. Scenario 7 assumes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste and food waste that are collected and processed separately from mixed waste as well as AD digestate.

Scenario 8 – Direct Combustion with Regional Landfill

Scenario 8 evaluates the addition of a direct combustion of waste-to-energy generation and the transfer of ash from combustion and non-processable materials to a regional partner landfill, due to the closure of the current Site #2 landfill and all associated facilities. A new sustainable waste campus including the direct combustion facility, co-located transfer station, new RRC, and composting facility would need to be sited, permitted, and constructed; owned and operated by CRLCSWA. The by-product and non-processable materials would be transferred to a landfill under contract and a potential 28E agreement would need to be negotiated between CRLCSWA and the other landfill for disposal. Scenario 8 assumes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste, food waste and other organics that are collected and processed separately from mixed waste.

3 Alternative Technology Development and Implementation Considerations

Several potential alternatives have been identified for future waste management. Based on the established criteria, along with HDR's findings, some technologies do not have projects that are adequately developed or suitable for further consideration at this time, mostly due to the level of commercial development with respect to being capable of processing MSW as feedstock, economic feasibility, or both. Complete systems with all the necessary facility components have not been demonstrated to be economically viable in the US for some technologies at this time. **This status will change in some cases as the technologies advance, but the rate of advancement is unknown.** To meet the need of a disposal solution specific to Linn County, Cedar Rapids, and the surrounding area, a developed technology is necessary. The technologies that currently do not have fully developed commercial facilities, and therefore are not recommended for further consideration, include:

- Plasma Arc Gasification
- Pyrolysis
- Hydrolysis
- Catalytic and Thermal Depolymerization
- Autoclaving

Our findings also concluded that some of the remaining technologies considered do not meet the criteria with respect to the types and quantities of feedstock they can process. For example, waste-to-fuels facilities may be able to address select plastic waste streams but cannot generally tolerate out of specification materials that will be part of the feedstock coming from a municipal waste system. The technology may be designed to process certain types of plastics, such as HDPE but may not be able to tolerate residual PET or PVC plastics or non-plastic contaminants such as food waste, paper and metal that would likely be in the feedstock. There are also a few technology categories where some suppliers may have developed a technology, but the process is not viable due to the elevated cost for development and operation in the range of several hundred dollars per ton processed, thus not meeting criteria. For example, gasification is used in some facilities in Japan and other countries, in many cases with exceptionally high tipping fees, but have not been economically feasible in the US. While several technologies are being developed at this time, gasification systems in the US have also tended to be small scale, special use facilities. While some technologies are not suited to processing the entire spectrum of waste discards, the use of mechanical biological treatment in combination can result in a viable waste management system. This technology has some commercial applications, mostly outside the US in areas with higher tipping fees or landfilling restrictions, and HDR anticipates the technology requires continued development to be commercially viable for CRLCSWA. Further investigation or technology development specific to CRLCSWA would be required for the following technologies to determine if an application might be appropriate:

- Gasification
- Mechanical Biological Treatment
- Waste-To-Fuels

Based on the criteria developed from the feedback received during the CRLCSWA Executive Board of Directors Workshop on June 23, 2021, the alternative technologies that represent viable systems that meet CRLCSWA's future needs include:

- Direct Combustion (Waste-to-Energy)
- Aerobic Composting
- Anaerobic Digestion
- Mixed Waste Processing
- RDF Processing [also known as Process Engineered Fuels (PEF)]

These proven technologies have the best promise of being developed (having been successfully implemented elsewhere in the US), have the potential for significant solid waste diversion and have the potential to provide a long-term financial solution. A few key points to consider for each alternative are addressed below. The capital and operating costs provided are considered preliminary, typical, are highly dependent on the specific project and will be refined as scenarios are developed. In all cases, a public-private partnership could be arranged for the construction and operation of the facility. CRLCSWA could also construct and operate the facility.

The following table presents the alternative technology refinement, as discussed above, where the technologies are evaluated based on the selection criteria developed by the Board.

Alternative Technology Refinement

Selection Criteria	Alternative Technologies												
	Plasma Arc Gasification	Pyrolysis	Hydrolysis	Catalytic and Thermal Depolymerization	Autoclaving	Gasification	Mechanical Biological Treatment	Waste-to-Fuels	Direct Combustion	Aerobic Composting	Anaerobic Digestion	Mixed Waste Processing	Refuse Derived Fuel Processing
Cost to Plan, Permit, Construct and Startup – Limit Need for Bonding										X	X	X	X
Timeline to Plan, Permit, Construct and Startup – <15yrs								X	X	X	X	X	X
Proven Technologies – Commercial >5yrs in US									X	X	X	X	X
Waste Processed – Primary Waste Streams		X				X	X	X	X	X	X	X	X
Waste Volume Alignment – Linn County and/or Region	X					X	X		X	X	X	X	X

The viable technologies that meet many of the selection criteria also have the potential for significant solid waste diversion and the ability to provide a long-term financial solution. The viable technologies are incorporated into scenarios for evaluation in the next step of the Forward 2044 Planning project.

Direct Combustion

Direct combustion with mass burn WTE technology could be completed for much of the post-recycling MSW stream. The commercial waste and C&D waste streams would need to be evaluated to determine how much could be processed. Of these alternatives, this option, or possibly RDF processing, would result in the largest landfill diversion. This option would have the fewest pre-processing requirements for the waste stream. Economics are driven heavily by the recovered energy markets. Most facilities produce electricity, but steam sales usually offer better economics (if a steam customer could be identified). For the combustible portions of the waste stream, about an eighty percent reduction in weight and ninety percent volume reduction is possible. Residual metal not recovered with recycling can be captured, but disposal of ash and residues is currently required. Reuse of certain portions of the ash stream is in development and may be possible in the future; however, at this time it should be assumed that the ash residue, approximately 10-20 percent of the processed waste stream, will need to be disposed in a landfill. If regulations allow contact of ash with waste within the landfill, it may be used for alternative landfill applications such as daily cover material or roadbed construction.

A mass burn facility will require solid waste, Title V air emission permits and will have some other permitting requirements for any wastewater in addition certain other requirements. Based upon a limited number of recent projects, facility capital development cost may be in the range of $350,000 to $450,000 per ton per day. In other words, a 750 tons per day (tpd) facility would likely have a capital cost between $263 million and $338 million. The operating cost may be in the range $80 to $120 per ton of MSW processed.

Aerobic Composting

Aerobic composting is commonly used for green waste and certain other organics and can be expanded to accommodate food waste if mechanized aeration systems are added to maintain aerobic conditions. Composting is also used to manage residual digestate from AD operating practices (see the Anaerobic Digestion section below). This technology is best applied to mixed green waste and yard waste, as is applied by CRLCSWA currently, which can be a significant percentage of the waste stream. Diversion can be increased further if an effective food waste collection system is developed, although additional measures are needed for odor control and removal of non-compostable contaminants.

Solid waste and stormwater permits would be required for a composting operation. An aerobic composting operation may require approximately $5 million to $10 million to set up depending on the area, throughput, technology used, etc., and an operating fee of approximately $30 to $75 per ton processed.

Anaerobic Digestion

A newer biological technology includes a variety of different types of AD. This type of technology has advanced significantly in the US for managing organic and food wastes. The AD process involves allowing bacteria to consume the organic material in a vessel without oxygen. An AD process produces a mixture of methane and other gases called biogas. Biogas can be collected from the digestion process and, with proper refinement systems, can be used for applications where natural gas (methane) is used. These include fuels such as compressed natural gas, renewable natural gas or the production of electricity directly from the biogas.

Most AD systems require digestible material, such as food waste, to be separated from materials that do not digest, such as packaging or mixed waste. To accomplish this, collecting organics separately is one of several approaches to isolate organics from municipal waste. Other approaches include the use of certain equipment to extract organics from select MSW loads of organic rich material. A final approach is to only collect very clean, digestible material from sources with very high quantities who will participate in the program such as grocery stores, food pantries, food/beverage manufactures, etc.

All biological systems (AD and composting) are maximized if an effective collection system is developed that is appropriate for the selected type of technology. There are technologies available that can extract organic material from mixed waste by pressure, screening, hydropulping, etc. However, these technologies, for the most part, are expensive and have high operating costs. The specific type of AD or composting system employed is subject to the types of wastes that will be managed.

Insomuch as these systems are enclosed in a vessel, the biogas produced requires special collection and control systems to use the methane portion of the biogas for energy or fuel production beneficially. However, trace emissions from these facilities can be highly odorous. Odor management will be necessary for this type of facility as well as the downstream stabilization of the undigested portion, which is typically managed in the aerobic or composting process.

Solid waste and wastewater permits would be required for an AD facility and potential other permitting requirements will be needed depending on how the gas produced might be utilized, for wastewater, and other needs. The cost of an AD system will need to be developed that reflects the anticipated types and quantities of feedstock available.

Mixed Waste Processing

Mixed waste processing could be implemented as a starter technology designed to increase diversion. A new mixed waste processing facility may be paired with other systems, such as a RDF facility, as a way to improve the quality of the by-product (see the RDF Processing section below). The most effective application for CRLCSWA may be a facility that focuses on C&D wastes and extracts green waste, wood, cardboard, metal, shingles, film plastic sheeting, concrete and other construction related material. Recovery of these materials can significantly increase the waste tonnage diverted, but these materials are often lower in value unless there are specific markets available. In some cases, the facility can be used to recover organics. However, the quantity and quality of the recovered materials may not be cost effective. The green waste may be incorporated into a composting or aerobic operation. Removal of these materials may allow for better recovery of recyclable containers not captured by the existing curbside single stream program. A facility could be built with the ability to change the recovered material mix, adapting by season, processing equipment or identified markets.

Mixed waste processing facilities would require solid waste permitting, similar to that required by other MRFs and transfer stations. Capital development costs, excluding land acquisition, for a low technology mixed waste MRF capable of processing 30,000 to 50,000 tons per year would likely be in the $20 million to $40 million range, but would vary based upon the size, type of processing, site constraints or other issues.

Refuse-Derived Fuel Processing

There may be a cement kiln, ethanol plant, or other industrial or agribusiness facility with industrial boilers or kilns interested in using RDF as a substitute for coal, oil, wood or biomass fuels used at the facility for heat, steam or electrical energy. These facilities are regulated by the EPA under the Clean Air Act (CAA) Section 112 or Section 111 and would most likely want to remain with that designation. The EPA is encouraging the development of non-hazardous secondary materials (NHSM) that can be used as a fuel substitute for traditional fuels. Creating RDF may allow for classification of the product as a non-waste product which limits the CAA requirements. Under NHSM provisions and certain management practices, certain materials usually considered to be wastes can be used as a traditional fuel If one or more local solid fuel fired facilities can be identified, it may be possible to produce a fuel, meeting EPA requirements, that can offset fossil fuel combustion. A cement kiln is ideal because these facilities may be able to incorporate the ash residuals into their products, further increasing diversion. Use of waste derived fuels may have greenhouse gas emission reduction benefits as well.

The processing system to generate the fuel could be incorporated with a MWP facility, but it must be capable of achieving the fuel requirements consistently. MWP typically would use optical sorters or other screening measures to remove PVC plastics and other chlorine containing materials as well as metals and inert fines, such as glass and grit. Removal of some items, such as fine organics, will help reduce the moisture. Items of concern for use of the fuel are chlorine content, ash content, and moisture. If potential users are identified, further analysis would be necessary to determine if a fuel could be produced at an acceptable cost.

An RDF processing facility will require solid waste permits and will have some other permitting requirements for wastewater and possibly air emissions control permitting if drying or certain other requirements are needed. These permits do not address the industrial boiler or cement kiln permitting requirements. Facility capital development cost may be in the range of $50 million to $100 million. The operating cost may be in the range of $35 to $100 per ton of MSW processed. These values could vary depending on the specific technologies used, the value of the RDF by-product, etc. This technology is only viable if a suitable facility is identified that can use the fuel produced and an agreement is developed.

4 Next Steps

These scenarios will be further evaluated along with the waste composition and quantity data developed in the Analysis of Infrastructure Options. Using this information, the quantity and types of wastes managed by the specific technologies identified in each scenario will be evaluated to determine the landfill diversion potential, thus determining the size range for the potential facility and landfill. These steps will provide enough information to begin to refine and compare the capital, operating and maintenance costs at a macro level. In this manner, the scenarios, including siting a new landfill, long haul transfer station, and others, can become more comparable. The scenarios will be evaluated for economic viability, environmental soundness, social acceptability, and social benefits through the Sustainable Return on Investment (SROI) process. A technical memorandum will be prepared summarizing the findings for review and comment by CRLCSWA. The findings will be presented to the CRLCSWA Board for next step determination upon completion.

The following activities and timelines are planned for the remainder of the project.

- Infrastructure Options Analysis – Sep 2021 through Jan 2022 (Routine Board Updates)
- Facility Tours – Sep/Oct 2021
- Stakeholder Engagement Meetings – Sep 2021 through Apr 2022

Environmental Justice Snapshot

April 4, 2022

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Appendices

Acronyms and Abbreviations

AADT	Average Annual Daily Traffic
ACS	American Community Survey, used to estimate demographics in the U.S. during years when there is not a census
Communities of Concern	Any geographic unit with a population of people of color and/or a population experiencing poverty that is higher than a certain threshold
CRLCSWA	Cedar Rapids Linn County Solid Waste Agency
EJ	Environmental Justice
EJScreen	The EPA's Environmental Justice Screening and Mapping Tool
EPA	Environmental Protection Agency
HHW	Household Hazardous Waste
km	Kilometers
LUST	Leaking Underground Storage Tanks
m^3	Meters cubed (measurement of volume)
µg	Microgram
NAAQS	National Ambient Air Quality Standards
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
$PM_{2.5}$	Air pollutant composted of tiny particles in the air that reduce visibility and cause the air to appear hazy when levels are elevated
ppb	Parts per Billion
ppm	Parts per Million
SROI	Social Return on Investment
UST	Underground Storage Tank
VMT	Vehicle Miles Traveled

Executive Summary

Environmental justice (EJ), as defined by the U.S. Environmental Protection Agency (EPA), is the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.[1] The environmental justice framework was developed in response to the observation that environmental factors disproportionately affect minority and low-income communities. The goal of environmental justice is to achieve equal protection from environmental and health hazards, and equal access to the decision-making process to have a healthy environment in which to live, learn, and work. Conducting an environmental justice review is considered best practice in planning for development and construction projects. Additionally, the 2021 US Infrastructure Bill requires that infrastructure projects that receive federal funding conduct an environmental justice assessment.

The Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) aims to be a responsible steward of its resources and consider its impacts on the local community. CRLCSWA has therefore elected to include environmental justice considerations in its long-term planning and decision-making processes. These include concerns from minorities and low-income populations, as well as potential environmental and health impacts

CRLCSWA is currently undergoing the Forward 2044 Waste Planning project. During this process, CRLCSWA is evaluating eight scenarios for the collection, management, and transfer of municipal solid waste (MSW), Household Hazardous Waste (HHW), yard waste, wood waste, recycling, and other materials generated by households, business, and industry within Linn County.

[1] https://www.epa.gov/environmentaljustice/learn-about-environmental-justice

Waste Solutions Scenarios

	New landfill (Solid Waste Agency owned)	Partner landfill	Waste transfer	Household hazardous materials	Resource Recovery Center	Aerobic organics composting	Anaerobic digestion (green waste/food)	Refused derived fuel (mixed waste) processing	Direct combustion (waste to energy)	
1 New landfill	●			●	●	●				
2 Transfer to Landfill Not owned by CRLCSWA		●	●	●	●	●				
3 Mixed Waste Processing with New Landfill CRLCSWA Owned	●			●	●	●		●		
4 Anaerobic Digestion with New Landfill CRLCSWA Owned	●			●	●	●	●			
5 Direct Combustion with New Landfill CRLCSWA Owned	●			●	●	●			●	
6 Mixed Waste Processing with Partnered Landfill		●	●	●	●	●		●		Partner/regional approach
7 AD/Organics with Partnered Landfill		●	●	●	●	●	●			
8 Direct Combustion with Partnered Landfill		●	●	●	●	●			●	

This Environmental Justice Snapshot Executive Summary provides CRLCSWA with an overview of the potential impacts each scenario would have on minority and low-income communities in the Cedar Rapids/Linn County service area. A more refined Environmental Justice Analysis is recommended once the details of a future waste solution are finalized and selected by the CRLCSWA's Board of Directors.

The key findings within this report include the following:

- The percentage of Black or African American people in Linn County is 6.1%, which exceeds the state percentage by 48.8%, and the population in Linn County that identified themselves as two or more races is 2.7%, which exceeds the state percentage by 35.0%. Both groups are flagged as potential communities of concern using the environmental justice guidelines defined by the EPA and described in **Section 2**.
- The percentage of Black or African American people in Linn County is 5.4%, which exceeds the state percentage of 3.6%. The population in Linn County that identified themselves as two or more races is 3.7%, which exceeds the state percentage of 3.0%. Both groups are flagged as potential communities of concern using the EPA's environmental justice guidelines.

- 10.0% of the population of Linn County has a disability. Accommodations for people with disabilities should be considered as CRLCSWA plans its outreach and public engagement efforts. Additionally, this needs to be considered during the design of new facilities and services, to ensure Americans with Disabilities Act compliance. Linn County ranks in the top fourth in health factors – 24th out of Iowa's 99 counties. Health factors represent a combination of factors that can influence how long and well we live, including health behaviors, clinical care, social and economic factors, and physical environment. The higher the ranking, the less healthy a county is.
- Linn County ranks 35th out of 99 counties in health outcomes, with one being the best possible ranking. Health outcomes represent how healthy a county is right now, including the length and quality of life. It includes a measure of premature death, poor or fair health, low birthweight and number of poor physical and mental health days in the last 30 days
- Linn County has higher values of pollutant source variables compared to the state of Iowa overall. These include particulate matter 2.5 (particles smaller than 2.5 micrometers in diameter, known as $PM_{2.5}$), ozone, diesel particulate matter, air toxics cancer risk, air toxics respiratory hazard index, traffic proximity, Superfund proximity, hazardous waste proximity, and underground storage tanks. The majority of these possibly contaminated sources are the result of non-point source pollutants, with the largest contributors being vehicles and transportation. These pollutant sources may be impacted by the scenarios under consideration.
- Construction of a new landfill and/or sustainability campus could increase job availability in the county, as poverty levels are higher than the state average for some minority groups.
- Scenarios involving the construction and use of a transfer station may result in an increase in vehicle miles traveled. If one of these scenarios is chosen, CRLCSWA should consider an evaluation of the vehicle traffic impact.

A high-level overview of the potential impacts each solution would have on the region is listed below. Since most scenarios have a combination of solutions, they have been broken into the following categories:

- **A new landfill within Linn County**: A similar environment to present-day, with the potential to increase job availability in the County.
- **Construction of a transfer station and/or regional landfill**: This scenario could lead to an increase in vehicle miles travelled, which could have an impact on air pollutants if a traditional gasoline and diesel fleet is used. Those air quality impacts could potentially be mitigated with the use of an electric fleet.
- **Mixed Waste Processing:** The focus on removing recyclables that remain in the trash, reducing total waste volumes I and providing a potential revenue stream, as the recovered material could be sold as traditional recyclables.
- **Anaerobic Digestion:** This solution would reduce waste going directly to a landfill while also generating a nutrient-rich compost product, which could potentially provide an additional revenue source.

- **Direct Combustion:** This would result in a decrease in waste going directly to the landfill while increasing the energy supply to the county.

Each of the scenarios being considered have potential environmental and health impacts. These effects and impacts to the region and environmental justice-burdened populations should be reviewed during the scenario refinement process.

1. Review Methods

This EJ assessment of potential impacts included a study of area demographics using available census data; review of the EPA's Environmental Justice Screening and Mapping Tool Version 2.0 (EJScreen) to compare environmental and demographic factors near the CRLCSWA Landfill with statewide and nationwide data; review of Linn County health data compared to statewide and nationwide data; and analysis of the impacts that the eight scenarios could potentially have on environmental and health outcomes in Linn County. The proposed facilities in the eight scenarios being considered by CRLCSWA are within the boundaries of Linn County, and therefore Linn County was the primary study area for this review.

Demographics for Linn County were compared to state-level census data to identify any potential disparities surrounding the project area. The Urban Institute defines a community of concern as any geographic unit with a population of people of color and/or a population experiencing poverty that is higher than a certain threshold.[2] Using standard environmental justice guidelines from the EPA, potential communities of concern were flagged based on the following thresholds:

- 10% or more in comparison to the state average
- 50% or more minority
- 5% or more in comparison to the state average for poverty

For example, if 35% of the population of a county is classified as low income but the state classifies 30% of its population as low income, the county would exceed the state average by 16.7% and thus be flagged as a potential area of concern. Census data from 2020 and 2021 (estimated) was used for this report.[3] 2020 Census Bureau data is actual data gathered every ten years, whereas the estimates from other years are modeled based on actual data and annual surveys conducted by the American Community Survey (ACS).[4]

2. Demographic Review

The following demographic information for Linn County and the State of Iowa was collected from U.S. Census Bureau data. Detailed tables are included in **Appendix A.** Items listed in italics are the exact categories listed in 2020 census data. Only the first usage of the term will be italicized.

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[2] https://www.urban.org/sites/default/files/publication/102746/defining-communities-of-concern-in-transportation-planning_1.pdf
[3] https://www.census.gov/quickfacts/fact/table/linncountyiowa/PST045221
[4] https://www.census.gov/programs-surveys/acs

2.1 Linn County Demographics

Linn County has a total estimated population of 230,299. The largest percentage of the county's population (54.5%) is between the ages of 18 and 64, followed by under 18 years (23.0%), and 65 years and older (16.3%). 85.1% of the population of Linn County is classified as *White alone*, and 5.4% of the population is classified as *Black or African American alone*. The percentage of Black or African American people in Linn County exceeds the state percentage by 50.0% (see **Appendix A**). The population in Linn County that identified themselves as *Two or more races* is 3.7%, which exceeds the state percentage of 3.0% by 23.0%. Both groups are flagged as potential communities of concern using the environmental justice guidelines defined by the EPA and described in **Section 2** (10% or more in comparison to the state average).

2.2 Disability Characteristics

Table S1810: Disability Characteristics from the U.S. Census Bureau was referenced for this review (see **Appendix A**). The Census Bureau reports disability characteristics based on the *Total civilian noninstitutionalized population.* 10.0% of the population of Linn County has a disability, which is lower than the statewide population (11.8%). The available data is also broken down by disability type, which includes *With a hearing difficulty* (2.9%), *With a vision difficulty* (1.4%), *With a cognitive difficulty* (4.2%), *With an ambulatory difficulty* (4.6%), *With a self-care difficulty* (1.7%), and *With an independent living difficulty* (4.4%). The disability type percentages add up to more than the total disability percentage for Linn County, presumably because some individuals are classified into several disability categories.

Accommodations for people with disabilities should be considered as CRLCSWA plans its outreach and public engagement efforts.

2.3 Limited English Proficiency (LEP)

Table DP02: Selected Social Characteristics in the United States from the U.S. Census bureau was referenced for this review (see **Appendix A**). 94.2% of the population of Linn County speaks *English only* at home, while 5.8% speak a *Language other than English* at home. 2.4% of Linn County's population *Speak[s] English less than "very well,"* which is lower than the state percentage of 3.4%. The non-English language that is spoken most often at homes in Linn County is Spanish, with 1.7% speaking Spanish at home.

Language accommodations, including translators at public meetings, may need to be considered, particularly if the EJScreen tool indicates that proposed facilities are near populations with a higher percentage of people who speak English less than "very well."

2.4 Economic Factors

The U.S. Census Bureau provides detailed information on economic factors, including household income and poverty levels. Table 1 below shows household income in the United States, Iowa, and Linn County in 2020 (the most recent dates information was available). An expanded version of this table, Table S1701: Poverty Status in the Past 12 Months, is listed in **Appendix A**.

TABLE 1: HOUSEHOLD INCOME IN THE PAST 12 MONTHS (IN 2020 INFLATION-ADJUSTED DOLLARS)

Income	United States	Iowa	Linn County, Iowa
	Estimated Percent	Estimated Percent	Estimated Percent
Total Population	122,354,219	1,273,941	91,304
Less than $10,000	5.8%	5.1%	3.9%
$10,000 to $14,999	4.1%	4.0%	3.2%
$15,000 to $24,999	8.5%	8.6%	7.4%
$25,000 to $34,999	8.6%	9.3%	8.4%
$35,000 to $49,999	12.0%	13.1%	13.5%
$50,000 to $74,999	17.2%	19.1%	18.7%
$75,000 to $99,999	12.8%	14.3%	15.0%
$100,000 to $149,999	15.6%	15.9%	16.2%
$150,000 to $199,999	7.1%	5.6%	7.4%
$200,000 or more	8.3%	5.0%	6.5%
Median income (dollars)	64,994	61,836	67,301
Mean income (dollars)	91,547	80,316	88,617

The Office of the Assistant Secretary for Planning and Evaluation publishes poverty guidelines for the 48 contiguous states and the district of Columbia. In 2020, the poverty guidelines were based on an income of $12,760 for an individual and $26,200 for a family of four. At that time, 11.1% of the population of Iowa was below the poverty level, and 9.4% of the population of Linn County was below the poverty level. Census data indicated that there are economic disparities by race in Linn County; 9.8% of individuals who identified themselves as white are below the poverty level, while an average of 22.7% of all other races (including Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Hispanic or Latino Origin, and two or more races) were below the poverty level.

3. County Health Data

The University of Wisconsin Population Health Institute, in collaboration with the Robert Wood Johnson Foundation, calculated a County Health Ranking for every county in the United States.[5] The purpose of the County Health Rankings & Roadmaps program is to build awareness of the factors that influence health; provide a reliable source of local data to communities; engage local leaders in creating community change; and connect and empower community leaders working to improve health. The ranking is based on health outcomes (e.g., length of life and quality of life) and health factors (e.g., health behaviors, clinical care, social and economic factors, and physical environment). The tool also reports health outcomes and behaviors that are not included in the overall ranking but provide a comprehensive review of health in Linn County.

According to the 2021 report, Linn County ranks 24th in health factors and 35th in health outcomes as compared to the 99 counties in Iowa, with 1 as the best possible ranking. **Figure 1** shows health

[5] https://www.countyhealthrankings.org/

factors and **Figure 2** shows health outcomes by county in Iowa. Linn County is marked with a star on both maps. The full 2021 State Level Data and Ranks Report for Iowa is included in **Appendix B**.

FIGURE 1: IOWA COUNTY HEALTH FACTORS

FIGURE 2: IOWA COUNTY HEALTH OUTCOMES

3.1 Health Outcomes

The health outcomes factors included in the County Health Rankings report include premature death, poor or fair health, number of poor physical and mental health days in the past 30 days, and low birthweight. Additional health outcomes that are not included in the ranking include life expectancy, child and infant mortality, frequent physical and mental distress, and prevalence of diabetes and HIV. Linn County does not exceed any of the environmental justice guidelines for health outcomes compared to the State of Iowa (10% or more in comparison to the county or state average; see **Section 2**).

3.2 Health Factors

The health factors included in the County Health Rankings report include health behaviors (e.g., smoking, access to exercise opportunities, excessive drinking); clinical care (e.g., insurance status, per-capita health providers, preventable hospital stays); social and economic factors (e.g., level of education, income inequality, children in poverty, violent crime); and physical environment (e.g., traffic volume, homeownership, broadband access). Linn County does not exceed any of the environmental justice guidelines for social and economic factors or physical environment compared to the State of Iowa used in the county ranking. However, traffic volume, which is not included in the overall ranking but available as reported data, exceeds state levels by 60.4%.

4. EJScreen Evaluation

The EPA's EJScreen tool was used to evaluate how Linn County and the immediate area surrounding the CRLCSWA Landfill compare to the state of Iowa, EPA Region 7, and the United States across a set of environmental metrics. EJScreen allows users to evaluate environmental and demographic indicators with a nationally consistent dataset and approach. The following environmental and demographic indicators are included in EJScreen:

TABLE 2: SUMMARY TABLE OF ENVIRONMENTAL INDICATORS AND DATA SOURCES

Key Medium	Indicator	Details
Air	Particulate matter 2.5	$PM_{2.5}$ levels in air, µg/m^3 annual avg.
Air	Ozone	Ozone summer seasonal average of daily maximum 8-hour concentration in air in parts per billion
Air	Diesel particulate matter	Diesel particulate matter level in air, µg/m^3
Air	Air toxics cancer risk	Lifetime cancer risk from inhalation of air toxics
Air	Air toxics respiratory hazard index	Ratio of exposure concentration to health-based reference concentration
Air/other	Traffic proximity and volume	Count of vehicles (AADT, average annual daily traffic) at major roads within 500 meters, divided by distance in meters (not kilometers)
Dust/lead paint	Lead paint	Percent of housing units built pre-1960, as indicator of potential lead paint exposure
Waste/air/water	Superfund proximity	Count of proposed or listed National Priorities List - also known as superfund - sites within 5 kilometers (or nearest one beyond 5 kilometers), each divided by distance in kilometers
Waste/air/water	Risk management plan (RMP) facility proximity	Count of RMP (potential chemical accident management plan) facilities within 5 kilometers (or nearest one beyond 5 kilometers), each divided by distance in kilometers
Waste/air/water	Hazardous waste proximity	Count of hazardous waste facilities (Treatment Storage and Disposal Facilities and Large Quantity Generators) within 5 kilometers (or nearest beyond 5 kilometers), each divided by distance in kilometers
Waste/air/water	Underground storage tanks (UST) and leaking UST (LUST)	Count of LUSTs (multiplied by a factor of 7.7) and the number of USTs within a 1,500-foot buffered block group
Water	Wastewater discharge	Risk-Screening Environmental Indicators modeled toxic concentrations at stream segments within 500 meters, divided by distance in kilometers

EJScreen outputs for the CRLCSWA Landfill, Cedar Rapids, and Linn County are included in **Appendix C.** Linn County has higher values of pollutant source variables compared to the state of Iowa overall. These include particulate matter 2.5 ($PM_{2.5}$), ozone, diesel particulate matter, air toxics cancer risk, air toxics respiratory hazard index, traffic proximity, Superfund proximity, hazardous waste proximity, and underground storage tanks. Linn County is the second most populous county in Iowa after Polk County, so many of these factors may be related to higher population density.

4.1 Particulate Matter Health Effects

Particulate matter, particularly particles smaller than 10 micrometers in diameter, can have long-term effects on peoples' lungs and hearts. Studies have linked particle pollution exposure to premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function and irritation, coughing, or difficulty breathing. Fine particles, including $PM_{2.5}$, can reduce visibility by causing a haze. Depending on chemical composition of the particles, wind-blown particulate matter can make lakes and streams acidic, change the nutrient balance in coastal waters and river basins, deplete soil nutrients, damage plant communities and farm crops, affect ecosystem diversity, and/or contribute to acid rain.

4.2 Ozone Health Effects

Ozone exposure can cause coughing, sore or scratchy throat, and make it more difficult to breathe deeply. It can also inflame and damage airways, making the lungs more susceptible to infection. Ozone exposure can aggravate existing lung conditions such as asthma, emphysema, and chronic bronchitis, and increase the frequency of asthma attacks. Ozone can also affect sensitive vegetation and ecosystems, and high concentrations can ultimately lead to loss of species diversity; changes in composition of plant communities; changes to habitat quality; and changes to water and nutrient cycles.

4.3 Air Quality Standards

The Clean Air Act requires that the EPA set National Ambient Air Quality Standards (NAAQS) for criteria air pollutants which can be harmful to public health and the environment. Primary air standards provide public health protection, including protecting the health of vulnerable populations. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetations, and buildings. The EPA's primary standard for $PM_{2.5}$ is 12.0 $\mu g/m^3$ and the secondary standard is 15.0 $\mu g/m^3$. The ozone standard is 0.070 ppm for both primary and secondary standard. Linn County is currently below these standards for $PM_{2.5}$ at 8.81 $\mu g/m^3$, but higher than the state average of 8.23 $\mu g/m^3$. Ozone concentrations in Linn County are also above the state average: Linn County's average ozone concentration is 0.0427 ppm while the state of Iowa's average is 0.0418 ppm.

Particulate matter and ozone can both be produced by combustion processes, including car engines. An increase in gas and diesel vehicle traffic associated with landfill or transfer station operations could potentially increase particulate matter and ozone concentrations of Linn County.

5. Local Industrial Sites

Within Linn County, there are 1,153 facility permits or incident reports in the following categories as of April 2022:

- 46 National Pollutant Discharge Elimination System (NPDES) wastewater treatment facility permits
- 1 permitted solid waste landfill
- 39 brownfield program sites
- 10 hazardous waste sites
- 716 USTs
- 341 UST incidents

It is important to note that there may be multiple permits associated with one facility and that UST incidents can vary in size, significance, and timeframe. At this time, there is no additional risk identified due to proximity to local industrial sites. However, an evaluation of potential combined impacts of industrial sites should be considered when a scenario is chosen, and a site is selected.

6. Impacts of the Scenarios

Linn County has higher values of pollutant source variables compared to the state of Iowa overall. These include particulate matter 2.5 ($PM_{2.5}$), ozone, diesel particulate matter, air toxics cancer risk, air toxics respiratory hazard index, traffic proximity, Superfund proximity, hazardous waste proximity, and underground storage tanks. Several proposed scenarios would increase vehicle miles traveled (VMT) in and around the county, which could increase both particulate matter and combustion byproducts into the air. Over time, this could eventually lead to a countywide exceedance of the EPA primary or secondary air standards. However, CRLCSWA could implement procedures to mitigate potential air quality impacts of the proposed scenarios. A detailed evaluation by scenario is listed in **Appendix D**.

7. Conclusions

This environmental justice snapshot was intended to provide CRLCSWA with current conditions in Linn County. HDR recommends that an updated environmental justice review be completed once a scenario is selected, and a site is identified to minimize impacts on the community and maintain eligibility for potential federal funding under the Infrastructure Bill.

Linn County was compared to the State of Iowa across various metrics, including demographics, health factors and outcomes, and environmental factors. Overall, Linn County currently performs well compared to the State of Iowa across the metrics evaluated. Fewer residents of Linn County live in poverty as compared to the rest of the State. The County also ranks highly in terms of health outcomes and health factors.

Areas of note where Linn County stands out in relation to the rest of Iowa are environmental factors, particularly those associated with air quality and traffic. Linn County is the second most populous county in Iowa, after Polk County (Des Moines), which may be the reason for its higher concentrations of air pollutants and increased traffic.

Most of the proposed scenarios are expected to contribute positively to Linn County's economic outlook. Scenarios 1, 3, 4, and 5 include construction of a new landfill, which is anticipated to increase job availability during construction and potentially operation of the landfill and its support structures. Scenarios 2, 6, 7, and 8 have transfer stations, which could potentially provide jobs in Linn County as well.

All the proposed scenarios have some environmental costs. Landfills emit both criteria pollutants and greenhouse gases, which can impact air quality. Increased vehicle miles traveled associated with transfer stations could also increase pollutants in the air, particularly those associated with combustion. HDR previously prepared a social return on investment (SROI) model for the scenarios and found that Scenarios 1 and 2 had the highest greenhouse gas emissions in metric tons.

Scenario 4 (anaerobic digestion with new landfill) and Scenario 7 (anaerobic digestion with regional landfill) had the lowest greenhouse gas emissions. However, CRLCSWA could implement measures to mitigate the impacts of several of these scenarios which will be discussed in a separate memo.

SROI Analysis

Cedar Rapids Linn County

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Acronyms

CAC – Criteria Air Contaminants

CO_2 – Carbon Dioxide

CRLCSWA – Cedar Rapids Linn County Solid Waste Agency

GHG – Greenhouse Gas

$MTCO_2E$ – Metric Tons of Carbon Dioxide Equivalent

NO_X – Nitrogen Oxides

$PM_{2.5}$ – Particulate Matter

S&L – Structure and Logic

SO_2 – Sulfur Dioxide

SROI – Sustainable Return on Investment

VOC – Volatile Organic Compounds

Introduction to SROI Analysis

This report provides detailed information on the Sustainable Return on Investment (SROI) analysis conducted for Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) to evaluate potential waste management solutions. The analysis examines eight waste solution scenarios, including five local waste management scenarios and three regional waste management scenarios. Technologies proposed in the scenarios include landfilling, waste transfer, mixed waste processing, anaerobic digestion, and waste-to-energy facilities. The SROI framework is a triple bottom line approach to monetizing and incorporating economic, social, and environmental factors into decision-making. The report outlines the energy conservation measures under consideration, presents monetized economic, social and environmental benefits and economic costs associated with the measures, and provides recommendations on which measures to evaluate further for implementation.

The remainder of the report is organized as follows:

- **SROI Methodology** describes the framework utilized in the SROI analysis and details the energy conservation measures that were evaluated;
- **Monetized Benefits and Costs** explains each benefit and cost included in the SROI analysis and provides results for each category;
- **Results** offers detailed tables highlighting SROI metrics for energy conservation measures; and
- **Appendix A** provides a detailed methodology of the benefits calculation in addition to the inputs used in the analysis.

Executive Summary

The Sustainable Return on Investment (SROI) analysis provides a framework to quantify the environmental, social, and economic impacts of each topic on the eight scenarios identified by Cedar Rapids Linn County Solid Waste Agency (CRLCSWA). This triple bottom line provides an effective mechanism for evaluation by quantifying costs and benefits that are not traditionally accounted for in standard analysis. This report includes a high-level analysis that is meant to be built upon as scenarios are refined and detailed further.

The net benefits of an investment in a social enterprise are comprised of two "cash flows". The first is generated from the operations of the social enterprise itself. The business cash flows are forecasted out 50 years and to perpetuity and are then discounted back to a present value figure. The second "cash flow" is a calculation of the total net savings to society, which is to say the economic value of the program's social impacts. Calculating the SROI involves adding the project costs with the economic, environmental and transportation impacts. The goal is to limit those impacts, ideally resulting in a zero-dollar impact or a lower impact whenever possible.

Eight scenarios were analyzed in this SROI as part of the Forward 2044 Waste Planning project.

- Scenario 1 – New Landfill (CRLCSWA Owned)
- Scenario 2 – Transfer to a Landfill Not Owned by CRLCSWA
- Scenario 3 – Mixed Waste Processing with New Landfill (CRLCSWA Owned)
- Scenario 4 – Anaerobic Digestion with New Landfill (CRLCSWA Owned)
- Scenario 5 – Direct Combustion with New Landfill (CRLCSWA Owned)
- Scenario 6 – Mixed Waste Processing with Regional Landfill
- Scenario 7 – Anaerobic Digestion with Regional Landfill
- Scenario 8 – Direct Combustion with Regional Landfill

Each scenario was evaluated based on the criteria for the SROI. The net capital project costs (cash) are the 50-year cost for capital costs for building each scenario. The net economic costs and benefits represent the user costs for material handling, revenues from material handling byproducts and excess energy exported to the grid, cost of electricity purchased and residual value of capital investments. The net transportation costs and benefits (non-cash) include cost of pavement damage, vehicle operating costs and accident costs from transportation of waste. The net environmental costs and benefits include reduced greenhouse gas emissions from electricity generation, reduced air contaminant emissions plus the cost of greenhouse gas emission from waste management and transportation. When evaluated all together, the net present value of costs of each scenario can be determined, representing the SROI.

The results indicate that all scenarios have economic and environmental impacts of some capacity. It is critical to consider that emission from landfills when they are not owned by the Agency, are not included in this evaluation, and would add to overall environmental impacts of Scenarios 2, 6, 7 and 8. Overall Scenario 4 (anaerobic digestion with new landfill) has the overall lowest combined cost (including project costs, plus economic, environmental, and social impacts). Further details about the costs of each scenario in the categories listed is included in this report.

SROI Methodology

The SROI analysis provides quantitative and monetized estimates of costs and benefits to assess future waste campus alternatives that offer the least overall costs to society.

The first step in this analysis is to define the waste solution scenarios for evaluation. In this study, each **Scenario** reflects the impacts of the development and implementation of an identified waste solution scenario. Once defined, the SROI analysis process generally follows the following steps:

- Identification of key impacts for assessment – benefits, and costs
- Stakeholder review of methodology and key assumptions
- Quantification of select environmental, community, and economic impacts for each waste solution scenario
- Production of detailed economic cost and benefit analysis results
  - **Economic** (e.g., net costs of energy production and consumption)
  - **Environmental** (e.g., greenhouse gas emissions)
  - **Social** (e.g., transportation impacts)

Each waste solution scenario is listed in the table below. These scenarios include several different waste management facilities and detailed descriptions of each scenario is described in Technical Memo: Infrastructure Options-Refinement of Options for Detailed Analysis.

WASTE SOLUTION SCENARIOS

Waste Solution Scenarios						Partner / Regional Approach		
	1	2	3	4	5	6	7	8
New Landfill (CRLCSWA Owned)	X		X	X	X			
Partner Landfill		X				X	X	X
Waste Transfer		X				X	X	X
HHM	X	X	X	X	X	X	X	X
Resource Recovery Center (RRC)	X	X	X	X	X	X	X	X
Aerobic Organics Composting	X	X	X	X	X	X	X	X
Anaerobic Digestion (Green Waste/Food)				X			X	
RDF (mixed waste) Processing			X			X		
Direct Combustion (WTE)					X			X

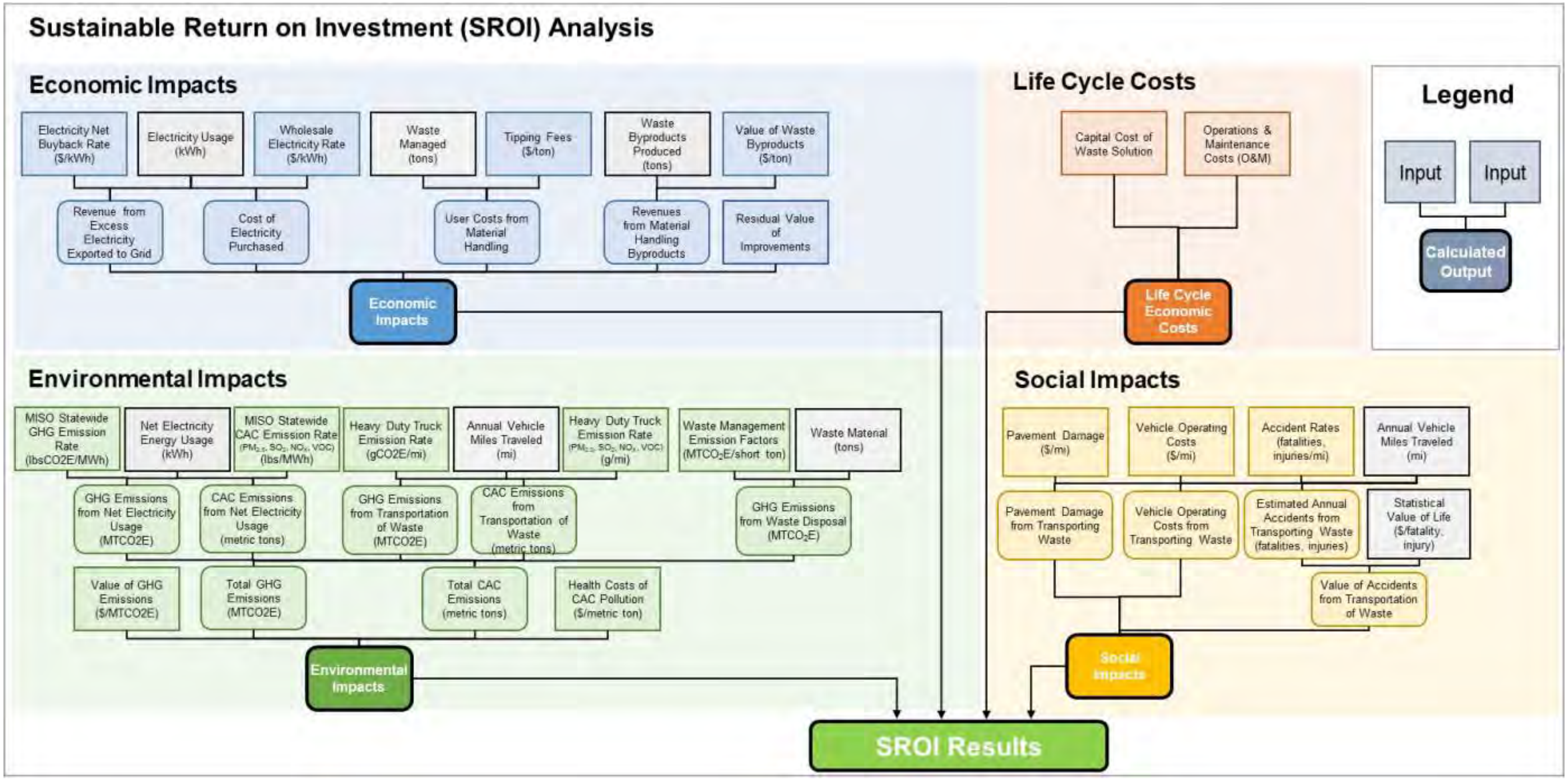
The next section outlines the benefits and costs monetized in the analysis, followed by a qualitative discussion of additional impacts that were not monetized. The Results section provides the net present value (NPV), which reflects the life cycle triple bottom line impact of each waste solution scenario evaluated.

Monetized Benefits and Costs

This section aims to outline the various benefits and costs considered in the SROI analysis. The SROI analysis is presented graphically in Figure 1 on the next page. The flowchart is referred to as a structure and logic diagram. It is designed to provide a graphical illustration of how different SROI results are monetized and flow into the overall results.

"Economic benefits to society," "environmental benefits," and "social benefits" comprise the benefit categories evaluated in the SROI and are weighed against the life cycle economic costs. The remainder of this section is organized to present the net energy savings, the economic, environmental, and social benefits, and the economic costs. Each category will contain a description of the respective benefits and costs, provide structure and logic diagrams, and include results by waste solution. Further detail on the inputs used in the calculations of each benefit category can be found in Appendix A.

Figure 1: SROI Analysis Structure and Logic Diagram



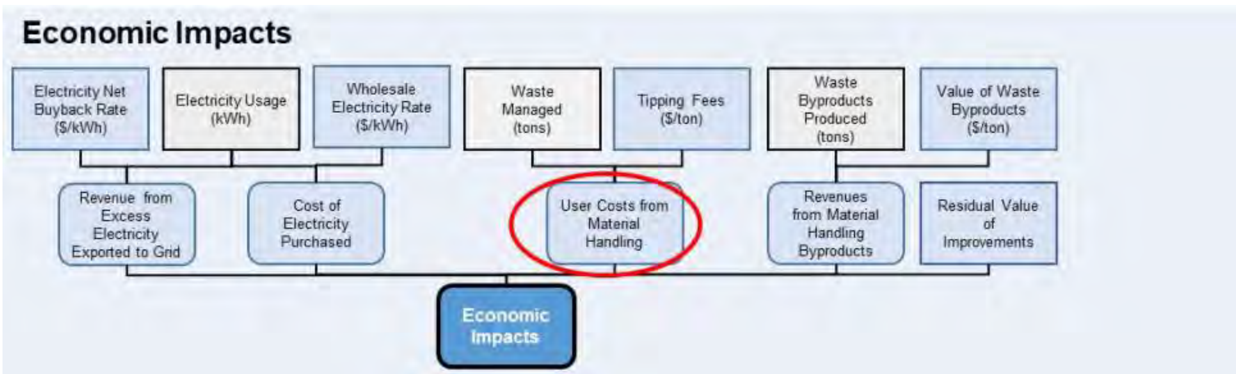
Economic Impacts

This section outlines the economic impacts captured in the SROI analysis. These include revenues from excess electricity exported to the grid, cost of electricity purchased, user costs from material handling, revenues from material handling byproducts, and a residual value of improvements.

User Costs from Material Handling

The user costs in material handling represent the costs associated with disposing of waste and related products. The impact is calculated from two inputs: volume of waste and tipping fees.

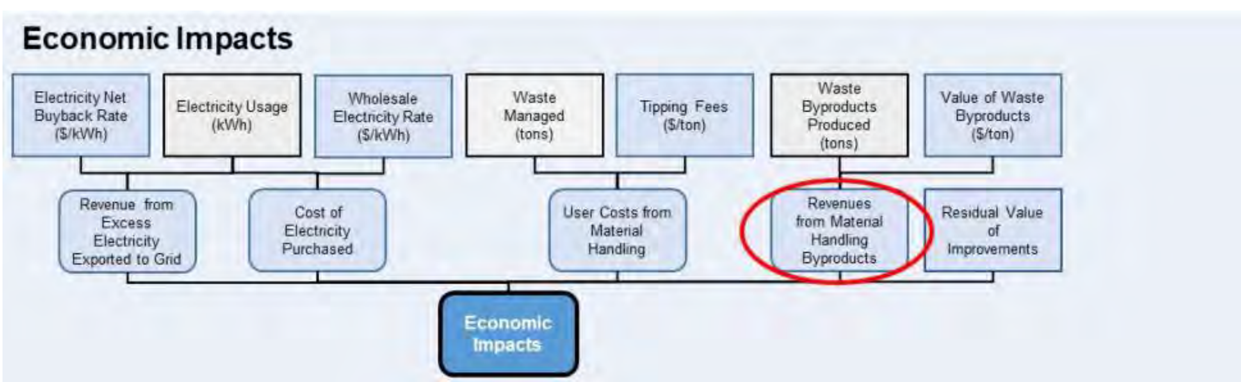
Figure 2: User Costs from Material Handling S&L Diagram



Revenues from Material Handling Byproducts

The revenues from material handling byproducts captures any waste stream that can be converted into another stream of income, including the sale of recovered ferrous or non-ferrous metals, other recyclables and compost that is sold to businesses. These revenues are a benefit to waste solutions where applicable.

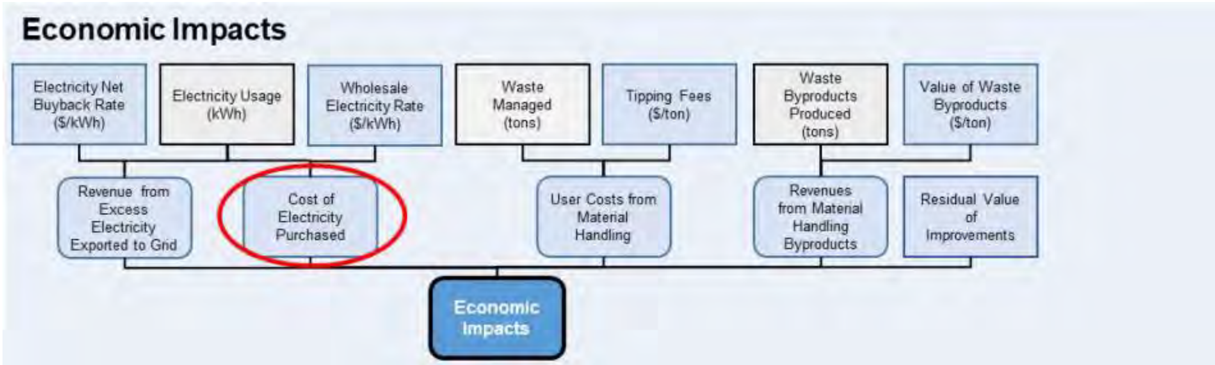
Figure 3: Revenues from Material Handling Byproducts S&L Diagram



Cost of Electricity Purchased

The cost of electricity purchased captures the cost of electricity purchased from the grid. Electricity was specifically broken out from the operations and maintenance costs to display the net electricity costs. Electricity produced at certain facilities in some scenarios could be sold back to the grid at a buyback rate, described below.

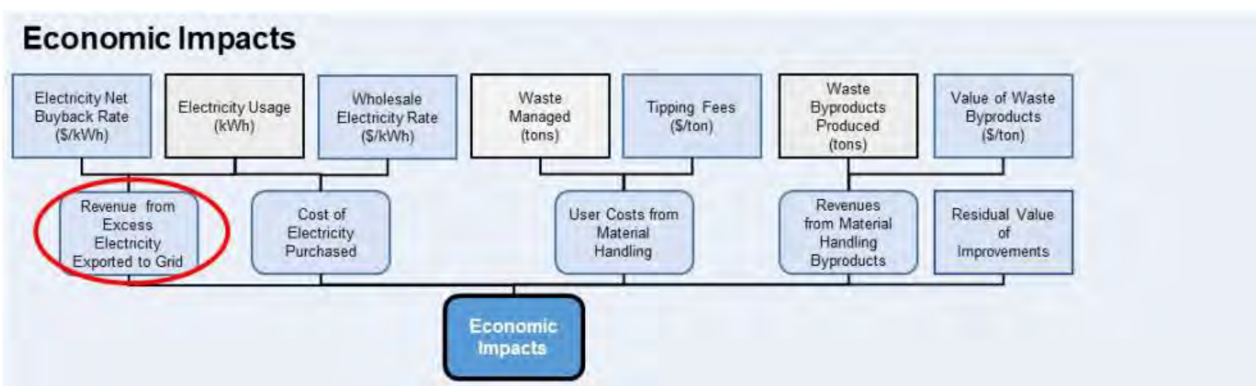
Figure 4: Cost of Electricity Purchased S&L Diagram



Revenue from Excess Electricity Exported to the Grid

The revenue from excess electricity exported to the grid is a benefit designed to capture any value from electricity generated on-site. It has been assumed in this analysis that any electricity generated is exported back to the grid, and no net metering will take place. Without firm knowledge about the potential locations of the waste solutions, specific utility tariff structures are unknown. It may be possible that net metering would be available, which would allow for electricity produced at a waste solution location to offset the electricity demand, thereby further reducing the cost of electricity at those facilities.

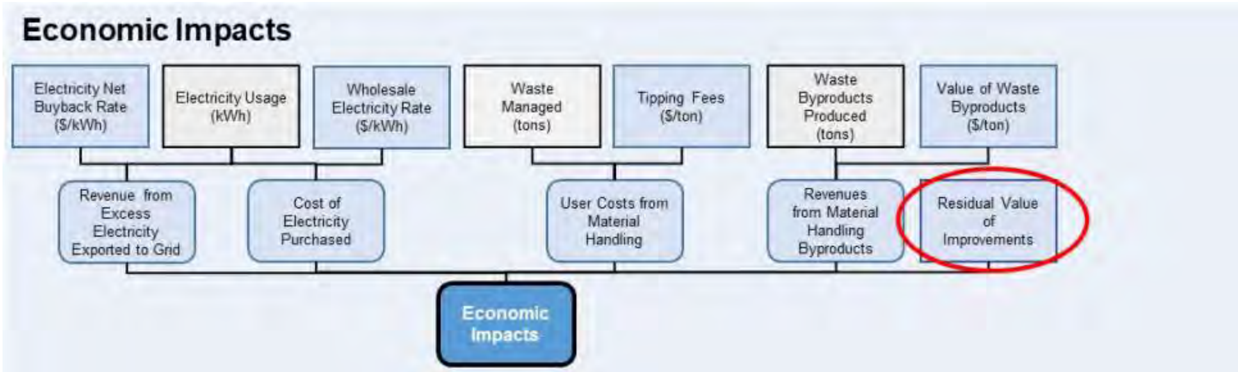
Figure 5: Revenue from Excess Electricity Exported to the Grid S&L Diagram



Residual Value of Improvements

The residual value of improvements is a benefit designed to capture any value pertaining to the remaining useful life of waste solutions at the end of the study period. Over the 35-year study period in this SROI analysis, facilities are still assumed to have another 15 years of useful life before needing major maintenance performed. Direct costs for each scenario assumed 50-years life for the technologies with major repairs and/or replacement of buildings and equipment included in annual operations and maintenance costs.

Figure 6: Residual Value of Improvements S&L Diagram



Total Economic Impacts

The present value of economic impacts across all waste solutions is presented in Table 2 from lowest total economic impact to highest. Negative values indicate benefit streams, while positive impacts indicate costs. Waste solution scenarios with greater economic impacts indicate a greater societal cost to implement that solution. Solutions 8, 3, and 6 would offer the lowest societal economic cost based on economic impacts alone.

Table 1: Present Value of Economic Impacts by Waste Solution, Discounted at 7%

Solution ID	Solution Description	User Costs from Material Handling	Material Handling Byproduct Revenues	Cost of Electricity Purchased	Revenue from Electricity Exported	Residual Value	Total Economic Impact
8	Direct Combustion with Regional Landfill	$74.4 M	-$5.2 M	-$18.1 M	$0.5 M	-$19.6 M	**$31.9 M**
3	Mixed Waste Processing/RDF with New Landfill	$48.2 M	-$9.0 M	-	$1.9 M	-$5.4 M	**$35.7 M**
6	Mixed Waste Processing/RDF with Regional Landfill	$48.6 M	-$8.1 M	-	$2.2 M	-$4.7 M	**$38.0 M**
5	Direct Combustion with New Landfill	$82.0 M	-$5.2 M	-$16.7 M	$0.5 M	-$13.9 M	**$46.7 M**
1	New Landfill	$55.5 M	-$0.9 M	-	$0.4 M	-$3.1 M	**$51.9 M**
4	Anaerobic Digestion with New Landfill	$57.4 M	-$0.9 M	-$0.7 M	$0.6 M	-$3.6 M	**$52.7 M**
7	Anaerobic Digestion and Regional Aerobic Composting with Regional Landfill	$71.1 M	-$0.9 M	-$0.9 M	$1.5 M	-$2.5 M	**$68.3 M**
2	Transfer to Landfill	$119.6 M	-$0.9 M	-	$0.5 M	-$1.4 M	**$117.8 M**

Environmental Impacts

This section outlines the environmental benefits to society considered in the SROI analysis. Environmental benefits capture the difference in environmental damages from greenhouse gas emissions and critical air contaminant emissions by waste management solutions. Specifically, a holistic approach was considered to assess the overall emissions related to the various waste management solutions, which include:

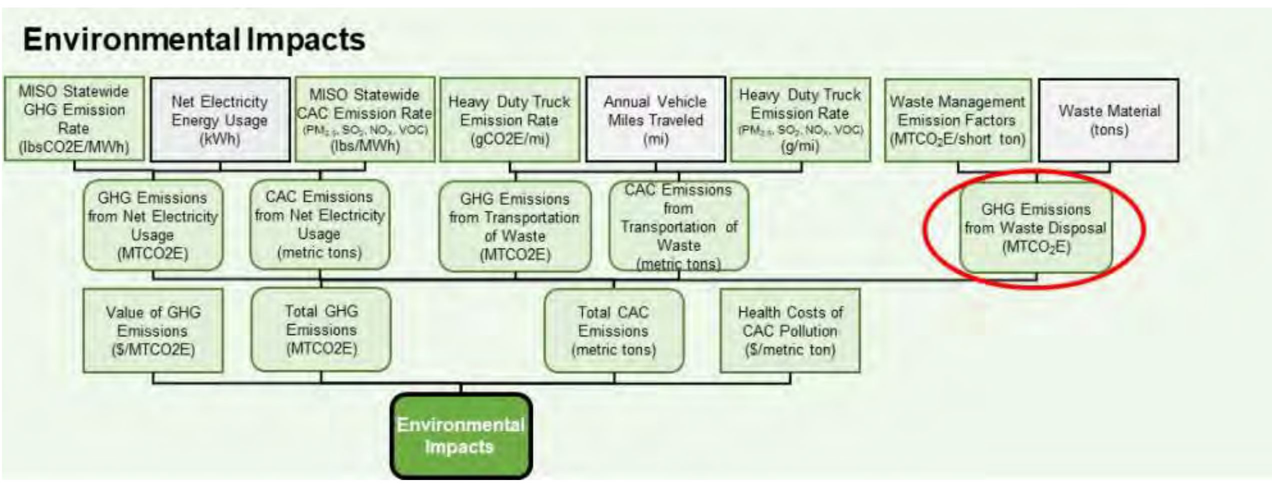
- Emissions generated by the disposal of waste;
- Emissions generated by additional transportation to the location; and,
- The net emissions from the electricity produced and consumed.

These factors were evaluated by each waste solution scenario. Some factors may not be applicable to select waste solution scenarios.

Emissions from Waste Disposal

The greenhouse gas emissions generated from waste disposal was estimated based on the waste management solution, the standard composition of waste based on the region, and the volume of waste by the material type. Specifically, the analysis leveraged emission factors obtained from the US Environmental Protection Agency's (US EPA) Waste Reduction Model (WARM), which varied due to waste and disposal methods.

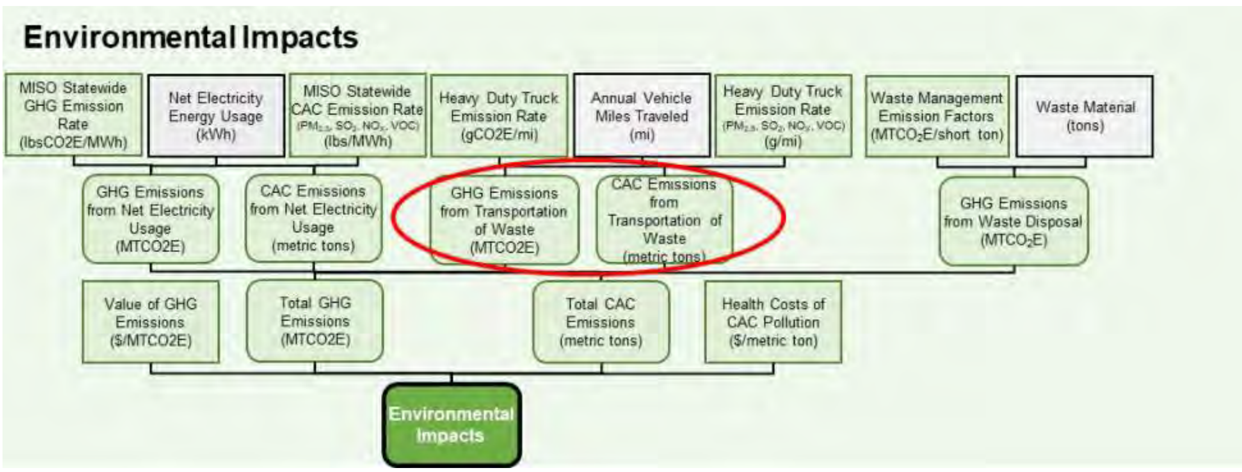
Figure 7: GHG Emissions from Waste Disposal S&L Diagram



Emissions from the Additional Transportation of Waste

In addition to the emissions generated from disposing of waste, the analysis also factors in emissions from any additional transportation. This reflects the case where waste is transported to a more distant location or additional transportation is needed to different landfill sites, which is applicable to select scenarios. These impacts were estimated based on the vehicle miles traveled and truck emission factors based on the average travel speeds obtained from US EPA's Motor Vehicle Emissions Simulator (MOVES). These emissions capture both greenhouse gas emissions and criteria air contaminants, including particulate matter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrous oxide (NO_x), and volatile organic compounds (VOC).

Figure 8: Emissions from the Transportation of Waste S&L Diagram

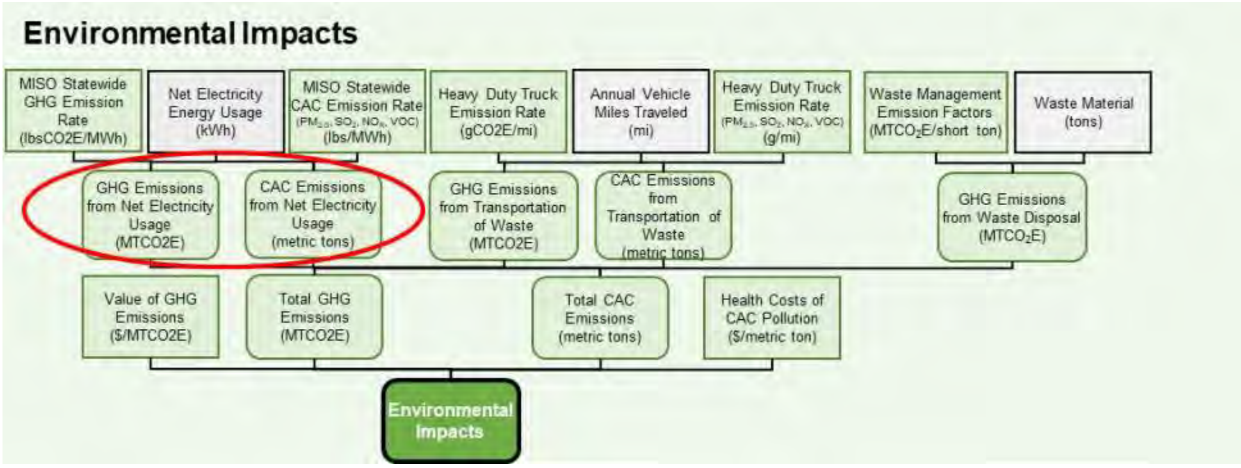


Net Emissions from Electricity Usage

Another part of the emissions consideration was electricity usage. This considers the emissions produced by the generation of electricity from the grid to fulfill the electricity demand based on the waste management solution. It also values the offsetting reduction in grid emissions from electricity produced through anaerobic digestion or combustion at a waste-to-energy facility.

The net emissions from electricity production and consumption were estimated based on the electricity demand by waste management solution, the marginal fuel mix from the electrical grid, the emissions generated by each marginal fuel, and the volume of electricity produced by waste management solutions.

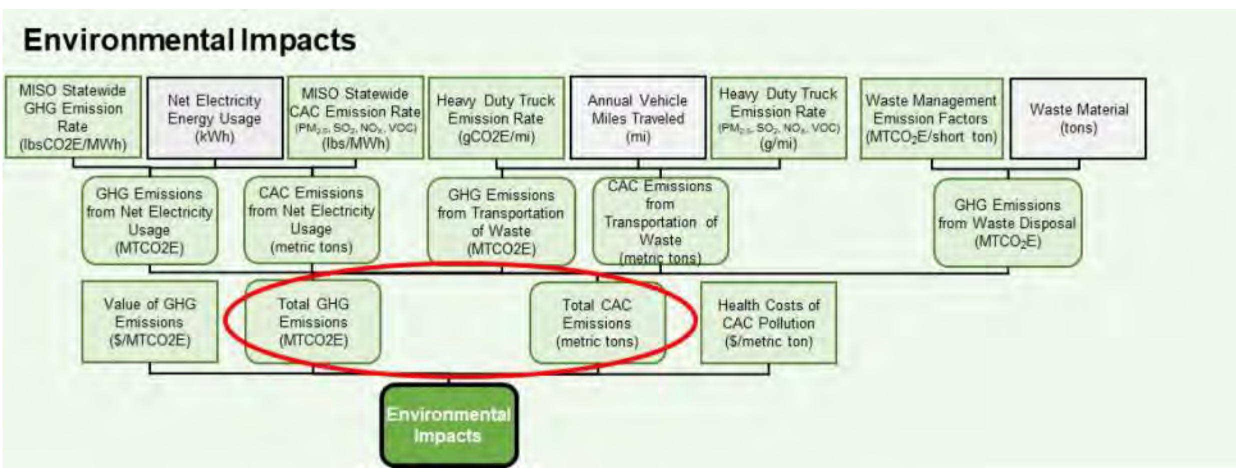
Figure 9: Net Emissions from Electricity Usage S&L Diagram



Total Emissions

The total emissions are the sum of emissions from waste disposal, transportation of waste, and electricity usage. Each pollutant (CO_2, $PM_{2.5}$, NO_x, SO_2, and VOC) is monetized by a cost per metric ton to quantify the environmental impact of a given solution.

Figure 10: Total Emissions S&L Diagram



Total Environmental Impacts

The present value of environmental impacts across all waste solutions is presented in Table 3 from lowest total environmental impacts to highest. Negative values indicate benefit streams, while positive impacts indicate costs. Waste solution scenarios with greater environmental impacts indicate a greater societal cost to implement that solution. Solutions 5, 6, and 3 would offer the lowest societal environmental cost based on environmental impacts alone.

Table 2: Present Value of Environmental Impacts by Waste Solution, Discounted at 7%

Solution ID	Solution Description	GHG Emissions from Electricity Usage	CAC Emissions from Electricity Usage	GHG Emissions from Waste Disposal	GHG Emissions from Transport of Waste	CAC Emissions from Transport of Waste	Total Environmental Impact
5	Direct Combustion with New Landfill	-$6.5 M	-$0.9 M	$41.6 M	$0.0 M	$0.0 M	**$34.3 M**
6	Mixed Waste Processing/RDF with Regional Landfill	$0.2 M	$0.0 M	$40.5 M	$0.2 M	$0.1 M	**$41.0 M**
3	Mixed Waste Processing/RDF with New Landfill	$0.1 M	$0.0 M	$42.2 M	$0.2 M	$0.1 M	**$42.6 M**
4	Anaerobic Digestion with New Landfill	-$0.2 M	-$0.0 M	$44.5 M	-	-	**$44.3 M**
7	Anaerobic Digestion and Regional Aerobic Composting with Regional Landfill	-$0.2 M	-$0.0 M	$44.5 M	$0.6 M	$0.2 M	**$45.0 M**
8	Direct Combustion with Regional Landfill	-$7.0 M	-$0.9 M	$57.3 M	$0.3 M	$0.1 M	**$49.7 M**
1	New Landfill	$0.0 M	$0.0 M	$72.5 M	-	-	**$72.6 M**
2	Transfer to Landfill	$0.0 M	$0.0 M	$72.5 M	$0.4 M	$0.1 M	**$73.1 M**

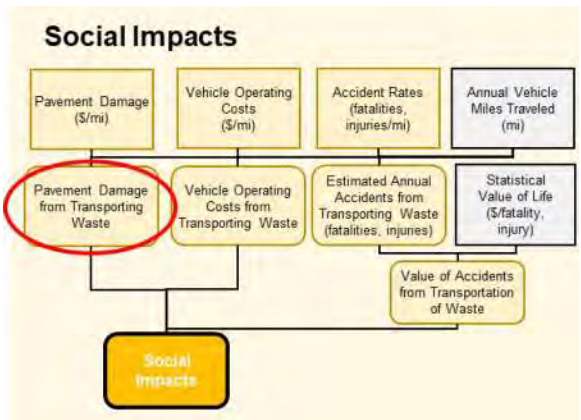
Social Impacts

This section outlines the social benefits of the SROI analysis. Social benefits capture the monetized value of anticipated transportation impacts from hauling waste and associated byproducts to its end destination. The impacts include the expected cost of pavement damage, vehicle operating costs, and anticipated accident costs.

Pavement Damage from the Additional Transportation of Waste

Pavement damage from the additional transportation of waste captures any costs associated with transporting waste beyond the initial campus. The pavement damage is estimated based on the truck capacity, the volume of waste transported, the distance traveled, and the pavement damage value.

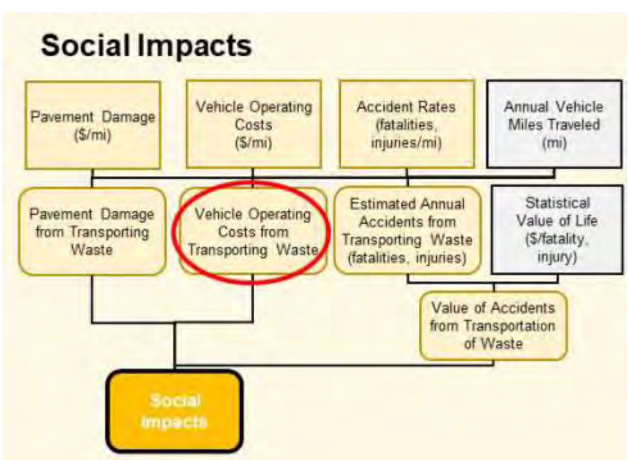
Figure 11: Pavement Damage S&L Diagram



Vehicle Operating Costs from the Additional Transportation of Waste

Vehicle operating costs from the additional transportation of waste capture vehicle use fuel and maintenance costs. The vehicle operating costs are measured based on the waste volumes being transported, truck capacity, distance traveled, and an estimated cost per mile.

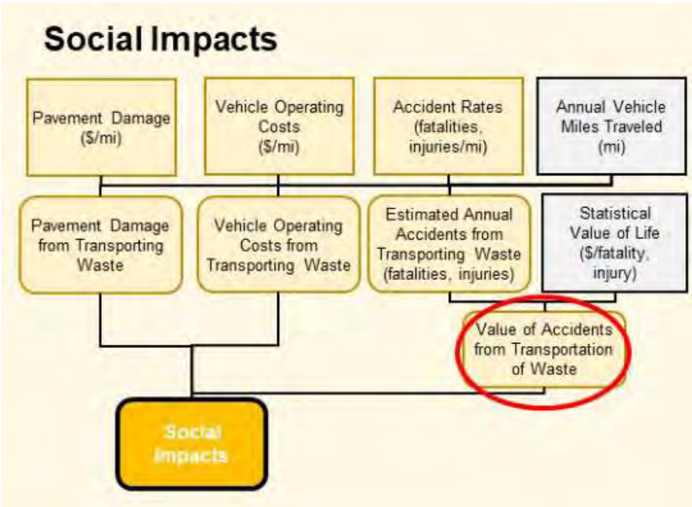
Figure 12: Vehicle Operating Costs S&L Diagram



Accident Costs from the Additional Transportation of Waste

Accident costs from the additional transportation of waste are designed to estimate potential costs of roadway accidents based on additional vehicle distances traveled. Accidents are estimated based on statewide accident rates and monetized per United States Department of Transportation guidance.

Figure 13: Accident Costs S&L Diagram



Total Social Impacts

The present value of social impacts across all waste solutions is presented in Table 4 from lowest total social impact costs to highest. Negative values indicate benefit streams, while positive impacts indicate costs. Waste solution scenarios with greater social impacts indicate a greater societal cost to implement that solution. Based on social impacts alone, waste solutions 1, 4, and 5, which involve no additional waste transportation, would offer the lowest societal social cost.

Table 3: Present Value of Social Impacts by Waste Solution, Discounted at 7%

Solution ID	Solution Description	Pavement Damage	Vehicle Operating Costs	Accident Costs	Total Social Impact
1	New Landfill	$0.0 M	$0.0 M	$0.0 M	**$0.0 M**
4	Anaerobic Digestion with New Landfill	$0.0 M	$0.0 M	$0.0 M	**$0.0 M**
5	Direct Combustion with New Landfill	$0.0 M	$0.0 M	$0.0 M	**$0.0 M**
3	Mixed Waste Processing/RDF with New Landfill	$0.1 M	$0.8 M	$0.4 M	**$1.3 M**
6	Mixed Waste Processing/RDF with Regional Landfill	$0.1 M	$1.1 M	$0.6 M	**$1.8 M**
8	Direct Combustion with Regional Landfill	$0.1 M	$1.3 M	$0.7 M	**$2.0 M**
2	Transfer to Landfill	$0.2 M	$1.9 M	$1.0 M	**$3.0 M**
7	Anaerobic Digestion and Regional Aerobic Composting with Regional Landfill	$0.3 M	$2.8 M	$1.5 M	**$4.6 M**

Life Cycle Costs

This section outlines the life cycle costs captured in the SROI analysis. The life cycle economic costs include capital costs and operations and maintenance (O&M) costs.

Capital Costs

The capital cost of improvements represents the full upfront costs to construct the facilities described as part of the waste solution. Table 5 capital costs do not include financing costs.

Table 4: Present Value of Capital Cost of Improvements, Discounted at 7%

Solution ID	Solution Description	Capital Cost
2	Transfer to Landfill	$23.2 M
1	New Landfill	$24.1 M
4	Anaerobic Digestion with New Landfill	$37.3 M
7	Anaerobic Digestion and Regional Aerobic Composting with Regional Landfill	$40.4 M
3	Mixed Waste Processing/RDF with New Landfill	$77.1 M
6	Mixed Waste Processing/RDF with Regional Landfill	$78.4 M
5	Direct Combustion with New Landfill	$235.8 M
8	Direct Combustion with Regional Landfill	$353.1 M

Operations & Maintenance Costs

The operations and maintenance (O&M) costs are the ongoing incremental costs to operate and maintain the waste solution facilities in a state of good repair during their service life. This includes both fixed and variable costs of operation and maintenance, excluding electricity consumption, which is included as part of the economic impacts. Operations and maintenance costs begin once the facilities open in Year 1 (assumed 2038 in this analysis) and continue throughout the study period.

Table 5: Present Value of Operations and Maintenance Costs, Discounted at 7%

Solution ID	Solution Description	O&M Costs
2	Transfer to Landfill	$27.3 M
7	Anaerobic Digestion and Regional Aerobic Composting with Regional Landfill	$33.1 M
4	Anaerobic Digestion with New Landfill	$38.3 M
6	Mixed Waste Processing/RDF with Regional Landfill	$39.1 M
3	Mixed Waste Processing/RDF with New Landfill	$44.9 M
1	New Landfill	$61.0 M
5	Direct Combustion with New Landfill	$62.9 M
8	Direct Combustion with Regional Landfill	$70.1 M

Total Project Costs

The present value of the total project costs, shown in Table 7, identifies the full project costs for each scenario. Scenarios 2, 7, and 4 present the lowest present value of total project costs.

Table 6: Present Value of Total Project Costs, Discounted at 7%

Solution ID	Solution Description	Capital Cost	O&M Cost	Total Costs
2	Transfer to Landfill	$23.2 M	$27.3 M	**$50.5 M**
7	Anaerobic Digestion and Regional Aerobic Composting with Regional Landfill	$40.4 M	$33.1 M	**$73.4 M**
4	Anaerobic Digestion with New Landfill	$37.3 M	$38.3 M	**$75.5 M**
1	New Landfill	$24.1 M	$61.0 M	**$85.1 M**
6	Mixed Waste Processing/RDF with Regional Landfill	$78.4 M	$39.1 M	**$117.5 M**
3	Mixed Waste Processing/RDF with New Landfill	$77.1 M	$44.9 M	**$122.0 M**
5	Direct Combustion with New Landfill	$235.8 M	$62.9 M	**$298.7 M**
8	Direct Combustion with Regional Landfill	$353.1 M	$70.1 M	**$423.2 M**

Results

The analysis produces a net present value that quantifies the relative societal cost of each waste solution from a triple bottom line perspective.

The net present value (NPV) is calculated by summing the present value of the project costs (or the life cycle economic costs) and the present value of the economic impacts, environmental impacts, and social impacts generated by the project. This measure indicates the total value of the net impacts on society, including accounting for the project costs.

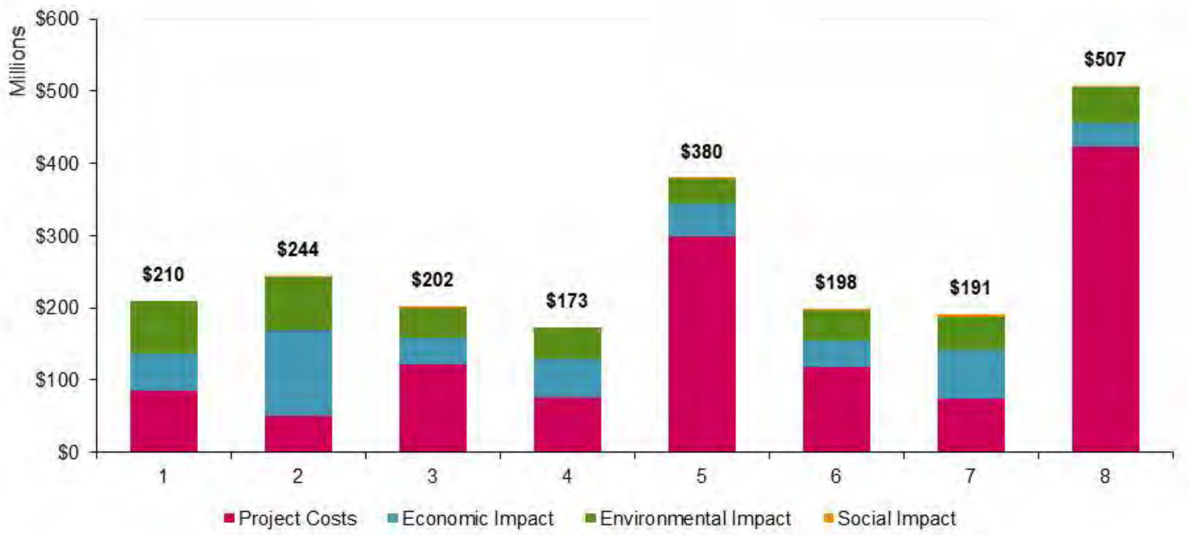
Table 8 presents the waste solution scenarios in lowest to highest total impacts through the triple bottom line framework.

Table 7: Present Value of Total Project Impacts, Discounted at 7%

Solution ID	Solution Description	Project Costs	Economic Impacts	Environmental Impacts	Social Impacts	Total Project Impacts
4	Anaerobic Digestion with New Landfill	$75.5 M	$52.7 M	$44.3 M	-	**$172.5 M**
7	Anaerobic Digestion and Regional Aerobic Composting with Regional Landfill	$73.4 M	$68.3 M	$45.0 M	$4.6 M	**$191.3 M**
6	Mixed Waste Processing/RDF with Regional Landfill	$117.5 M	$38.0 M	$41.0 M	$1.8 M	**$198.4 M**
3	Mixed Waste Processing/RDF with New Landfill	$122.0 M	$35.7 M	$42.6 M	$1.3 M	**$201.6 M**
1	New Landfill	$85.1 M	$51.9 M	$72.6 M	-	**$209.6 M**
2	Transfer to Landfill	$50.5 M	$117.8 M	$73.1 M	$3.0 M	**$244.4 M**
5	Direct Combustion with New Landfill	$298.7 M	$46.7 M	$34.3 M	$0.0 M	**$379.7 M**
8	Direct Combustion with Regional Landfill	$423.2 M	$31.9 M	$49.7 M	$2.0 M	**$506.8 M**

Figure 14 graphically displays the net present value of each waste solution. Projects with higher net present value of impact present a greater cost to society.

Figure 14: Net Present Value of Impacts of Waste Solutions, Discounted at 7 Percent in Millions of Dollars



Appendix A: Detailed SROI Inputs and Assumptions

General Economic Parameters

The SROI analysis is predicated on general assumptions to define the framework of the analysis. These parameters include defining the study period and a discount rate representing the opportunity cost of capital, typically estimated as the average borrowing rate for new capital investments. This study is set to examine the implementation of waste solution scenarios which begin development in 2023 and be operational by 2038. Impacts are accrued over a 35-year period from year 2038, and all future costs and benefits are discounted to 2022, in 2021$.

Discounting is weighting future net impacts against current net impacts to reflect society's general preference for the present and reflect the opportunity cost of not investing these funds in another project. The conversion ensures a meaningful comparison of benefit and cost streams over the project life cycle.

Table 8: General Economic Parameters

General Assumptions	Value	Source
Base Date	2022	All results are presented in 2022 terms (e.g., all life cycle economic costs and benefits are discounted back to a Present Value estimate in 2022 terms.
First Year of Operations	2038	Assuming all waste solutions are operational in 2038, with all solutions accruing impacts simultaneously.
Study Period Length	50 years	2022 - 2072
Discount Rate	7.0%	The assumption to represent the opportunity cost of capital is based on federal government guidance and used to discount all future costs and benefits to a present value total.

Economic Impacts

This section outlines the economic impacts on society in the SROI analysis. These include user costs of material handling, revenues from material handling byproducts, the cost of electricity purchased, revenue from excess electricity exported to the grid, and the residual value of improvements.

User Costs of Material Handling

The user cost of material handling represents the cost associated with handling and disposing of waste. The benefit is calculated from two inputs: the tonnage of material landfilled and the landfill tipping fee.

TONNAGE OF MATERIAL LANDFILLED

The tonnage of waste landfilled varies in the waste solution scenarios depending on the diversion and recovery of products. The waste composition was based on the 2020 composition and assumed to maintain the same overall composition throughout the study period. Landfilled materials included MSW, disaster debris, special waste, construction and demolition waste, and shingles.

Revenues from Material Handling Byproducts

Revenues from material handling byproducts capture revenue streams from material handling, including the sale of composted materials, recovered cardboard, metals and plastics, and refuse-derived fuel. All revenue stream assumptions and recovery rates were developed as part of the scenarios.

Cost of Electricity Purchased

The cost of electricity purchased captures the electricity demand at the various buildings in the scenarios. Assumptions on the cost of electricity were derived from the scenarios' cost estimates, and the same rate was assumed across all scenarios.

Revenue from Excess Electricity Exported to the Grid

The revenue from electricity generated on-site from either anaerobic digestion or waste-to-energy facilities are assumed to be exported back to the grid at a buyback rate. Depending on the location of the facility and the utility providing electricity, net metering rates may be an option, which would allow electricity produced to first offset the facility demand, and then export any excess back to the grid. The buyback rate is assumed to be significantly less than the cost of electricity and was derived as part of the cost estimates for the scenarios.

Residual Value of Improvements

Residual value is designed to capture the benefit of any remaining value of investments at the end of the study period. Straight-line depreciation is used to estimate the remaining value of waste solutions at the end of the study period.

Environmental Impacts

This section outlines the environmental impacts on society in the SROI analysis. Environmental impacts capture the environmental damages from greenhouse gas emissions and criteria air contaminants. The net impacts of emissions from material handling, waste transportation, and the production and generation of electricity are captured as environmental impacts.

GHG Emissions from Material Handling

Greenhouse gas (GHG) emissions from material handling represent the impacts of landfilling and waste diversion for each waste solution. Emission factors for waste management were derived from the United States Environmental Protection Agency's (EPA) Waste Reduction Model (WARM) version 15. Emission factors are available for various material types, with different emission factors for recycling, composting, combustion, landfilling, and anaerobic digestion. Each material part of the CRLCSWA waste stream was mapped to a material in the WARM model, and emission factors were applied based on the tonnage of waste and the method used to handle the waste.

Emissions from the Transportation of Waste

Emissions from the transportation of waste capture GHG and CAC emissions from trucks hauling waste. Emissions from heavy-duty trucks were simulated from the EPA's Motor Vehicle Emission Simulator (MOVES) for CRLCSWA. MOVES produces emissions by vehicle speed and year. The output was interpolated to construct emission factors every year at each 5-mile per hour increments. Each emission factor is multiplied by the distance traveled to estimate the total annual emissions for carbon dioxide, nitrogen oxides, sulfur dioxide, particulate matter, and volatile organic compounds.

Emissions from the Production and Generation of Electricity

Emissions from the production and generation of electricity capture the net impact of GHG and CAC emissions from the electricity demand at the facilities. The emissions are offset by any electricity generation by the waste solution. Emissions from the electric grid were estimated based on the EPA's Emissions & Generation Resource Integrated Database (eGRID) and the forecasted marginal fuel mix. eGRID was used to identify the emission rates for each generation fuel type. The marginal fuel mix captures the blend of generation assets that would be deployed or curtailed by adding or reducing 1 megawatt of electricity. The marginal fuel mix was forecast based on current marginal fuel mix reports and future generation capacity, including additions and retirements from Midcontinent Independent System Operator (MISO) reports. Combined, eGRID and the MISO reports were used to calculate a weighted average emission rate each year. The marginal emission rates were applied based on the electricity demand and electricity produced to estimate the total emissions from electricity. These emissions were monetized per the United States Department of Transportation's recommended values in their Benefit-Cost Analysis Guidance. Assumptions used in the electricity emission calculations are shown in Table 10, Table 11, and Table 12.

Table 9: Emission Factors for Electricity Generation Energy Type, lbs. per MWh

Energy Type	NO_X	SO_2	CO_2	CH_4	N_2O
Coal	1.673	2.353	2,233	0.2527	0.0368
Oil	5.18	3.258	1,115	0.0453	0.0078
Gas	0.345	0.009	932	0.0177	0.0018
Fossil Fuel	1.422	1.899	1,977	0.2065	0.0299
Combustion Fuel	1.452	1.887	1,952	0.211	0.031

Source: United States Environmental Protection Agency. Emissions & Generation Resource Integrated Database (eGRID). MRO West Subregion, 2019. https://www.epa.gov/egrid/download-data

Table 10: Marginal Fuel Mix by Electricity Generation Type

Energy Type	2020	2025	2030	2035	2040+
Nuclear	17%	14%	14%	13%	13%
Coal	34%	13%	6%	4%	1%
Natural Gas	34%	31%	32%	32%	32%
Oil	0%	0%	0%	0%	0%
Hydro	2%	2%	2%	2%	2%
Wind	12%	34%	35%	34%	35%
Other	1%	6%	11%	15%	17%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Midcontinent Independent System Operator. "2020 State of the Market Report for the MISO Electricity Markets," May 7, 2021. https://www.potomaceconomics.com/wp-content/uploads/2021/05/2020-MISO-SOM_Report_Body_Compiled_Final_rev-6-1-21.pdf. Data beyond 2020 calculated based on scaling the marginal mix with planned retirement and additions of capacity presented in the MISO Futures Report from April 2021.

Table 11: Planned MISO Generation Capacity, MW

Energy Type	2020	2025	2030	2035	2040+
Nuclear	11,638	10,371	10,371	9,279	9,279
Coal	46,030	19,477	7,939	5,633	1,203
Natural Gas	58,226	58,226	58,226	58,226	58,226
Oil	1,578	0	0	0	0
Hydro	3,729	3,811	3,811	3,811	3,811
Wind	4,470	13,950	13,938	13,201	13,951
Other	3,061	21,345	34,564	49,857	54,048
Total	**128,732**	**127,180**	**128,849**	**140,007**	**140,518**

Source: Midcontinent Independent System Operator. "MISO Futures Report," April 2021. https://cdn.misoenergy.org/MISO%20Futures%20Report538224.pdf. The report presents a combination of Tables 7 and 8 under Future 1.

Value of Emissions

The GHG emissions from waste handling, transportation of waste, and electricity production and generation are monetized based on values per metric ton from the Interagency Working Group on the Social Cost of Greenhouse Gases report, *Technical Update of the Social Cost of Carbon for Regulatory Impact*. The values capture the environmental damage, in terms of damage to crops and other vegetation, of 1 metric ton of carbon dioxide equivalent ($MTCO_2E$) emitted into the atmosphere. Table 13 shows the annual values applied to the total avoided GHG emissions to monetize the total environmental benefits. The values increase every year as emissions accumulate in the atmosphere, and each incremental ton of pollution has a higher environmental cost.

The CAC emissions from the transportation of waste and electricity production and generation are monetized based on values per metric ton from the United States Department of Transportation Benefit-Cost Analysis Guidance. The values presented are to capture the health costs associated with CAC emissions, and Table 13 presents the monetized values for each emission factor.

Table 12: Value of Emissions, Dollars per Metric Tonne

Calendar Year	CO_2	NO_X	$PM_{2.5}$	SO_2	VOC
2022	$54.65	$16,598	$778,272	$43,518	$0
2023	$55.66	$16,800	$792,138	$44,429	$0
2024	$56.68	$17,003	$806,205	$45,441	$0
2025	$57.69	$17,205	$817,237	$46,049	$0
2026	$58.70	$17,509	$828,470	$46,757	$0
2027	$59.71	$17,711	$839,805	$47,466	$0
2028	$60.72	$17,913	$851,343	$48,174	$0
2029	$61.74	$18,217	$862,982	$48,781	$0
2030	$62.75	$18,217	$862,982	$48,781	$0
2031	$63.76	$18,217	$862,982	$48,781	$0
2032	$64.77	$18,217	$862,982	$48,781	$0
2033	$66.80	$18,217	$862,982	$48,781	$0
2034	$67.81	$18,217	$862,982	$48,781	$0
2035	$68.82	$18,217	$862,982	$48,781	$0
2036	$69.83	$18,217	$862,982	$48,781	$0
2037	$70.84	$18,217	$862,982	$48,781	$0
2038	$71.86	$18,217	$862,982	$48,781	$0
2039	$72.87	$18,217	$862,982	$48,781	$0
2040	$73.88	$18,217	$862,982	$48,781	$0
2041	$75.90	$18,217	$862,982	$48,781	$0
2042	$76.92	$18,217	$862,982	$48,781	$0
2043	$77.93	$18,217	$862,982	$48,781	$0
2044	$78.94	$18,217	$862,982	$48,781	$0
2045	$79.95	$18,217	$862,982	$48,781	$0
2046	$80.96	$18,217	$862,982	$48,781	$0
2047	$81.98	$18,217	$862,982	$48,781	$0
2048	$84.00	$18,217	$862,982	$48,781	$0
2049	$85.01	$18,217	$862,982	$48,781	$0
2050	$85.01	$18,217	$862,982	$48,781	$0

Source: Interagency Working Group on Social Cost of Greenhouse Gases (IWGSCC), Technical Update of the Social Cost of Carbon for Regulatory Impact. Cost assumed to be constant beyond 2050, escalated to 2021$. Technical Support Document: Estimating the Benefit per Ton of Reducing $PM_{2.5}$ Precursors from 17 Sectors (February 2018)" https://www.epa.gov/sites/default/files/2018-02/documents/sourceapportionmentbpttsd_2018.pdf. Using the GDP deflator, NOX, SOX, and PM2.5 values are inflated from 2015 to 2020.

Social Impacts

This section outlines the social impacts of the SROI analysis. Social impacts capture the monetized value of pavement damage caused by the additional transportation of waste, accident costs from the additional transportation of waste, and vehicle operating costs. The distances drive all social impacts traveled to transport waste and any byproducts to its destination.

Pavement Damage from the Additional Transportation of Waste

Pavement damage from the additional transportation of waste captures the increased road maintenance costs from heavy-duty vehicles traveling on roadways. Table 14 presents the factors used to monetize the pavement damage costs.

Table 13: Pavement Damage Assumptions

Assumption	Unit	Value	Source
Pavement Maintenance Cost	$/mile	$0.05	Addendum to the 1997 Federal Highway Cost Allocation Study, Final Report, US Department of Transportation and Federal Highway Administration, May 2000; Table 13. Assuming 60 kip 5-axle trucks on rural highways escalated to 2021$ using the GDP deflator.

Vehicle Operating Costs from the Additional Transportation of Waste

Vehicle operating costs capture the operating and maintenance costs associated with heavy-duty vehicles, including fuel costs. Table 15 provides the assumptions used to monetize vehicle operating costs.

Table 14: Vehicle Operating Cost Assumptions

Assumption	Unit	Value	Source
Vehicle Operating Cost	$/mile	$0.99	American Transportation Research Institute, An Analysis of the Operational Costs of Trucking: 2020 Update http://truckingresearch.org/wp-content/uploads/2020/11/ATRI-Operational-Costs-of-Trucking-2020.pdf. Escalated to 2021$ using the GDP deflator.

Accident Costs from the Additional Transportation of Waste

Accident costs capture the estimated accident costs associated with the additional transportation of waste.

Table 16 provides the assumptions used to monetize accident costs.

Table 15: Accident Cost Assumptions

Assumption	Unit	Value	Source
Fatality Accident Rate	fatalities/ 100,000 vehicle miles traveled	0.001	Calculated based on data from 2014-2016 from Iowa Department of Transportation 2016 Crash Facts: Crashes Involving Heavy Trucks and Iowa DOT 2014, 2015, & 2016 Annual VMT by Classification. https://iowadot.gov/maps/msp/vmt/clvmt16.pdf
Injury Accident Rate	injuries/ 100,000 vehicle miles traveled	0.03	
Property Damage Only Accident Rate	accidents/ 100,000 vehicle miles traveled	0.1	
Cost of Fatality	$/fatality	$11,562,091	Guidance on Treatment of the Economic Value of a Statistical Life in US Department of

Assumption	Unit	Value	Source
Cost of Injury	$/injury	$209,603	Transportation Analyses (2016) https://www.transportation.gov/officepolicy/transportation-policy/reviseddepartmental-guidance-on-valuation-of-astatistical-life-in-economic-analysis. Escalated to 2021$ using the GDP deflator.
Cost of Property Damage Only	$/accident	$4,773	

Preliminary Location Assessment Memo

May 13, 2022

Executive Summary

The Cedar Rapids Linn County Solid Waste Agency (CRLCSWA or the Agency) is researching future waste disposal options via its Forward 2044 Waste Planning initiative. Per the Agency's settlement agreement, Site 2 is not able to receive waste after June 30, 2044.[1] Additionally, current airspace projections for Site 2 indicate that the landfill will run out of available airspace by 2037. The Agency is looking at diversion options to lengthen the available airspace through the end of the settlement agreement while also deciding where waste from Linn County and its surrounding area (Region) will go beyond 2044.

At the direction of the CRLCSWA Board, HDR is leading an evaluation of eight waste campus scenarios that may be the solution to the future of waste management in the Region. These scenarios were derived from a funneling process that considered management of the Region's solid waste volumes through several industry technologies. The eight waste campus scenarios were selected by the Board based on the feasibility of commercial operation, permitting, and construction in the Midwest. The eight scenarios being evaluated are listed in **Table 1.**

TABLE 1: WASTE SOLUTION SCENARIOS

						Partner / Regional Approach		
	1	2	3	4	5	6	7	8
New Landfill (CRLCSWA Owned)	X		X	X	X			
Partner Landfill		X				X	X	X
Waste Transfer		X				X	X	X
HHM	X	X	X	X	X	X	X	X
Resource Recovery Center (RRC)	X	X	X	X	X	X	X	X
Aerobic Organics Composting	X	X	X	X	X	X	X	X
Anaerobic Digestion (Green Waste/Food)				X			X	
Mixed Waste Processing with RDF			X			X		
Direct Combustion (WTE)					X			X

Land Requirements

Each scenario requires securing land to house the facilities and programs identified for the waste campuses. The evaluation has focused on a singular location for the waste campuses that equates to securing land ranging from 80 to 320 acres. Following selection of the preferred scenario by the Board, the segregation of the waste campuses into locations and parcel sizes that fit the needs of the Region will be further evaluated prior to siting and permitting. If regionalization is part of

[1] CRLCSWA 28E Agreement and 2005 Settlement Agreement with the City of Marion, Iowa.

the selected scenario, certain facilities and/or programs may be located at a partner community's waste campus, further limiting the land needs within Linn County.

As part of the current evaluation, the Agency envisions the development of a waste campus to house the selected scenario components. A waste campus is an area that houses multiple waste processing facilities. Each proposed scenario includes the construction, operation, maintenance, and staffing of a Household Hazardous Material (HHM) building and program, aerobic organics composting, resource recovery center and program, scale house, maintenance building, and support infrastructure as roads and utilities, and education center. The space suggested for each scenario is included in **Table 2**. A separate memo has been prepared capturing the analysis of infrastructure options that were used to develop the estimated parcel sizes for the waste campuses, and an environmental justice snapshot has been prepared to consider potential impacts on surrounding communities.

TABLE 2: LAND REQUIREMENTS BY SCENARIO (ACRES)

						Partner / Regional Approach		
	1	2 [a]	3	4	5	6	7 [b]	8
New Landfill (CRLCSWA Owned)	220	-	141	204	141	-	-	-
Partner Landfill	-	0	-	-	-	0	0	0
Waste Transfer	-	15	-	-	-	12	14	10
RRC/HHM	4	4	4	4	4	4	4	4
Aerobics Organic Composting	30	30	30	31	30	30	17	30
Anaerobic Digestion	-	-	-	15	-	-	15	-
Mixed Waste Processing/RDF	-	-	21	-	-	22	-	-
Waste to Energy	-	-	-	-	18			20
Scale House & Scales	10	10	10	10	10	10	10	10
Administration & Environmental Education Center	2	2	2	2	2	2	2	2
Maintenance Facility	2	2	2	2	2	2	2	2
Citizen Drop Off	4	2	4	4	2	2	4	4
Total	**272**	**65**	**214**	**272**	**209**	**84**	**68**	**82**
Parcel / Property Size	**320**	**65**	**320**	**320**	**320**	**90**	**80**	**90**

Notes:

[a] Scenario 2 requires two solid waste campuses: one for the transfer station and the second for all other facilities.

[b] Scenario 7 uses an aerated static pile (ASP) composting system, as opposed to windrow composting used in the other scenarios. Less space is needed for ASP systems.

Preliminary Location Assessment Criteria

Given the Agency is actively reviewing the eight scenarios and in the process of funneling options for a path forward to continued waste management in Linn County beyond 2044, there was not a defined criteria that would assess the components of each scenario. Other than landfilling, the additional primary solutions to managing waste within each scenario are subject to local zoning restrictions when assessing locations for development. Therefore, our preliminary location assessment used the more general restrictions for municipal solid waste landfills (MSWLF) identified in Iowa Administrative Code (IAC), in addition to the Linn County ordinance associated with corn suitability rating. The evaluation criteria were used to preliminarily evaluate suitable land within the county that may be considered for a waste campus. The following list details the preliminary evaluation criteria:

- Prohibition of locating a new MSWLF within six miles of public airport – IAC 113.6(2)a(1);
- Limitation of MSWLF units located within 100-year floodplains – IAC 113.6(2)b;
- Restriction of MSWLF unit located within 1,000 feet of potable well or community water system – IAC 113.6(2)j;
- Restriction of MSWLF unit located within 500 feet of an occupied residence – IAC 113.6(2)l; and
- Local siting restriction for sanitary landfills on land that has a corn suitability rating greater than 65 (CSR >65) – Linn County Planning & Development – Unified Development Code Article VII Section 107-145.

Preliminary Assessment Outcomes

Based on the preliminary evaluation there are 62,577 acres that meet the criteria listed above, relative to 463,681 acres total in Linn County or 13.4% of the County land that may be developed as a landfill. A further evaluation of land available for development suggests that there are no areas within the county that are a contiguous 320-acre parcel and three (3) areas that are 100-acre parcels.

The most limiting location criteria, according to the preliminary evaluation, is the local zoning restriction associated with preventing development for sanitary landfill use on land with a CSR>65. The next most limiting criteria in order of impact are 500ft distance from occupied residence, 1000ft distance from potable wells, and 6-mile prohibition of development from a public airport, respectively.

A more detailed evaluation would be required to determine if these areas meet each of the federal, state, and local siting criteria for the selected waste campus scenario. Additionally, a multi-campus approach, separation of waste management programs and facilities across multiple parcels within the county, would create more options with regards to available land (smaller parcels needed).

Results suggest that evaluation of regional partnerships for various components of the waste management system should be further explored given the limited available land within Linn County.

Infrastructure Options Analysis Memo

Abbreviations

AD	Anaerobic Digestion
Agency	Cedar Rapids Linn County Solid Waste Agency
ASP	Aerated Static Pile
C&D	Construction and Demolition Waste
CRLCSWA	Cedar Rapids Linn County Solid Waste Agency
FTE	Full-Time Employee
HHM	Household Hazardous Materials
lbs.	Pounds
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
MWP	Mixed Waste Processing
OCC	Old Corrugated Cardboard
O&M	Operating and Maintenance
(R)	Regional Option
RDF	Refuse Derived Fuel
Region	City of Cedar Rapids, Linn County, and surrounding area
RRC	Resource Recovery Facility
WTE	Waste-to-Energy

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1. Executive Summary

The Cedar Rapids Linn County Solid Waste Agency (CRLCSWA or the Agency) is researching future waste disposal options via its Forward 2044 Waste Planning initiative. The Agency's existing landfill, Site 2, cannot receive trash after 2044, and[1] Airspace projections for Site 2 indicate that the landfill will run out of airspace by 2037. The Agency is deciding where trash from Linn County and its surrounding area (Region) will go in the future.

The Agency has used the Forward 2044 project process to funnel options to a review of eight waste campus scenarios. The selected Scenario will be cost-effective, operate by 2044 or earlier, use proven technologies, and handle the volume of waste produced in the Region.[2]

The Agency has the following goals for the selected Scenario:

- Reduce the amount of waste landfilled
- Ensure landfill space (local or regional) is available in case of a high-volume event (i.e., derecho)
- Provide competitive rates
- Provide end markets where possible
- Provide public education
- Conserve environmental resources
- Manage risk associated with waste disposal
- Minimize impact on the surrounding communities (i.e., traffic and/or odor)

The eight scenarios being considered are listed in **The Agency** envisions the development of a waste campus to house the selected scenario components. A waste campus is an area that houses multiple waste processing facilities. Each proposed Scenario includes the construction, operations, maintenance, and staffing of a Household Hazardous Material (HHM) building and program, aerobic organics composting, resource recovery center and program, scale house, maintenance building, and support infrastructure as roads and utilities, and education center.

The advantages of a consolidated waste campus include the following:

[1] CRLCSWA 28E Agreement and 2005 Settlement Agreement with the City of Marion, Iowa.
[2] CRLCSWA Board Workshop, Forward 2044 Waste Planning. June 23, 2021.

- Siting multiple facilities on a single site can be more economical and create efficiencies for staffing, equipment, and utilities.
- A waste campus represents the most compact use of land.
- There is potential for a reduction of vehicle miles traveled.
- Consolidation maximizes educational opportunities; visitors to the education center can tour multiple facilities and learn about various disposal and diversion processes.
- A waste campus enables more centralized administrative and record-keeping activities.

Scenario 2 includes two waste campuses: the first campus would include a transfer station for landfill disposal near a population center, and the second campus would include the diversion facilities.

TABLE 1. The Agency envisions the development of a waste campus to house the selected scenario components. A waste campus is an area that houses multiple waste processing facilities. Each proposed Scenario includes the construction, operations, maintenance, and staffing of a Household Hazardous Material (HHM) building and program, aerobic organics composting, resource recovery center and program, scale house, maintenance building, and support infrastructure as roads and utilities, and education center.

The advantages of a consolidated waste campus include the following:

- Siting multiple facilities on a single site can be more economical and create efficiencies for staffing, equipment, and utilities.
- A waste campus represents the most compact use of land.
- There is potential for a reduction of vehicle miles traveled.
- Consolidation maximizes educational opportunities; visitors to the education center can tour multiple facilities and learn about various disposal and diversion processes.
- A waste campus enables more centralized administrative and record-keeping activities.

Scenario 2 includes two waste campuses: the first campus would include a transfer station for landfill disposal near a population center, and the second campus would include the diversion facilities.

TABLE 1: WASTE SOLUTION SCENARIOS

	New landfill (Solid Waste Agency owned)	Partner landfill	Waste transfer	Household hazardous materials	Resource Recovery Center	Aerobic organics composting	Anaerobic digestion (green waste/food)	Refused derived fuel (mixed waste) processing	Direct combustion (waste to energy)
1 New landfill	●			●	●	●			
2 Transfer to Landfill Not owned by CRLCSWA		●	●	●	●	●			
3 Mixed Waste Processing with New Landfill CRLCSWA Owned	●			●	●	●		●	
4 Anaerobic Digestion with New Landfill CRLCSWA Owned	●			●	●	●	●		
5 Direct Combustion with New Landfill CRLCSWA Owned	●			●	●	●			●
6 Mixed Waste Processing with Partnered Landfill		●	●	●	●	●		●	
7 AD/Organics with Partnered Landfill		●	●	●	●	●	●		
8 Direct Combustion with Partnered Landfill		●	●	●	●	●			●

Partner/regional approach

Error! Not a valid bookmark self-reference. lists the tonnages managed by either recycling, organics, or landfilling for each Scenario. The ownership of the landfill changes between scenarios. Scenarios 1, 3, 4, and 5 assume the Agency will construct, own, and operate a landfill in addition to the other diversion programs and manage the tonnage shown in **Table 2**. Scenarios 2, 6, 7, and 9 assume the tons of materials gathered for landfilling will be transferred to a partner landfill(s) owned, operated, and managed not by the Agency. Therefore, these tons represent the volumes that need to be transferred.

The waste management technologies, not currently used by the Agency, such as Anaerobic Digestion, will increase the amount of waste diverted from a landfill. This is shown in **Table 2** as the percentage of total material diverted from the landfill, regardless of whether the landfill is owned by the Agency or by a partner.

TABLE 2: YEAR 1 TONNAGE MANAGED BY SCENARIO (TONS)

	Recycling	Organics	Refuse-Derived Fuel	Landfill Bolded numbers represent tons transferred to a partner landfill	Percent Diversion [a]
Scenario 1 New Landfill	5,218	38,118	-	236,846	15%
Scenario 2 Transfer Station w/ Partner Landfill	5,218	38,118	-	**236,879**	17%
Scenario 3 [b] MWP with New Landfill	10,364	38,118	133,314	94,684	66%
Scenario 4 AD with New Landfill	5,218	63,051	-	211,946	24%
Scenario 5 [c] WTE with New Landfill	9,292	38,118	-	101,068	64%
Scenario 6 [b] MWP with Partner Landfill	14,275	62,022	185,914	**90,375**	74%
Scenario 7 AD with Partner Landfill	5,218	84,218	-	**206,297**	30%
Scenario 8 [c] WTE with Partner Landfill	14,771	38,118	-	**163,457**	69%

[a] Percent diversion based on Year 1 (the first year the scenarios are operational).

[b] This diversion rate assumes that a refuse-derived fuel (RDF) system is built along with the mixed-waste processing (MWP) facility; diversion rates are lower (15%) without RDF.

[c] Diversion rate includes a waste-to-energy volume reduction of 131,723 tons for Scenario 5 and a volume reduction of 308,869 tons for Scenario 8.

Waste Disposal and Reduction

Each of the scenarios includes both waste reduction and waste disposal elements. Reducing the amount of waste sent to a landfill (whether owned by CRLCSWA or a regional partner) will reduce costs and risks.

The following reduction strategies may be used in the scenarios:

- Household Hazardous Materials center (HHM)
- Resource Recovery Center (RRC)
- Aerobic Organics Composting
- Anaerobic Digestion (AD)
- Mixed-Waste Processing (MWP)
- Refuse-Derived Fuel (RDF)
- Direct Combustion or Waste to Energy (WTE)

The Agency is also considering disposal options. Regardless of the amount of waste that is diverted from landfilling, there will be material that will be disposed of in a lined landfill. The Agency must decide whether the waste will go to one of the following:

- A new landfill owned by CRLCSWA, or
- A partner landfill via a waste transfer station in Linn County.

Each of the eight scenarios includes an HHM center, RRC, and organics composting, which means that there are built-in waste reduction strategies.

Cost Summary

The cost evaluation includes initial capital investment, operations and maintenance (O&M) costs, and anticipated tipping fees for each Scenario. The O&M costs include labor, utilities, maintenance and repairs, equipment, supplies, fuel, insurance, and administration for 50 years of operation beyond 2044. They also include anticipated costs for rebuilds, updates, and expansion.[3] The tipping fees listed for each Scenario include anticipated expenditures offset by revenues. Some scenarios have a more substantial up-front capital investment but lower annual operating costs. The initial capital investment with contingencies and anticipated tipping fees are included in **Table 3**.

[3] Summary of Waste Volumes and Projections Memorandum. HDR. June 14, 2021.

The total capital cost listed in this table includes the cost to build the facilities, including land purchase, site preparation for construction, construction costs for each facility, and equipment. The cost estimate also included costs for support of the purchase and construction process, including engineering and design costs, construction quality assurance, permitting costs, and contingent legal fees. Lastly, the capital cost estimate includes contingencies and market variability factors, which are calculated as a percentage of the total cost of the facility. Contingencies and market variability factors account for unforeseen circumstances that may affect the land purchase and construction costs, such as high inflation rates, volatile markets, or supply chain issues with construction materials, etc.

Information on O&M costs is included in tables by the Scenario in later sections of this report.

TABLE 3: CAPITAL COSTS AND TIPPING FEES BY SCENARIO

	Waste Campus Cost [a]	Technology Cost [a]	Total Capital Cost [b]	Net Tipping Fee
Scenario 1 New Landfill	$30,363,700	$103,069,800	$180,536,500	$43
Scenario 2 Transfer Station w/ Partner Landfill	$33,467,900	$30,049,300	$95,975,200	$95
Scenario 3 MWP with New Landfill	$28,986,500	$205,806,200	$348,954,700	$92
Scenario 4 AD with New Landfill	$30,585,800	$126,554,100	$220,184,900	$50
Scenario 5 WTE with New Landfill	$27,923,200	$573,669,300	$896,079,500	$153
Scenario 6 MWP with Partner Landfill	$26,859,900	$177,682,300	$309,190,700	$93
Scenario 7 AD with Partner Landfill	$42,386,700	$64,372,900	$164,363,600	$58
Scenario 8 WTE with Partner Landfill	$26,859,900	$821,991,600	$848,851,500	$72

[a] Transfer station required for scenarios with partner landfills is listed in the "Technology Cost" category. The waste campus cost includes administration and environmental education center, scale house and scales, maintenance facility, resource recovery, household hazardous materials center, organic composting, and citizen drop-off.
[b] Capital costs include land purchase, legal and support costs for land purchase, contingency, permitting, construction observation for new facilities, and equipment for each Scenario. Contingency is a cost added to account for unforeseen circumstances during the construction of the facilities.

TABLE 4: COST BREAKDOWNS FOR LEAD TECHNOLOGY ONLY FOR EACH SCENARIO

	Total Facilities Capital	Year 1 O&M Costs	Year 1 O&M – Hauling Costs	Year 1 Landfill Disposal at $38 per ton	Year 1 Closure/Post-Closure Fund Cost
Scenario 1 New Landfill Construction and Operations	$103,069,800	$2,928,200	--	--	$637,300
Scenario 2 Transfer Station Construction and Operations	$28,908,000	$1,620,000	$5,139,000	$8,173,700	--
Scenario 3 MWP – RDF Facility	$156,207,200	$8,869,800	--	--	$1,832,000
Scenario 4 AD Facility	$39,797,500	$2,109,000			
Scenario 5 WTE Facility	$525,352,000	$20,343,000			
Scenario 6 Regional MWP – RDF Facility	$170,098,900	$10,000,400	$2,797,500		
Scenario 7 Regional AD Facility	$48,594,100	$2,212,600			
Scenario 8 Regional WTE Facility	$816,752,000	$29,549,100			

Land Requirements

Land will need to be purchased regardless of which Scenario is chosen. The required land size for the waste campuses ranges from 65 to 320 acres, with scenarios that do not assume the Agency owns and operates a landfill have a smaller parcel size.

Each Scenario includes a waste campus with an HHM center, RRC, organics composting facility, scale house, maintenance building, administrative building, roads, and utilities. The total land purchased includes contingent buffer space around the waste campus and facilities. The space required for each Scenario is included in **Table 5**. A separate memo has been prepared on preliminary location options for each Scenario, and an environmental justice snapshot has been prepared to consider potential impacts on surrounding communities.

TABLE 5: LAND REQUIREMENTS BY SCENARIO (ACRES)

						Partner / Regional Approach		
	1	2 [a]	3	4	5	6	7 [b]	8
Waste Campus [c]	52	50	52	53	50	50	39	52

[redacted]

New Landfill (CRLCSWA Owned)	220	-	141	204	141	-	-	-
Partner Landfill	-	0	-	-	-	0	0	0
Waste Transfer	-	15	-	-	-	12	14	10
Mixed Waste Processing/RDF	-	-	21	-	-	22	-	-
Anaerobic Digestion	-	-		15	-	-	15	-
Waste to Energy	-	-	-	-	18	-	-	20
Total Land Purchase	**320**	**65**	**320**	**320**	**320**	**90**	**80**	**80**

[a] Scenario 2 requires two solid waste campuses: one for the transfer station and the second for all other facilities.
[b] Scenario 7 uses an aerated static pile (ASP) composting system instead of the windrow composting used in the other scenarios. Less space is needed for ASP systems.
[c] The waste campus for every Scenario includes the following: administration and environmental education center, scale house and scales, maintenance facility, resource recovery, household hazardous materials center, organic composting, and citizen drop-off. Waste campus varies slightly in size by Scenario.

Evaluating Outcomes

The processing and disposal of waste have some inherent risks. There are potentially hazardous materials in waste brought to a transfer station or landfill. Regulation changes could impact how waste can be processed or disposed, and materials that are currently unregulated or less regulated may have more strict requirements in the future. There are also potential environmental impacts from waste.

The largest financial risk is associated with the end disposal of waste through landfilling, regardless of ownership. The risk associated with landfills and potential environmental impact can be mitigated through sound engineering, design, and monitoring. Still, the public ownership of risk and impacts continues long after the landfill closes.

The Scenarios were designed to improve flexibility for the Agency and the communities it serves by:

- Maximizing the use of artificial intelligence when separating materials to ensure the equipment installed in 2044 can be repurposed and used for the next 50 years;
- Supporting the use of waste diversion from landfilling to lower overall tonnage for final disposal; thus, reducing costs and overall risk; and
- Considering efficiencies and scalability of regional partnerships in Scenarios 6, 7, and 8.

CRLCSWA's evaluation of the scenarios should consider cost, land requirements, and the level of control over waste quantities and disposal provided by each Scenario.

CRLCSWA-Owned Landfill (Scenarios 1, 3, 4, 5)

Scenarios that include the construction of a new CRLCSWA-owned landfill (Scenarios 1, 3, 4, and 5) require the most land, but they also give CRLCSWA the most control over the waste and its cost. If CRLCSWA owns a landfill, they can set tipping fees to cover additional program and operational costs. The Agency's planning area would also have landfill space for disaster debris (for example, in the event of a derecho, tornado, flooding, etc.). If CRLCSWA owns a landfill, they are responsible for environmental protection and monitoring costs, operations, closure, and post-closure.

Partner Landfill (Scenarios 2, 6, 7, and 8)

Scenarios that include constructing a transfer station and disposal into a partner landfill (Scenarios 2, 6, 7, and 8) require less land, but CRLCSWA has less control over the waste and disposal costs. In this case, CRLCSWA would not be directly responsible for environmental protection and monitoring, operations, closure, and post-closure but would still pay for those costs as part of the landfill tipping fee. The Region would not necessarily have guaranteed landfill space if a catastrophic event resulted in high volumes of trash (disaster debris). There is also the possibility that the partner landfills would close or stop accepting materials before the end of the 50 years, and CRLCSWA would have to find a new partnered landfill. Lastly, no single landfill in the Region has stated that they have airspace capacity for all of the Agency's waste. Several partner landfills may be required to accept all of CRLCSWA's solid waste.

Waste Reduction

Certain waste produced by the Region can be diverted from landfill disposal, which reduces the airspace required in a CRLCSWA-owned landfill or the amount of money spent on tipping fees at a partner landfill. Each Scenario minimally includes three core services for waste reduction: a household hazardous material center, resource recovery center, and organics composting. Scenarios 3-7 introduce additional strategies for waste reduction, each with costs and benefits. Each reduction strategy is paired with either a CRLCSWA-owned facility or a partner landfill to make up each Scenario.

<u>Mixed Waste Process with Refuse-Derived Fuel (Scenarios 3 and 6)</u>

Scenarios 3 and 6 include mixed waste processing, which could be used with a refuse-derived fuel facility. Mixed waste processing is also known as "second chance recycling." In mixed-waste processing, material that is disposed of as trash is processed through sorting equipment to extract materials that could be reused or recycled. Recovery of these materials can significantly increase the tonnage diverted, but these materials can be lower in value unless specific markets are developed. A mixed-waste processing facility could be paired with a refuse-derived fuel processing system, which would use a boiler to incinerate the processed waste to produce fuel. This technology could provide long-term revenue to CRLCSWA if the Agency can set up an agreement with a facility that can use the fuel. If potential users are identified, further analysis would be necessary to determine if fuel could be produced at an acceptable cost.

<u>Anaerobic Digestion (Scenarios 4 and 7)</u>

Anaerobic digestion is a biological process that allows bacteria to consume organic waste material in a vessel without oxygen. The process produces methane and biogas, which can be used in applications where natural gas (methane) is used. Most anaerobic digestion systems require digestible materials, such as food waste, to be separated from materials that do not digest, such as packaging and mixed waste. Anaerobic digestion focuses on the organic fraction of the waste, representing approximately 28% of CRLCSWA's MSW waste stream. The facility would handle 31,000 tons per year or 84 tons per day by year 25 for Scenario 4. Anaerobic digestion produces biogas that can be sold as fuel, and the Agency would need to set up an agreement for the beneficial use of the fuel. The anaerobic digestion process would be closed in a vessel with special collection and control systems to use the biogas for energy. However, trace emissions from anaerobic digestion facilities can be highly odorous, and odor management will be necessary for this facility.

Waste-to-Energy (Scenarios 5 and 8)

Scenarios 5 and 8 include a waste-to-energy facility. Waste to energy, also known as direct combustion, significantly reduces the volume of waste transferred to a landfill and represents the highest diversion rate of the scenarios. For the combustible portions of the waste stream, it is possible to reduce weight by approximately 80% and volume by 90%. The volume reduction could potentially lead to significant cost savings in tipping fees. Waste to energy also requires the fewest pre-processing of the waste stream. Waste to energy also provides the most options for disposal, as the by-product from waste to an energy process can be disposed of in an ash landfill or an MSW landfill. Waste to energy is one way to significantly reduce the long-term risk of waste disposal. Similar to anerobic digestion, trace emissions from anaerobic digestion facilities can be highly odorous, and odor management will be necessary for this facility.

Conclusions

The Agency is anticipated to select an option to move forward with from the eight scenarios. Each Scenario includes options for traditional landfill disposal and waste reduction via proven technologies. The Agency will have the opportunity to select the disposal option (CRLCSWA-owned landfill or partner landfill) and reduction options (anaerobic digestion, mixed waste processing, refuse-derived fuel, and waste to energy).

The selected Scenario (s) will be evaluated for economic viability, environmental soundness, social acceptability, potential environmental justice impacts, and social benefits through a Sustainable Return on Investment (SROI) process.

2. Waste Campus

The Agency envisions the development of a waste campus to house the waste processing facilities in the selected scenario. Each proposed scenario includes the construction, operations, maintenance, and staffing of a household hazardous material (HHM) building and program, aerobic organics composting, resource recovery center (RRC) and program, scale house, maintenance building, supporting infrastructure such as roads and utilities, and administration/education center.

Scenario 2 includes two waste campuses: one campus would include a transfer station near a population center, and the second campus would include the diversion facilities and programs.

Details on each of the waste campus is listed below. Although the same facilities will be included in each scenario, different land requirements may be necessary due to slightly different infrastructure by scenario.

- **Aerobic Organics Composting** - The composting site will be located on the waste campus and is expected to be approximately 30 acres with a 100-foot buffer. The composting area will require 21 acres for operations by 2087. The aerobic composting facility will use windrow or aerated static pile (ASP) composting technology. Screening and storage pads will be compacted soil.
- **Resource Recovery Center & Household Hazardous Materials Facility** - The RRC will contain the recyclables transfer station, offices, breakroom, and restroom facilities and will cover approximately 4 acres. The total building space for the RRC will be approximately 10,300 square feet. It is recommended that the recyclables transfer station is designed for open-top loading into the transfer trailers, as opposed to the current lift and load operation. The HHM Facility will cover approximately 8,000 square feet and include a 2,000 square foot drive-through canopy. The two facilities will be on the same campus but in different buildings.
- **Scale House and Scales** - The scale house and scale area will require approximately 10 acres of land for the waste campus main entrance and queuing roads. The queuing roads will require an estimated 3,000 linear feet, and the scale house will need approximately 600 square feet with three truck scales.
- **Administration & Environmental Education Center** – The Administration & Environmental Education Center will be two stories to provide space for both administrative offices and an educational center. The land area will be approximately 2 acres with a building footprint of 5,500 square foot. Parking, access, and landscaping is included in the 2 acres.
- **Maintenance Facility** - An approximately 17,000 square foot maintenance facility will be located on a 2-acre parcel. The heated facility will include a 5-ton overhead crane, equipment parking, access, and asphalt roads. The facility's mobile equipment will be maintained here.
- **Citizen Drop-Off Center -** A drop-off center for residents will be located on the waste campus to ensure a space for citizens to drop off appliances/white goods, tires, scrap metal, and glass. For Scenarios 1 and 4, the solid waste drop off center would include seven unloading

bays, similar to the drop off center at Site #2. The solid waste drop off area will require approximately 57,000 square feet in a four-acre area, while the diverted materials drop-off are requiring 15,000 square feet in a two-acre area for three bunkers and a glass roll-off area.

3. Scenario 1 New Landfill

Scenario 1: New Landfill

3.1 Description

MSW landfills are engineered and managed facilities for the disposal of solid waste. Landfills are located, designed, operated, and monitored to ensure compliance with the State of Iowa and Federal requirements. They are also designed to protect human health and the environment. Landfills cannot be built in environmentally sensitive areas and are evaluated onsite environmental monitoring systems. These monitoring systems check for signs of groundwater and soil contamination and landfill gas migration. The modern-day landfill must meet stringent design, operation, and closure requirements under the Resource Conversation and Recovery Act (RCRA) and the State of Iowa Administrative Code.

Landfill disposal at CRLCSWA Site #2 is the cornerstone of current solid waste services that the Agency provides. Scenario 1 evaluates the permitting and construction of a new landfill campus owned by CRLCSWA due to the future closure of the current Site #2 landfill and all associated facilities.

A new landfill campus, including a new RRC and composting facility, would need to be sited, permitted, and constructed. Scenario 1 includes an aerobic composting facility (turned windrow or ASP) capable of composting green waste, food waste, and other organics that are collected and processed separately from mixed waste. The following additions would be included in the Agency's waste campus:

- Aerobics organic composting facility
- RRC, including an HHM facility
- Scale house and scales
- Administration and environmental education center
- Maintenance facility
- Citizen drop-off center

3.2 Summary

TABLE 3-1 SCENARIO 1 INFRASTRUCTURE ASSUMPTIONS

Infrastructure	Overall Assumptions

Overall Campus	• Total site = 320 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	  o Facilities/Buildings, 20 years bond at an annual 4% interest rate
	  o Compost Facility, 20 years bond at an annual 4% interest rate
	  o Landfill with nine cells/phases of development, seven years bond for each phase at an annual 4% interest rate (overlap of bond payments)
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

New Landfill	• All tonnages currently going to the landfill assumed to continue to the landfill
	• Permitted by = Year 2035
	• Assume start waste receipt = Year 2038
	• Provide capacity for = 50 years (i.e., Year 2087)
	• Public Days/Hours operation
	  o Monday – Friday: 7 am – 4 pm
	  o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours:
	  o Monday-Friday: 6:30 am-4:30/5pm
	  o Saturday: 6:30am-2:30pm

3.3 Waste Stream

CRLCSWA currently accepts over 200,000 tons of waste per year. The predicted tonnages for each waste stream included in Scenario 1 are represented in

Table 3-2. The evaluation includes predicted tonnages for Year 1 and Year 50. The waste diverted through the composting facility and the RRC/HHM is broken down in

Table 3-2. The compost facility is responsible for managing organics, a resource recovery center for single-stream, OCC, glass, and the citizen drop-off diverts scrap metal and white goods, along with tires and glass.

TABLE 3-2 SCENARIO 1 WASTE STREAM VOLUMES

Facility	Year 1, TPY	Year 50, TPY
New Landfill	236,846	345,523
	Diversion	
Compost Facility	38,118	55,601
RRC/HHM	4,045	5,943
Citizen Drop-Off	1,173	1,711
Diversion Tonnages	**43,336**	**63,256**
Landfill Tonnages	**236,846**	**345,523**
% Diversion/Reduction	**15%**	**15%**

3.4 Planned Infrastructure

The overall size of Scenario 1 solid waste campus will be approximately 320 acres. Table 3-3 breaks down the minimum area needed for each component. The final parcel size for land acquisition was determined based on purchasing two adjacent 160-acre plots.

The landfill disposal area will be 100 acres. However, the total area needed is 220 acres which include a 500-foot buffer. There will be nine cells or phases, where the first cell will be the largest. Leachate is to be managed onsite with an evaporation pond, leachate recirculation, and a new leachate tanker truck.

TABLE 3-3 SCENARIO 1 LAND REQUIREMENTS

Facility	Area (Acres)
Landfill (With Buffer)	220
Aerobic Composting	30
RRC/HHM	4
Scale House & Scales	10
Administration & Environmental Education Center	2
Maintenance Facility	2
Citizen Drop Off	4
Parcel Size Required	**320**

3.5 Summary of Costs

Scenario 1 capital development costs, operation and maintenance costs for Year 1 and revenue for Year 1 are shown in Table 3-4 below. The revenue for the compost facility includes the yard waste and food waste tipping fees at the current rate.

TABLE 3-4 SCENARIO 1 YEAR 1 FACILITY BUILD OUT

Facility	Full Build-Out	Year 1 O&M ($)		Year 1 Revenues $	
	Total Facilities Capital ($)	O&M ($)	Closure/Post-Closure Fund ($)	Other Revenues ($)	Energy/ Materials Revenues ($)
New Landfill	$103,069,800	$2,928,200	$637,300	$335,700	$436,000
Compost Facility	$9,052,700	$1,142,600	---	$0	$1,091,100
Scale House & Scales	$2,189,600	$293,900	---	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	$0	$0
RRC/HHM	$9,933,900	$1,407,400	---	$0	$647,900
Maintenance Shop	$4,694,100	$566,000	---	$0	$0
Citizen Drop-Off	$1,615,300	$51,300	---	$0	$0
TOTALS	**$133,433,500**	**$8,927,100**	**$637,300**	**$335,700**	**$2,175,000**

Opening a new landfill requires land acquisition, permitting, and equipment. Contingencies were added to the capital costs of the landfill and waste campus facilities. With the estimated financing costs, the total capital costs equal approximately $180,536,500, as shown in detail in Table 3-5 below.

Scenario 1's tipping fee estimates are included in Table 3-6, the capital costs include a full build-out of the facilities for a 50-year period which is then divided by the projected landfilled tons between the years 2037-2087. The financing costs assume a constant annual 4% interest rate on Facilities Capital plus Contingencies shown in Table 3-5. The last cost considered includes the land acquisition and other costs around social justice and legal fees. The total gross tipping fee is estimated to be approximately $52.92, which does not consider other revenues obtained from the CRLCSWA FY2022 budget, materials revenue, and energy revenue shown in Table 3-7. With the additional revenue, the expected rounded tipping fee for CRLCSWA would be approximately $43 per ton.

[redacted]

Table 3-5 Scenario 1 Capital with Contingencies

SCENARIO 1 CAMPUS	Quantity	Unit	Unit Price	Total
Land Acquisition - Purchase	320	Acres	$25,000	$8,000,000[a]
Land Acquisition - Legal/Support	25%	LS	$8,000,000	$2,000,000[b]
Social Justice/Env Impact/Legal	1	RSK	$7,000,000	$7,000,000[c]
SUBTOTAL				**$17,000,000**
Facilities Capital - Landfill Only				$76,530,200
Contingency, Permitting, Eng./Construction Observation/CQA - Landfill Only				$24,489,600
Facilities Capital - All Other Facilities				$21,019,400
Contingency, Permitting, Eng./Construction Observation/CQA - All Other Facilities				$7,194,300
Equipment/Mobile Equipment				$4,200,000
SUBTOTAL				**$133,433,500**
Estimated Financing Costs - Landfill				$16,796,000[d]
Estimated Financing Costs - All Other Facilities				$13,307,000[e]
SUBTOTAL				**$30,103,000**
TOTAL CAPITAL $				**$180,536,500**

Notes:

a. 2 Quarter Sections
b. % Land Purchased
c. Risk Factor
d. Nine cells, seven years each, 4% APR
e. 20 years, 4% APR

[redacted]

An estimated tipping fee of $43 per ton would need to be charged to each ton of waste collected for disposal to operate and maintain Scenario 1. See the table below for a breakdown of the tipping fee needed to cover capital investment, fund annual O&M, and generate the landfill closure and post-closure fund.

Table 3-6 Scenario 1 Estimated Cost

	Capital	Annual O&M	Annual Closure/PC	Total - Gross
Total Costs - Facilities	$133,433,500	$8,927,100	$637,300	
Total Costs - Financing	$30,103,000	---	---	
Total Costs-Land/Legal/Env Impact	$17,000,000	---	---	
Landfilled Tons	14,400,128	236,846	236,846	
$/Ton	**$12.54**	**$37.69**	**$2.69**	**$52.92**

Scenario 1 assumes that revenues will be collected for landfill users via tipping fees, miscellaneous revenues such as grants and investments, sale of recyclables, and energy generated from landfill gas capture. The estimated annual revenues are presented in the table below.

Table 3-7 Scenario 1 Annual Revenues and Estimated Tipping Fee

	Annual Other Revenues	Annual Mat'l/ Energy Revenues	Total - Revenues Before Fees
Revenues	$335,700	$2,175,000	
Landfilled Tons	236,846	236,846	
$/Ton Revenue	**$1.42**	**$9.18**	**$10.60**
Estimated Net Tip Fee			**$42.32**
Rounded Estimate Net Tip Fee			**$43**

4. Scenario 2 Transfer Station

4.1 Description

Scenario 2 evaluates the transfer of waste to a regional landfill that is not owned and operated by CRLCSWA due to the future closure of the current Site #2 landfill and all associated facilities. This scenario includes siting, permitting, and design of a transfer station and new RRC facility owned and operated by CRLCSWA. MSW will be transferred to a landfill under contract, and a potential 28E agreement will be negotiated between CRLCSWA and the other landfill for waste disposal. Scenario 2 includes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste, food waste, and other organics that are collected and processed separately from mixed waste.

In Scenario 2, there are two solid waste campuses: one for the transfer station to haul the waste to another landfill, and the second for all other necessary facilities, including the composting facility, RRC, and HHM facility, administration, and environmental education center, and maintenance facility. Both campuses will have a scale house to accurately track the waste and waste diversion.

4.2 Summary

Table 4-1 Scenario 2 Infrastructure Assumptions

Infrastructure		Overall Assumptions
Campus 1	**Overall**	• Total site = 15 acres • Revenue bonds assumed to finance development • Financing assumptions o Transfer Station & Scale House • Industrial zoned site • Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

	Transfer Station	• Sized for current disposed waste, although some material like Special Waste may need to be direct hauled by hauler to a regional landfill
		• Public Days/Hours operation
		   o Monday – Friday: 7 am – 4 pm
		   o Saturday, by appointment only: 7 am – 2 pm
		• Work Hours:
		   o Monday-Friday: 6:30 am-4:30/5pm
		   o Saturday: 6:30am-2:30pm

Campus 2		• Total site = 50 acres
		• Revenue bonds assumed to finance development
		• Financing assumptions
		   o Facilities/Buildings, 20 years bond at an annual 4% interest rate
		   o Compost Facility, 20 years bond at an annual 4% interest rate
		• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

4.3 Waste Stream

Campus 1 will manage greater waste volumes than Campus 2, as the transfer station will handle most of the County's waste. Campus 2 will manage organics, yard waste, single-stream/OCC/glass, scrap metal/white goods, and tires from the citizen drop-off center. Table 4-2 shows a breakdown of Year 1 and Year 50 expected tons per year.

Table 4-2 Scenario 2 Waste Stream VOLUMES

		Year 1, TPY	Year 50, TPY
Campus 1	Transfer Station	215,097	313,750
Campus 2	Compost Facility	38,118	55,601
	RRC/HHW	4,045	5,943
	Citizen Drop Off	1,173	1,711
Diversion Subtotal		43,336	63,256
% Diversion/Reduction		17%	17%

Campus 1 transfer station tonnages do not include Special Waste.

4.4 Planned Infrastructure

Scenario 2 plans for two solid waste campuses. Campus 1 will consist of a new transfer station for the transfer of waste to a regional landfill within 115-miles. Campus 1 requires 15 acres for the new transfer station and scale house. The second campus will consist of the RRC and HHM facility, aerobics composting facility, and other buildings and services included in each scenario; scale house and scales, administration and environmental education center, maintenance facility, and citizen drop-off center.

Table 4-3 Scenario 2 Land Requirement

Facility	Campus 1 (acres)	Campus 2 (acres)
Transfer Station	15	-
Regional Landfill (Existing)	-	-
Scale House & Scales	-	10
Aerobic Composting	-	30
RRC/ HHM	-	4
Administration & Environmental Education Center	-	2
Maintenance Facility	-	2
Citizen Drop-Off Center	-	2
Total Parcel Size	**15**	**50**

4.4.1 Transfer Station

The transfer station will be the only facility at Campus 1 in Scenario 2. It will be sized for the mid-planning period waste of 900 tons per day and then expanded after Year 25 to accommodate up to 1,060 tons per day. The initial facility building size will be 42,400 square feet. In total, the land area will need to be 15 acres which also includes space for the scale house, scales, and queuing roads.

4.4.2 Regional Landfill

Scenario 2 will haul the waste away from Linn County to a regional landfill within 115 miles. No land area is required for the landfill in this scenario.

[redacted]

4.5 Summary of Costs

TABLE 4-4 SCENARIO 2 CAMPUS 1 FACILITY BUILD OUT

	Full Build-Out	Year 1 O&M$			Year 1 Revenues $	
Facility	Total Facilities Capital $	O&M $	O&M - Haul$ (115-mile one-way)	Regional LF Disposal @ $38/ton	Other Revenues$	Energy/ Materials Revenues$
Transfer Station	$28,908,000	$1,620,000	$5,139,700	$8,173,700	$335,700	$0
Scale House & Scales	$1,141,300	$282,700	---	---	$0	$0
TOTALS	**$30,049,300**	**$1,902,700**	**$5,139,700**	**$8,173,700**	**$335,700**	**$0**

TABLE 4-5 SCENARIO 2 CAMPUS 2 FACILITY BUILD OUT

Facility	Full Build-Out	Year 1 O&M$			Year 1 Revenues $	
	Total Facilities Capital $	O&M $	O&M - Haul$	Regional LF Disposal	Other Revenues$	Energy/ Materials Revenues$
Compost Facility	$15,914,100	$1,192,000	---	---	$0	$1,091,100
Scale House & Scales	$1,939,600	$189,000	---	---	$0	$0
Admin / Educational Center	$2,878,100	$2,537,700	---	---	$0	$0
RRC/HHM	$9,933,900	$1,407,400	---	---	$0	$647,900
Maintenance Shop	$2,567,500	$346,800	---	---	$0	$0
Citizen Drop-Off	$234,700	$6,500	---	---	$0	$0
TOTALS	**$33,467,900**	**$5,679,400**	**$0**	**$0**	**$0**	**$1,739,000**

A transfer station requires land acquisition, permitting, and mobile equipment. Contingencies were added to the capital costs of the facilities, including the transfer station and scale house. With the estimated financing costs, the total capital costs for Campus 1 and Campus 2 will be $45,304,800 and $50,670,400, respectively.

The financing costs per campus assume a constant annual 4% interest rate on Facilities Capital plus Contingencies shown in

Table 4-6 and

Table 4-7Table 3-5. The last cost considered includes the land acquisition and other costs around social justice and legal fees. The total gross tipping fee is estimated to be approximately $66.48, which does not consider other revenues obtained from the CRLCSWA FY2022 budget, materials revenue, and energy revenue shown in

Table 4-8. With the additional revenue and the assumed landfill tip fee of $38/ton, the expected rounded tipping fee for CRLCSWA would be approximately $95 per ton.

Table 4-6 Scenario 2 Campus 1 Cost Totals

SCENARIO 2 TS CAMPUS	Quantity	Unit	Unit Price	Total
Land Acquisition - Purchase	15	Acres	$50,000	$750,000[a]
Land Acquisition - Legal/Support	25%	LS	$750,000	$187,500[b]
Social Justice/Env Impact/Legal	0.1	RSK	$7,000,000	$700,000[c]
SUBTOTAL				**$1,637,500**
Facilities Capital				$21,398,000
Contingency, Permitting, Eng./Construction Observation/CQA				$7,476,300
Equipment/Mobile Equipment				$1,175,000
SUBTOTAL				**$30,049,300**
Estimated Financing Costs - Transfer Station Campus 1				$13,618,000[d]
SUBTOTAL				**$13,618,000**
TOTAL CAPITAL$				**$45,304,800**

Notes:
a: Industrial zoning site
b: % Land Purchase
c: Risk Factor
d: 20 years, 4% APR

Table 4-7 Scenario 2 Campus 2 Cost Totals

SCENARIO 2 CAMPUS	Quantity	Unit	Unit Price	Total
Land Acquisition - Purchase	50	Acres	$25,000	$1,250,000[a]
Land Acquisition - Legal/Support	25%	LS	$1,250,000	$312,500[b]
Social Justice/Env Impact/Legal	0.1	RSK	$7,000,000	$700,000[c]
SUBTOTAL				**$2,262,500**
Facilities Capital				$23,675,900
Contingency, Permitting, Eng./Construction Observation/CQA				$8,002,000
Equipment/Mobile Equipment				$1,790,000
SUBTOTAL				**$33,467,900**
Estimated Financing Costs - All Facilities Campus 2				$14,940,000[d]
SUBTOTAL				**$14,940,000**
TOTAL CAPITAL$				**$50,670,400**

Notes:
a: < ½ Quarter Section
b: % Land Purchase
c: Risk Factor
d: 20 years, 4% APR

Table 4-8 Scenario 2 Estimated Costs

	Capital	Annual O&M	Annual Haul	Total - Gross
Total Costs - Facilities	$63,517,200	$7,582,100	$5,139,700	
Total Costs - Financing	$28,558,000	---	---	
Total Costs-Land/Legal/Env Impact	$3,900,000	---	---	
Transferred Tons	13,076,008	215,097	215,097	
$/Ton	**$7.34**	**$35.25**	**$23.89**	**$66.48**

Scenario 2 assumes revenues from sold recyclable materials from the RRC and HHM recovery, compost tip fees, and compost sales. The estimated annual revenues can be seen in the table below.

TABLE 4-9 SCENARIO 2 ANNUAL REVENUES & ESTIMATED TIPPING FEE

	Annual Other Revenues	Annual Mat'l/ Energy Revenues	Total - Revenues Before Fees
Revenues	$335,700	$1,739,000	
Transferred Tons	215,097	215,097	
$/Ton Revenue	**$1.56**	**$8.08**	**$9.65**
Estimated Net Tip Fee Before Landfill Disposal			**$56.84**
Assumed Regional Landfill Tip Fee ($/ton)			**$38**
Estimated Net Tip Fee			**$94.84**
Rounded Estimate Net Tip Fee ($/ton)			**$95**

The estimated net tipping fee before the landfill disposal is calculated as the difference between the annual revenues from CRLCSWA budgets, material sales, and energy market from the total gross costs, calculating $56.84 per ton. The assumed landfill tipping fee for contracted disposal at a regional landfill was estimated to be $38 per ton in 2021 dollars. When rounded, the total estimated tipping fee would be $95 per ton to haul waste to a partner landfill.

5. Scenario 3 MWP-RDF Facility

Scenario 3:
Mixed Waste Processing with New Landfill
CRLCSWA OWNED

5.1 Description

Scenario 3 evaluates the addition of mixed waste processing (MWP) and/or production of Refuse Derived Fuel (RDF) to sustainably manage most of the waste stream. This scenario will require the development of a new landfill to manage MWP residue and non-processable materials. The materials processed and the products produced can be evaluated based on the maximum potential landfill diversion. A new sustainable waste campus, including the MWP/RDF system, new RRC, and landfill, will need to be sited, permitted, and constructed. Scenario 3 assumes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste, food waste, and other organics that are collected and processed separately from mixed waste is sited, permitted, and operated.

5.2 Summary

Mixed waste processing could be implemented as a starter technology designed to increase diversion. A new MWP facility may be paired with other systems, such as an RDF facility, to improve the quality of the byproduct. The most effective application for CRLCSWA may be a facility that focuses on C&D wastes and extracts green waste, wood, cardboard, metal, shingles, film plastic sheeting, concrete, and other construction-related material. Recovery of these materials can significantly increase the waste tonnage diverted, but these materials are often lower in value unless specific end markets are identified. MWP of municipal solid waste extracts plastic containers, metals, papers, and old corrugated cardboard (OCC). In some cases, the facility can be used to recover organics. However, the quantity and quality of the recovered materials may not be cost-effective. Separated green waste may be incorporated into a composting or aerobic operation. Removal of these materials may allow for better recovery of recyclable containers not captured by the existing curbside single-stream program and recyclables drop-off centers. A MWP facility could be built with the ability to change the recovered material mix, adapting by season, processing equipment, or identified markets.

MWP facilities will require solid waste permitting, similar to that required by other material recycling facilities (MRFs) and transfer stations. Capital development costs, excluding land acquisition, for a low technology mixed waste MRF capable of processing 30,000 to 50,000 tons per year would likely be in the $20 million to $40 million range but would vary based upon the size, type of processing, site constraints or other issues. A MWP with sophisticated technology of optical sorters, robotics and artificial intelligence will increase capital costs but should retrieve higher quality recyclables with minimal manual sorting.

An RDF processing facility will require solid waste permits and will have some other permitting requirements for wastewater and possibly air emissions control permitting if drying or certain other material preparation is needed. These permits do not address the industrial boiler or cement kiln permitting requirements. Facility capital development costs may be in the range of $50 million to $100 million. The operating cost may be in the range of $35 to $100 per ton of MSW processed. These values could vary depending on the specific technologies used, the value of the RDF byproduct, etc. This technology is only viable if a suitable facility is identified that can use the fuel produced and an agreement is developed.

Scenario 3 combines an MWP facility with RDF production to increase diversion from landfilling. Table 5-1 lists the Scenario 3 assumptions.

Table 5-1 Scenario 3 Infrastructure Assumptions

Infrastructure	Overall Assumptions

Overall Campus	• Total site = 320 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	  o Facilities/Buildings, 20 years bond at an annual 4% interest rate
	  o Compost Facility, 20 years bond at an annual 4% interest rate
	  o Landfill with five cells/phases of development, ten years bond for each phase at an annual 4% interest rate
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

Mixed Waste Processing-RDF Facility	• Total area = 21 acres w/ 300' buffer
	• MSW directed to MWP-RDF facility, other wastes direct haul to the landfill
	• Permit by = Year 2034
	• First waste receipt = Year 2038
	• Public Days/Hours Operation (waste receipt)
	  o Monday – Friday: 7 am – 4 pm
	  o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours:
	  o Tipping Floor – M-F 6:30am-4:30pm, Sat 6:30am-2:30pm
	  o Processing – one 8-hour shift Mon-Sat, initially
	  o Increase shifts after Year 10

New Landfill	• Non-processible waste and MWP-RDF rejects to a new landfill
	• Permitted by = Year 2035
	• Assume start waste receipt = Year 2038
	• Provide capacity for = 50 years (i.e., Year 2087)
	• Public Days/Hours operation
	  o Monday – Friday: 7 am – 4 pm
	  o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours: 6:30 am-4:30/5pm M-F, 6:30am-2:30pm Sat

[redacted]

5.3 Waste Stream

It is expected that the MWP-RDF facility will divert more recyclable materials away from landfills. The estimated MSW composition of typical recyclables found in CRLC MSW is included in

Table 5-2.

TABLE 5-2 SCENARIO 3 RECOVERED MATERIALS

Recovered Materials	% of MSW
Ferrous	1.0%
Non-Ferrous	0.4%
Plastics #1	0.2%
Plastics #2	0.1%
OCC	1.0%
RDF	70%

Out of the incoming MSW processed, only rejects and process residue/fines will be sent to the new landfill. Rejects are estimated to be approximately 10% of the MSW, and typically process residue and fines are >5% of the MSW.

TABLE 5-3 SCENARIO 3 WASTE STREAM VOLUMES

Facility	Year 1, TPY	Year 50, TPY
MWP-RDF Facility	190,592	278,007
MWP - Ferrous Metals	1,906	2,780
MWP – Non-Ferrous Metals	762	1,112
MWP - Plastics #1	381	556
MWP - Plastics #2	191	278
MWP - OCC	1,906	2,780
RDF	133,414	194,605
New Landfill	94,684	138,130
Traditional Diversion		
Compost Facility	38,118	55,601
RRC/HHM	4,045	5,943
Citizen Drop-Off	1,173	1,711
Diversion Subtotal (MWP-RDF + Traditional)	**181,897**	**265,367**

[redacted]

Landfill Tonnages	**94,684**	**138,130**
% Diversion/Reduction	**66%**	**66%**

5.4 Planned Infrastructure

The overall size of the Scenario 3 solid waste campus will be approximately 320 acres. Table 3-3 breaks down the minimum area needed for each component. The final parcel size for land acquisition was determined based on the purchase of multiple 160-acre plots.

TABLE 5-4 SCENARIO 3 LAND REQUIREMENTS

Facility	Area (Acres)
Mixed Waste Processing/RDF	21
New Landfill	141
Aerobics Organic Composting	30
RRC/HHM	4
Scale House & Scales	10
Administration & Environmental Education Center	2
Maintenance Facility	2
Citizen Drop Off	2
Total	**212**
Total Parcel Size	**320**

5.4.1 Mixed Waste Processing/RDF

Scenario 3 incorporates a mixed waste processing facility for RDF. The land area for the MWP-RDF facility would be 21 acres with a 300-foot buffer to contain the 112,000-square-foot building. Cedar Rapids Linn County MSW would be directed to this facility designed to comfortably accept up to 234,000 tons per year and process between 172,000 to 211,000 tons per year (690 tons per day) with adjustments in process line shifts when needed. The facility will be initially designed to have 12 unloading bays, including a citizen self-haul area, RDF storage large enough to hold one week of RDF production, and one-week storage of recovered materials. The equipment needed will include shredders, magnets, screens, eddy current, optical sorters, and artificial intelligence (AI)/robotics to recover more and cleaner recyclables. The facility will be designed to run two processing lines at a capacity of 35-40 tons per hour per shift. The RDF is anticipated to be hauled to markets such as cement kilns within a 50-mile radius of the facility. Viable markets will need to be confirmed in the next [redacted] detailed evaluation phase if Scenario 3 proceeds forward. Rejects and process residue will be sent to the new landfill discussed in Section 5.4.2.

5.4.2 New Landfill

The total area of the new landfill will cover 141 acres which includes a 500-foot buffer. The landfill size itself will only be 50 acres, accepting non-processible waste, rejects, and process residue. The landfill is designed to have five cells, where the first being the largest. If Scenario 3 is pursued, the landfill would be permitted by the year 2035 to be able to start accepting residue by 2038. This new landfill should provide waste capacity for 50 years. Leachate is to be managed onsite with an evaporation pond and leachate recirculation.

5.5 Summary of Costs

TABLE 5-5 SCENARIO 3 FACILITY BUILD OUT

	Full Build-Out	Year 1 O&M$			Year 1 Revenues $	
Facility	Total Facilities Capital $	O&M $	O&M - Haul$	Closure/ Post-Closure Fund$	Other Revenues$	Energy/ Materials Revenues$
MWP-RDF Facility	$156,207,200	$8,869,800	$1,832,000	$0	$335,700	$307,000
New Landfill	$49,599,000	$2,185,100	---	$381,120	$0	$436,000
Compost Facility	$9,052,700	$1,171,200	---	$0	$0	$1,091,100
Scale House & Scales	$2,189,600	$293,900	---	---	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0
RRC/HHM	$9,933,900	$1,407,400	---	$0	$0	$647,900
Maintenance Shop	$4,694,100	$566,000	---	---	$0	$0
Citizen Drop-Off	$238,100	$6,500	---	---	$0	$0
TOTALS	**$234,792,700**	**$17,037,600**	**$1,832,000**	**$381,120**	**$335,700**	**$2,482,000**

Table 5-6 Scenario 3 Capital with Contingencies

SCENARIO 3 CAMPUS	Quantity	Unit	Unit Price	Total
Land Acquisition - Purchase	320	Acres	$25,000	$8,000,000
Land Acquisition - Legal/Support	25%	LS	$8,000,000	$2,000,000
Social Justice/Env Impact/Legal	1	RSK	$7,000,000	$7,000,000
SUBTOTAL				**$17,000,000**
Facilities Capital				$177,590,100
Contingency, Permitting, Eng./Construction Observation/CQA				$52,488,600
Equipment/Mobile Equipment				$4,714,000
SUBTOTAL				**$234,792,700**
Estimated Financing Costs - Landfill				$11,075,000
Estimated Financing Costs - All Other Facilities				$86,087,000
SUBTOTAL				**$97,162,000**
TOTAL CAPITAL $				**$348,954,700**

An MWP-RDF facility requires land acquisition, permitting, and equipment. Contingencies were added to the capital costs of the facilities, including the MWP-RDF facility itself as well as the landfill, compost facility, scale house, and other additional buildings. Including the estimated financing costs, the total capital costs equal approximately $348,954,700, shown in detail in Table 5-6 above.

For Scenario 3's total gross tipping fee estimate in Table 5-7, the capital costs include a full build-out of the facilities for a 50-year period which is then divided by the projected landfilled tons between the years 2038-2087. The financing costs assume a constant annual 4% interest rate on Facilities Capital plus Contingencies shown in Table 5-6. The last cost considered includes the land acquisition and other costs around social justice and legal fees. The total gross tipping fee is estimated to be approximately $103.89, which does not consider other revenues obtained from the CRLCSWA FY2022 budget, material revenues, and energy revenue shown in Table 5-8Table 3-7. With the additional revenue, the expected rounded tipping fee for CRLCSWA will be approximately $92 per ton.

Table 5-7 Scenario 3 Cost Totals

	Capital	Annual O&M	Annual Haul	Annual Closure/PC	Total - Gross
Total Costs - Facilities	$234,792,700	$17,037,600	$1,832,000	$381,120	
Total Costs - Financing	$97,162,000	---	---	---	
Total Costs-Land/Legal/Env Impact	$17,000,000	---	---	---	
Processed & Landfilled Tons	14,400,160	236,879	236,879	236,879	
$/Ton	**$24.23**	**$71.93**	**$7.73**	**$1.61**	**$103.89**

[redacted]

Scenario 3 assumes revenues from grants and investments, sale of recovered materials and energy generated from landfill gas capture, compost sales, and tip fees. The estimated annual revenues can be seen in the table below.

TABLE 5-8 SCENARIO 3 ANNUAL REVENUE & ESTIMATED TIPPING FEE

	Annual Other Revenues	Annual Mat'l/ Energy Revenues	Total - Revenues Before Fees
Revenues	$335,700	$2,482,000	
Landfilled Tons	236,879	236,879	
$/Ton Revenue	**$1.42**	**$10.48**	**$11.90**
Estimated Net Tip Fee			**$91.99**
Rounded Estimate Net Tip Fee ($/ton)			**$92**

The estimated net tipping fee before the landfill disposal is calculated as the difference between the annual revenues from budgets, materials sales, and the energy market from the total gross costs of $103.89 per ton. When rounded, the total estimated tipping fee will be $92 per ton applied to all waste received for processing or landfilling.

6. Scenario 4 Anaerobic Digestion

Scenario 4:
Anaerobic Digestion with New Landfill
CRLCSWA OWNED

6.1 Description

Scenario 4 evaluates the addition of anaerobic digestion (AD) of food scraps and other highly organic materials with the opening of a new landfill due to the future closure of the current Site #2 landfill with all associated facilities. The new sustainable waste campus will include the AD facility, landfill, new RRC and HHM facility, and composting facility needing to be sited, permitted, and constructed. Scenario 4 includes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste and food waste that are collected and processed separately from mixed waste as well as digeste from AD.

6.2 Summary

Newer biological technology includes a variety of different types of AD. This type of technology has advanced significantly in the US for managing organic and food wastes. The AD process involves allowing bacteria to consume the organic material in a vessel without oxygen. An AD process produces a mixture of methane and other gases called biogas. Biogas can be collected from the digestion process and, with proper refinement systems, can be used for applications where natural gas (methane) is used. These include fuels such as compressed natural gas, renewable natural gas, or the production of electricity directly from the biogas.

Most AD systems require digestible material, such as food waste, to be separated from materials that do not digest, such as packaging or mixed waste. To accomplish this, collecting organics separately is one of several approaches to isolating organics from municipal waste. Other approaches include the use of processing equipment to extract organics from select MSW loads of organic-rich material. A final approach is to only collect very clean, digestible material from sources with very high quantities that will participate in the program, such as grocery stores, food pantries, food/beverage manufacturers, etc.

All biological systems (AD and composting) are maximized if an effective collection system is developed that is appropriate for the selected type of technology. There are technologies available that can extract organic material from mixed waste by pressure, screening, hydro pumping, etc. However, these technologies, for the most part, are expensive and have high operating costs. The specific type of AD or composting system employed is subject to the types of wastes that will be managed.

Insomuch as these systems are enclosed in a vessel, the biogas produced requires special collection and control systems to beneficially use the methane portion of the biogas for energy or fuel production. However, trace emissions from these facilities can be highly odorous. Odor management will be necessary for this type of facility, as well as the downstream stabilization of the undigested portion, which is typically managed in the aerobic composting process.

Solid waste and wastewater permits would be required for an AD facility, and potential other permitting requirements will be needed depending on how the gas produced might be utilized, air emissions, and other needs. The cost of an AD system will need to be developed that reflects the anticipated types and quantities of feedstock available.

TABLE 6-1 SCENARIO 4 INFRASTRUCTURE ASSUMPTIONS

Infrastructure	Overall Assumptions
Overall Campus	• Total site = 320 acres • Revenue bonds assumed to finance development • Financing assumptions o Facilities/Buildings, 20 years bond at an annual 4% interest rate o Compost Facility, 20 years bond at an annual 4% interest rate o Landfill with eight cells/phases of development, seven years bond for each phase at an annual 4% interest rate (some overlap of bond payments) • Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts
Anaerobic Digestion	• Organic rich loads directed to the AD receiving facility o Organics Stream = 28% of CRLCSWA MSW o AD Capture Rate = 50% of Organics Stream w/ mandatory program • Other wastes direct haul to the new landfill • Permit by = Year 2035 • First waste receipt = Year 2038 • AD Design Capacity = up to 31,000 TPY processed waste • Public Days/Hours Operation o Monday – Friday: 7 am – 4 pm o Saturday, by appointment only: 7 am – 2 pm • Work Hours: 1 shift/day, 306 days per year
New Landfill	• Non-Processed MSW, C&D, Special Waste, and AD rejects to a new landfill • Permitted by = Year 2035 • Assume start waste receipt = Year 2038 • Provide capacity for = 50 years (i.e., Year 2087) • Public Days/Hours operation o Monday – Friday: 7 am – 4 pm o Saturday, by appointment only: 7 am – 2 pm • Work Hours: o Monday – Friday: 6:30am-4:30/5pm o Saturday: 6:30am-2:30pm

Waste Stream

TABLE 6-2 SCENARIO 4 WASTE STREAM VOLUMES

Facility	Year 1, TPY	Year 50, TPY
AD Facility	26,245	38,282
New Landfill	211,946	309,155
Diversion		
Composted Organics-YW, FW	38,118	55,601
Composted Organics-Digestate	3,740	5,455
RRC/HHM	4,045	5,943
Citizen Drop-Off	1,173	1,711
AD - Organics, Less Digestate	21,192	30,912
Diversion Subtotal	**68,269**	**99,623**
Landfill Tonnages	**211,946**	**309,155**
% Diversion/Reduction	**24%**	**24%**

6.3 Planned Infrastructure

The overall size of the new Scenario 4 solid waste campus will be approximately 320 acres. Table 3-3 breaks down the minimum area needed for each component. The final parcel size for land acquisition was determined based purchase of multiple 160-acre plots.

TABLE 6-3 SCENARIO 4 LAND REQUIREMENTS

Facility	Area (Acres)
Anerobic Digestion	15
New Landfill	204
Aerobics Organic Composting	31
RRC/HHM	4
Scale House & Scales	10
Administration & Environmental Education Center	2
Maintenance Facility	2
Citizen Drop Off	4
Total Parcel Size	**320**

6.3.1 Anaerobic Digestion

The land area required for the anaerobic digester is 15 acres with a 300-foot buffer. The receiving building will be 16,000 square feet with two unloading bays to receive organic-rich loads and pre-processing equipment to produce cleaner organics for the AD. Organics have been approximately 28% of the MSW waste stream, with an assumed 50% captured through the AD, leaving the remaining to be directed to the new landfill. The design capacity of the facility is 31,000 tons per year by Year 25, processing 84 tons per day. Depending on the unit sizes, preliminary efforts suggest 5 to 10 digesters and three 20,000-gallon tanks for the wet AD system. Dry AD systems would also have modular digesters.

6.3.2 New Landfill

The new landfill will need approximately 204 acres including a 500-foot buffer. The actual landfill disposal area will be 90 acres containing eight cells. The landfill is to be permitted by 2035 and accepting waste by 2038. The sizing provides enough capacity for 50 years. Leachate will be managed onsite with an evaporation pond, leachate recirculation, and a new leachate tanker truck.

6.4 Summary of Costs

Table 6-4 Scenario 4 Facility Build Out

	Full Build-Out	Year 1 O&M$			Year 1 Revenues $	
Facility	**Total Facilities Capital**	**O&M**	**O&M – Haul**	**Closure/ Post-Closure Fund**	**Other Revenues**	**Energy/ Materials Revenues**
AD Facility	$39,797,500	$2,109,000	---	---	$335,700	$197,100
New Landfill	$86,756,600	$2,605,800	---	$578,480	$0	$436,000
Compost Facility	$9,384,800	$1,174,100	---	---	$0	$1,100,700
Scale House & Scales	$2,189,600	$293,900	---	---	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0
RRC/HHM	$9,933,900	$1,407,400	---	---	$0	$647,900
Maintenance Shop	$4,694,100	$566,000	---	---	$0	$0
Citizen Drop-Off	$1,505,300	$34,700	---	---	$0	$0
TOTALS	**$157,139,900**	**$10,728,600**	**$0**	**$578,480**	**$335,700**	**$2,381,700**

Table 6-5 Scenario 4 Capital with Contingencies

SCENARIO 4 CAMPUS	Quantity	Unit	Unit Price	Total
Land Acquisition - Purchase	320	Acres	$25,000	$8,000,000
Land Acquisition - Legal/Support	25%	LS	$8,000,000	$2,000,000
Social Justice/Env Impact/Legal	1	RS	$7,000,000	$7,000,000
SUBTOTAL				**$17,000,000**
Facilities Capital				$115,879,900
Contingency, Permitting, Eng./Construction Observation/CQA				$36,594,000
Equipment/Mobile Equipment				$4,666,000
SUBTOTAL				**$157,139,900**
Estimated Financing Costs - Landfill				$14,084,000
Estimated Financing Costs - All Other Facilities				$31,961,000
SUBTOTAL				**$46,045,000**
TOTAL CAPITAL $				**$220,184,900**

The AD facility requires land acquisition, permitting, and equipment. Contingencies were added to the capital costs of the facilities, including the AD as well as the landfill, compost facility, scale house, and other additional buildings. Including the estimated financing costs, the total capital costs equal approximately $220,184,900, shown in detail in

Table 6-5 above.

For Scenario 4's total gross tipping fee estimate in Table 6-6, the capital costs include a full build-out of the facilities. The financing costs assume a constant annual 4% interest rate on Facilities Capital plus Contingencies shown in
Table 6-5Table 3-5. The last cost considered includes the land acquisition and other costs around social justice and legal fees. The total gross tipping fee is estimated to be approximately $60.58, which does not consider other revenues obtained from the CRLCSWA FY2022 budget, materials sales, and energy revenue shown in Table 6-7. With the additional revenue, the expected rounded tipping fee for CRLCSWA is estimated to be nearly $50 per ton.

TABLE 6-6 SCENARIO 4 COST TOTALS

	Capital	Annual O&M	Annual Haul	Annual Closure/PC	Total - Gross
Total Costs - Facilities	$157,139,900	$10,728,600	$0	$578,480	
Total Costs - Financing	$46,045,000	---	---	---	
Total Costs-Land/Legal/Env Impact	$17,000,000	---	---	---	
Processed & Landfilled Tons	14,400,160	236,879	236,879	236,879	
$/Ton	**$15.29**	**$45.29**	**$0.00**	**$2.44**	**$60.58**

Scenario 4 assumes revenues from grants and investments collected for recycled materials through the RRC, compost tip fees, and the sale of compost. The estimated annual revenues can be seen in the table below.

TABLE 6-7 SCENARIO 4 ANNUAL REVENUES & ESTIMATED TIPPING FEE

	Annual Other Revenues	Annual Mat'l/ Energy Revenues	Total - Revenues Before Fees
Revenues	$335,700	$2,381,700	
Landfilled Tons	236,879	236,879	
$/Ton Revenue	**$1.42**	**$10.05**	**$11.47**
Estimated Net Tip Fee			**$49.11**
Rounded Estimate Net Tip Fee ($/ton)			**$50**

The estimated net tipping fee is calculated as the difference between the annual revenues from CRLCSWA FY2022 budgets and the energy market from the total gross costs, coming to $11.47 per ton. The calculated tipping fee for the new CRLCSWA waste campus is estimated to be $49.11 per ton. When rounded, the total estimated tipping fee will be $50 per ton for waste processed through the AD or direct landfilled.

7. Scenario 5 WTE Facility

Scenario 5:
Direct Combustion with New Landfill
CRLCSWA OWNED

7.1 Description

Scenario 5 evaluates the addition of direct combustion of waste with energy generation (waste-to-energy) and the development of a new landfill for ash from combustion and non-processable materials due to the future closure of the current Site #2 landfill and all associated facilities. A new sustainable waste campus, including the direct combustion facility, landfill, new RRC and HHM facility, and composting facility, will need to be sited, permitted, and constructed. Scenario 5 assumes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste, food waste, and other organics that are collected and processed separately from mixed waste.

7.2 Summary

Direct combustion with mass-burn waste-to-energy (WTE) technology could be completed for much of the post-recycling MSW stream. The commercial waste and C&D waste streams would need to be evaluated to determine how much could be processed. Of these alternatives, this option, and possibly RDF processing, would result in the largest landfill diversion. Mass burn WTE would have the fewest pre-processing requirements for the waste stream. Economics are driven heavily by the recovered energy markets. Most facilities produce electricity, but steam sales usually offer better economics (if a steam customer could be identified). For the combustible portions of the waste stream, about a seventy-five percent reduction in weight and ninety percent volume reduction is possible. Metals not recovered with recycling can be removed from the ash and captured, but disposal of ash and residues is currently required. Reuse of certain portions of the ash stream is in development and may be possible in the future; however, at this time, it should be assumed that the ash residue, approximately 25 percent of the processed waste stream, will need to be disposed of in a landfill. If regulations allow contact of ash with the waste within the landfill, it may be used for alternative landfill applications such as daily cover material or roadbed construction.

A WTE facility will require a solid waste permit, Title V air emission permits, and other permitting requirements for any wastewater in addition to certain other requirements. Based on a limited number of recent projects, facility capital development costs may be in the range of $350,000 to $450,000 per ton per day facility capacity. In other words, a 750 tons per day (tpd) facility would likely have a capital cost between $263 million and $338 million-plus contingencies. The operating cost may be in the range of $80 to $120 per ton of MSW processed.

TABLE 7-1 SCENARIO 5 INFRASTRUCTURE ASSUMPTIONS

Infrastructure	Overall Assumptions

Overall Campus	• Total site = 320 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	  o Facilities/Buildings, 20 years bond at an annual 4% interest rate
	  o Compost Facility, 20 years bond at an annual 4% interest rate
	  o Landfill with five cells/phases of development, ten years bond for each phase at an annual 4% interest rate
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

WTE	• MSW directed to WTE facility, other wastes direct haul to the landfill
	• Permit by = Year 2034
	• First waste receipt = Year 2038
	• Design Capacity = 700 TPD
	• Public Days/Hours Operation
	  o Monday – Friday: 7 am – 4 pm
	  o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours: 24-hours/day, 365 days per year

New Landfill	• Non-processible waste and WTE rejects and ash to a new landfill
	• Permitted by = Year 2035
	• Assume start waste receipt = Year 2038
	• Provide capacity for = 50 years (i.e., Year 2087)
	• Public Days/Hours operation
	  o Monday – Friday: 7 am – 4 pm
	  o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours:
	  o Monday – Friday: 6:30am-4:30/5pm
	  o Saturday: 6:30am-2:30pm

7.3 Waste Stream

TABLE 7-2 SCENARIO 5 WASTE STREAM VOLUMES

Facility	Year 1, TPY	Year 50, TPY
WTE Facility	190,592	278,007
New Landfill	101,068	147,443
Diversion		
Organics	38,118	55,601
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
WTE - Ferrous Metals	3,621	5,282
WTE – Non-Ferrous Metals	453	660
Diversion Subtotal	**47,410**	**69,198**
Landfill Tonnages	**101,068**	**147,443**
% Diversion/Reduction	**64%**	**64%**

7.4 Planned Infrastructure

The overall size of the new Scenario 5 solid waste campus will be approximately 320 acres. Table 3-3 breaks down the minimum area needed for each component. The final parcel size for land acquisition was determined based on multiple traditional 160-acre plot.

TABLE 7-3 SCENARIO 5 LAND REQUIREMENTS

Facility	Area (Acres)
Waste to Energy	18
New Landfill	141
Aerobics Organic Composting	30
RRC/HHM	4
Scale House & Scales	10
Administration & Environmental Education Center	2
Maintenance Facility	2
Citizen Drop Off	2
Total	**209**
Parcel Size	**320**

7.4.1 Waste to Energy Facility

All MSW would be directed to the new WTE facility that would require approximately 18 acres with a 300-foot buffer. The 75,000 square foot power plant would be designed to process 223,000 tons per year by Year 25 at 90% operating capacity. There will be two units sized for 350 tpd capacity each. This provides flexibility and availability to continue to combust waste during maintenance outages. The WTE tipping floor will have 11 unloading bays to push waste into the pit that is large enough for five days of waste storage. The ash management building will also be onsite, approximately 2,400 square foot in size.

7.4.2 New Landfill

The new landfill in Scenario 5 will receive the non-processible waste, rejects, and ash from the WTE facility. The total area needed for the on-site landfill will be 141 acres, including a 500-foot buffer around the 50-acre disposal area. Landfill design is anticipated to be five cells and permitted by 2035, with the assumption of starting to receive waste by 2038. This landfill should be able to provide capacity for 50 years with the predicted tonnages of non-processable wastes and ash residue from the WTE facility.

7.5 Summary of Costs

TABLE 7-4 SCENARIO 5 FACILITY BUILD OUT

	Full Build-Out	Year 1 O&M$			Year 1 Revenues $	
Facility	Total Facilities Capital	O&M	O&M – Haul	Closure/ Post-Closure Fund	Other Revenues	Energy/ Materials Revenues
WTE Facility	$525,352,000	$20,343,000	---	---	$335,700	$4,064,900
New Landfill	$48,317,300	$1,297,700	---	$264,300	$0	$0
Compost Facility	$9,052,700	$1,171,200	---	---	$0	$1,091,100
Scale House	$2,189,600	$293,900	---	---	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0
RRC/HHW	$9,933,900	$1,407,400	---	---	$0	$647,900
Maintenance Shop	$3,630,800	$527,300	---	---	$0	$0
Citizen Drop-Off	$238,100	$6,500	---	---	$0	$0
TOTALS	**$601,592,500**	**$27,584,700**	**$0**	**$264,300**	**$335,700**	**$5,803,900**

TABLE 7-5 SCENARIO 5 CAPITAL WITH CONTINGENCIES

SCENARIO 4 CAMPUS	Quantity	Unit	Unit Price	Total
Land Acquisition - Purchase	320	Acres	$25,000	$8,000,000
Land Acquisition - Legal/Support	25%	LS	$8,000,000	$2,000,000
Social Justice/Env Impact/Legal	2	RSK	$7,000,000	$14,000,000
SUBTOTAL				**$24,000,000**
Facilities Capital				$464,775,300
Contingency, Permitting, Eng./Construction Observation/CQA				$132,785,200
Equipment/Mobile Equipment				$4,032,000
SUBTOTAL				**$601,592,500**
Estimated Financing Costs - Landfill				$11,067,000
Estimated Financing Costs - All Other Facilities				$259,420,000
SUBTOTAL				**$270,487,000**
TOTAL CAPITAL $				**$896,079,500**

A WTE facility requires land acquisition, permitting, and equipment. Contingencies were added to the capital costs of the facilities, including the landfill itself as well as the compost facility, scale house, and other additional buildings. With the estimated financing costs, the total capital costs equal approximately $896,079,500, shown in detail in

[redacted]

Table 7-5 above.

For Scenario 5's total gross tipping fee estimate in Table 7-6, the capital costs include a full build-out of the facilities. The financing costs assume a constant annual 4% interest rate on Facilities Capital plus Contingencies shown in

Table 7-5. The last cost considered includes the land acquisition and other costs around social justice and legal fees. The total gross tipping fee would be approximately $178.68, which does not consider other revenues obtained from the CRLCSWA FY2022 budget, materials sales, and energy revenue shown in Table 7-7. With the additional revenue, the expected rounded tipping fee for CRLCSWA would be nearly $153 per ton.

Table 7-6 Scenario 5 Cost Totals

	Capital	Annual O&M	Annual Haul	Annual Closure/PC	Total - Gross
Total Costs - Facilities	$601,592,500	$27,584,700	$0	$264,300	
Total Costs - Financing	$270,487,000	---	---	---	
Total Costs-Land/Legal/Env Impact	$24,000,000	---	---	---	
Processed & Landfilled Tons	14,400,161	236,879	236,879	236,879	
$/Ton	**$62.23**	**$116.45**	**$0.00**	**$1.12**	**$178.68**

Scenario 5 assumes revenues from grants and investments collected from recovered materials from the RRC; compost sales and tip fees; and sale of energy and recover metals from the WTE facility. The estimated annual revenues can be seen in the table below.

Table 7-7 Scenario 5 Annual Revenues

	Annual Other Revenues	Annual Mat'l/ Energy Revenues	Total - Revenues Before Fees
Revenues	$335,700	$5,803,900	
Landfilled Tons	236,879	236,879	
$/Ton Revenue	**$1.42**	**$24.50**	**$25.92**
Estimated Net Tip Fee			**$152.76**
Rounded Estimate Net Tip Fee ($/ton)			**$153**

The estimated net tipping fee is calculated as the difference between the annual revenues from budgets, materials sales, and the energy market from the total gross costs of $178.68 per ton. The assumed tipping fee for the new CRLCSWA waste campus for Scenario 5 is estimated to be $152.76 per ton. When rounded, the total estimated tipping fee would be $153 per ton for waste processed at WTE or direct landfilled.

Scenario 6:
Mixed Waste Processing
with Partnered Landfill

8. Scenario 6 MWP-RDF Facility (R)

8.1 Description

Scenario 6 evaluates the addition of regional waste to the mixed waste processing (MWP) or production of Refuse Derived Fuel (RDF) to sustainably manage most of the waste stream. This scenario will include the receipt of MSW from both CRLCSWA service area and regional partners to be processed through the MWP-RDF system with the transfer of MWP residue and non-processable materials to a regional partner landfill due to the future closure of the current Site #2 landfill and all associated facilities. A new sustainable waste campus, including the MWP-RDF system, co-located transfer station, new RRC, and HHM facility, and composting facility, will need to be sited, permitted, constructed, owned, and operated by CRLCSWA. The process residue rejects, and non-processable materials would be transferred to a landfill under contract, and a potential 28E agreement will need to be negotiated between CRLCSWA and the other landfill for disposal. A 28E agreement will also need to be negotiated between CRLCSWA and regional partners for processing the MSW. Scenario 6 assumes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste, food waste, and other organics that are collected and processed separately from mixed waste is sited, permitted, and operated.

8.2 Summary

Mixed waste processing could be implemented as a starter technology designed to increase diversion. A new MWP facility may be paired with other systems, such as an RDF facility, to improve the quality of the byproduct. The most effective application for CRLCSWA may be a facility that focuses on C&D wastes and extracts green waste, wood, cardboard, metal, shingles, film plastic sheeting, concrete, and other construction-related material. Recovery of these materials can significantly increase the waste tonnage diverted, but these materials are often lower in value unless there are specific markets available. In some cases, the facility can be used to recover organics. However, the quantity and quality of the recovered materials may not be cost-effective. The green waste may be incorporated into a composting or aerobic operation. Removal of these materials may allow for better recovery of recyclable containers not captured by the existing curbside single-stream program. A facility could be built with the ability to change the recovered material mix, adapting by season, processing equipment, or identified markets.

Mixed waste processing facilities would require solid waste permitting, like that required by other MRFs and transfer stations. Capital development costs, excluding land acquisition, for a low technology mixed waste MRF capable of processing 30,000 to 50,000 tons per year would likely be in the \$20 million to \$40 million range but would vary based upon the size, and type of processing, site constraints or other issues. A regional MWP-RDF system will include more sophisticated technology of optical sorters, robotics, and artificial intelligence to process more than 250,000 tons per year from CRLCSWA and regional partners.

An RDF processing facility will require solid waste permits and will have some other permitting requirements for wastewater and possibly air emissions control permitting if drying or certain other requirements are needed. These permits do not address the industrial boiler or cement kiln permitting requirements. Facility capital development costs may be in the range of $50 million to $100 million. The operating cost may be in the range of $35 to $100 per ton of MSW processed. These values could vary depending on the specific technologies used, the value of the RDF byproduct, etc. This technology is only viable if a suitable facility is identified that can use the fuel produced and an agreement is developed.

TABLE 8-1 SCENARIO 6 INFRASTRUCTURE ASSUMPTIONS

Infrastructure	Overall Assumptions

Overall Campus	• Total site = 90 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	    o Facilities/Buildings, 20 years bond at an annual 4% interest rate
	    o Compost Facility, 20 years bond at an annual 4% interest rate
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

Mixed Waste Processing – RDF Facility	• CRLCSWA MSW directed to MWP-RDF facility, other wastes direct haul to the landfill
	• Regional MSW directed to MWP-RDF facility by regional partners, estimate ranging from 75,000 to 125,000 tons per year
	• Permit by = Year 2034
	• First waste receipt = Year 2038
	• Haul RDF to markets within an assumed 50-mile radius
	• Haul Organics Fines to landfills within an assumed 30-mile radius for ADC
	• Rejects & Process Residue/Fines to landfill
	• Public Days/Hours Operation (waste receipt)
	    o Monday – Friday: 7 am – 4 pm
	    o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours:
	    o Tipping Floor – M-F 6:30am-4:30pm, Sat 6:30am-2:30pm
	    o Processing – one 8-hour shift Mon-Sat, initially
	• Increase shifts as MSW received increases

Transfer Station	• Sized for current CRLCSWA disaster debris, C&D waste, shingles, rejects, and process residue from MWP, although some materials like Special Waste may need to be direct hauled to a regional landfill
	• Public Days/Hours operation
	  o Monday – Friday: 7 am – 4 pm
	  o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours:
	  o Monday – Friday: 6:30am-4:30/5pm
	  o Saturday: 6:30am-2:30pm

8.3 Waste Stream

TABLE 8-2 SCENARIO 6 WASTE STREAM VOLUMES

Facility	Year 1, TPY	Year 50, TPY
MWP-RDF Facility	265,592	403,007
Transfer Station	68,593	102,643
Diversion		
Yard Waste/Misc. Food	38,118	55,601
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
MWP - Ferrous Metals	2,656	4,030
MWP - Nonferrous Metals	1,062	1,612
MWP - Plastics #1	531	806
MWP - Plastics #2	266	403
MWP- Papers	1,886	2,861
MWP - OCC	2,656	4,030
MWP - Organics Fines	23,903	36,271
RDF	185,914	282,105
Diversion Subtotal	**262,211**	**395,374**
Landfill Tonnages	**90,375**	**134,415**
% Diversion/Reduction (From LF)	**74%**	**75%**
% Diversion without RDF & Organics Fines	**15%**	**15%**

Transfer station waste includes the rejects and process residue coming from the MWP-RDF facility.

8.4 Planned Infrastructure

TABLE 8-3 SCENARIO 6 LAND REQUIREMENTS

Facility	Area (Acres)
Mixed Waste Processing/RDF	22
Transfer Station	12
Regional Landfill (Existing)	-
Aerobics Organic Composting	30
RRC/HHM	4
Scale House & Scales	10
Administration & Environmental Education Center	2
Maintenance Facility	2
Citizen Drop Off	2
Total	**84**
Parcel Size	**90**

8.4.1 Mixed Waste Processing/RDF

The MWP-RDF facility requires 22 acres, including a 300-foot buffer to contain the 128,000-square-foot building. It is to be permitted by 2034 in order to be constructed and start accepting waste by 2038. MSW from regional partners and CRLCSWA will be directed to the facility, while other CRLCSWA wastes will be directed to the onsite transfer station or direct hauled to the regional landfill. This scenario assumes additional MSW for processing from multiple regional partners based on the regional stakeholder discussion.

The initial MWP-RDF facility will be designed to process up to 300,000 tons per year, at a rate of 970 tons per day. There will be two processing lines that can process between 40-50 tons per 8-hour shift. The facility will have 12 unloading bays which includes an area for citizen self-haul. The RDF storage and the recovered materials storage will each be able to store a week's worth of materials. Process equipment will include shredders, magnets, screens, eddy current, optical sorters, additional screens for organics fraction, and AI/robotics to recover more and cleaner recyclables. After processing, RDF will be hauled to markets such as cement kilns within an assumed 50-mile radius. Organic fines will be hauled to landfills for ADC within an assumed 30-mile radius.

8.4.2 Transfer Station

The transfer station will be sized for CRLCSWA disaster debris, C&D waste, shingles, and rejects and process residue from the MWP-RDF facility. It is to be permitted by 2036 to start receiving waste 2038. The capacity of the transfer station is sized for 280 tons per day in the 10,500-square-foot building. The facility would have five unloading bays and one load-out hopper. In total, the land area for the transfer station will be approximately 12 acres, including a 300-foot buffer.

8.4.3 Regional Landfill

In this scenario, waste will be hauled to a non-CRLCSWA landfill in the region based on the regional stakeholder discussion. There are multiple landfills within a 115-mile range with varying haul costs, which are shown in Attachment 1. This scenario will require RFPs and negotiations for a long-term/multi-year contract for disposal and possibly hauling. Contracts should be minimum of 10 years with an option for renewal.

8.5 Summary of Costs

TABLE 8-4 SCENARIO 6 FACILITY BUILD OUT

	Full Build-Out	Year 1 O&M$			Year 1 Revenues $		
Facility	Total Facilities Capital	O&M	O&M – Haul	Regional Landfill Disposal	Other Revenues	Energy/ Materials Revenues	Other Tip Fee Revenues $
MWP-RDF Facility	$170,098,900	$10,000,400	$2,797,500	$0	$335,700	($3,012,700)	$6,975,000
Transfer Station	$7,583,400	$549,000	$1,652,300	$2,606,500	$0	$0	$0
Compost Facility	$9,052,700	$1,171,200	---	$0	$0	$1,091,100	$0
Scale House & Scales	$2,189,600	$293,900	---	---	$0	$0	$0
Admin/ Educational Center	$2,878,100	$2,537,700	---	---	$0	$0	$0
RRC/HHM	$9,933,900	$1,407,400	---	$0	$0	$647,900	$0
Maintenance Shop	$2,567,500	$385,800	---	---	$0	$0	$0
Citizen Drop-Off	$238,100	$6,500	---	---	$0	$0	$0
TOTALS	**$204,542,200**	**$16,351,900**	**$4,449,800**	**$2,606,500**	**$335,700**	**($1,273,700)**	**$6,975,000**

[redacted]

Table 8-5 Scenario 6 Capital with Contingencies

SCENARIO 6 CAMPUS	Quantity	Unit	Unit Price	Total
Land Acquisition - Purchase	90	Acres	$25,000	$2,250,000
Land Acquisition - Legal/Support	25%	LS	$2,250,000	$562,500
Social Justice/Env Impact/Legal	1	RS	$7,000,000	$7,000,000
SUBTOTAL				**$9,812,500**
Facilities Capital				$155,641,900
Contingency, Permitting, Eng./Construction Observation/CQA				$45,436,300
Equipment/Mobile Equipment				$3,464,000
SUBTOTAL				**$204,542,200**
Estimated Financing Costs - All Other Facilities				$94,836,000
SUBTOTAL				**$94,836,000**
TOTAL CAPITAL $				**$309,190,700**

Scenario 6 requires land acquisition, permitting, and equipment. Contingencies were added to the capital costs of the facilities, including the MWP-RDF facility as well as the landfill, compost facility, scale house, and other additional buildings. With the estimated financing costs, the total capital costs equal approximately $309,190,700, shown in detail in Table 8-5 above.

For Scenario 6's total gross tipping fee estimate in Table 8-6, the capital costs include a full build-out of the facilities. The financing costs assume a constant annual 4% interest rate on Facilities Capital plus Contingencies shown in Table 8-5. The last cost considered includes the land acquisition and other costs around social justice and legal fees. The total gross tipping fee is estimated to be approximately $120.35 per ton, which does not consider other revenues obtained from the CRLCSWA FY2022 budget, materials sale, and energy revenue shown in

Table 8-7. With the additional revenue, the expected rounded tipping fee for CRLCSWA Scenario 6 will be nearly $93 per ton.

Table 8-6 Scenario 6 Cost Totals

	Capital	Annual O&M	Annual Haul	Annual Disposal	Total - Gross
Total Costs - Facilities	$204,542,200	$16,351,900	$4,449,800	$2,606,500	
Total Costs - Financing	$94,836,000	---	---	---	
Total Costs-Land/Legal/Env Impact	$9,812,500	---	---	---	
CRLCSWA Process & Transfer Tons	13,076,000	215,100	215,100	215,100	
$/Ton	**$23.65**	**$76.02**	**$20.69**	**$12.12**	**$120.35**

Scenario 6 assumes revenues from the sale of recyclables from the MWP and RRC, the sale of compost, compost tipping fees, and a cost to the sale of RDF and Organic Fines. The estimated annual revenues can be seen in the table below.

TABLE 8-7 SCENARIO 6 ANNUAL REVENUES

	Annual Other Revenues	Annual Mat'l/ Energy Revenues	Other Tip Fee Revenues	Total - Revenues Before Fees
Revenues	$335,700	($1,273,700)	$6,975,000	
Landfilled Tons	236,879	215,100	215,100	
$/Ton Revenue	**$1.42**	**($5.92)**	**$32.43**	**$28.07**
Estimated Net Tip Fee				**$92.29**
Rounded Estimate Net Tip Fee ($/ton)				**$93**

The estimated net tipping fee is calculated as the difference between the annual revenues from budgets, regional partners tip fee revenues, materials sales, and the energy market from the total gross costs of $120.35 per ton. The calculated tipping fee for Scenario 6 is estimated to be $92.29 per ton. When rounded, the total estimated tipping fee will be $93 per ton to process waste through the MWP-RDF facility and haul non-processible waste, residues, and rejects to a regional landfill.

[redacted]

Scenario 7:
Anaerobic Digestion
with Partnered Landfill

9. Scenario 7 Anaerobic Digestion (R)

9.1 Description

Scenario 7 evaluates the addition of a new aerated static pile (ASP) composting facility and anaerobic digestion (AD) of food scraps and other highly organic materials from CRLCSWA, regional partners, and industrial food preparation/manufacturing facilities. Food scraps collection will be implemented in the region with an estimated 20 percent of currently disposed food waste, compostable paper, and cardboard/kraft paper in the MSW stream captured through voluntary programs. High quality food scraps and papers will be directed to the ASP composting facility. Packaged food waste captured from the MSW stream and industrial food waste will be directed to the AD. The process rejects and remaining CRLCSWA waste materials are transferred to a regional partner landfill due to the future closure of the current Site #2 landfill and all associated facilities. The non-organic material will be transferred to a landfill under contract, and a potential 28E agreement will need to be negotiated between CRLCSWA and the other landfill for disposal. A 28E agreement will also need to be negotiated between CRLCSWA and regional partners for processing the food scraps and other compostable organic materials. A new sustainable waste campus, including the AD facility, co-located transfer station, new RRC, and HHM facility, and composting facility, will need to be sited, permitted, constructed, owned, and operated by CRLCSWA. Scenario 7 assumes a robust aerobic composting facility (ASP) that is capable of composting green waste and food waste from regional partners that are collected and processed separately from mixed waste as well as AD digestate.

9.2 Summary

TABLE 9-1 SCENARIO 7 INFRASTRUCTURE ASSUMPTIONS

Infrastructure	Overall Assumptions

Overall Campus	• Total site = 80 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	  o Facilities/Buildings, 20 years bond at an annual 4% interest rate
	  o Compost Facility, 20 years bond at an annual 4% interest rate
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

Anaerobic Digestion	• Packaged food waste-rich loads directed to an AD receiving facility
	  o 20% capture rate from CRLCSWA, Iowa City, Black Hawk County & Dubuque w/ voluntary program
	  o Only 30% of Dubuque capture sent to the regional facility

	o Industrial waste stream (from food manufacturing/food prep) redirected; initial 10,000 TPY
	• Permit by = Year 2035
	• First waste receipt = Year 2038
	• Initial AD Design Capacity = 20,000 TPY processed waste
	• Public Days/Hours Operation
	  o Monday – Friday: 7 am – 4 pm
	  o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours: 1 shift/day, 306 days per year

Transfer Station	• Sized for current CRLCSWA disaster debris, C&D waste, shingles, rejects from AD, and remaining CRLCSWA MSW; although some materials like Special Waste may need to be direct hauled to the regional landfill
	• Permit by = Year 2036
	• First waste receipt = Year 2038
	• Public Days/Hours operation
	  o Monday – Friday: 7 am – 4 pm
	  o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours:
	  o Monday – Friday: 6:30am-4:30/5pm
	  o Saturday: 6:30am-2:30pm

ASP Compost Facility	• Loose food waste-rich loads with compostable papers and OCC/kraft papers directed to ASP Compost Facility
	  o 20% capture rate from CRLCSWA, Iowa City, Black Hawk County & Dubuque w/ voluntary program
	  o Only 30% of Dubuque capture sent to the regional facility
	• Initial Design Capacity 68,000 TPY (230 tons per day)
	• Permit by = Year 2036
	• First waste receipt = Year 2038

9.3 Waste Stream

TABLE 9-2 SCENARIO 7 WASTE STREAM VOLUMES

Facility	Year 1, TPY	Year 50, TPY
AD Facility	18,930	41,870
Transfer Station	206,297	300,710
Diversion		
Composted Organics-YW, FW, Papers	65,288	92,271
Composted Organics-Digestate	2,840	6,281
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
AD - Organics, Less Digestate	16,091	35,590
Diversion Subtotal	**89,436**	**141,796**
Landfill Tonnages	**206,297**	**300,710**
%Diversion/Reduction	**30%**	**32%**

9.4 Planned Infrastructure

TABLE 9-3 SCENARIO 7 LAND REQUIREMENTS

Facility	Area (Acres)
Anaerobic Digestion	15
Transfer Station	14
Regional Landfill (Existing)	-
Regional Aerobics Organic Composting	17
RRC/HHM	4
Scale House & Scales	10
Administration & Environmental Education Center	2
Maintenance Facility	2
Citizen Drop Off	2
Total	**66**
Parcel Size	**80**

[redacted]

9.4.1 Anaerobic Digestion

The land area for the anaerobic digester is designed to be 15 acres, including a 300-foot buffer. The receiving building is to be 16,000 square feet with two unloading bays to receive organic-rich loads. This scenario assumes additional organics for processing from multiple regional partners based on the regional stakeholder discussion. Rich loads of package food waste at an approximate 20% capture rate from CRLCSWA, Iowa City, and Black Hawk County through a voluntary program will be directed to the AD. Another 6% from Dubuque is assumed, i.e., only 30% of the 20% capture rate that is currently sent to their existing facility. Industrial food waste streams will be solicited and redirected to the AD adding an initial 10,000 tons per year. Permitting the facility by 2035 will provide the ability to receive organic waste by 2038. The initial AD design capacity is to be able to handle 20,000 tons per year with the ability to add digester units as additional food waste streams are obtained. The recovered biogas is assumed to be converted into energy with an assumed power output of 750KW. Biogas may also be transformed into renewable natural gas or other energy output. An estimated 5% of the food waste-rich loads are considered rejects and sent to the transfer station for hauling to the regional landfill.

9.4.2 Transfer Station

The transfer station will be sized for CRLCSWA disaster debris, C&D waste, shingles, and rejects from the AD and ASP compost facility, and the remaining MSW from CRLCSWA. It is to be permitted by 2036 to start receiving waste 2038. The capacity of the transfer station is to be sized for 840 tons per day in the 23,500-square-foot building. The transfer station will have 12 unloading bays and two load-out hoppers. In total, the land area needed is 14 acres, including a 300-foot buffer.

9.4.3 Regional Landfill

In this Scenario 7, waste will be hauled to a non-CRLCSWA landfill in the region based on the regional stakeholder discussion. There are multiple landfills within a 115-mile range with varying haul costs, which are shown in Attachment 1. This scenario will require RFPs and negotiations for a long-term/multi-year contract for waste disposal and possibly hauling. Contracts should be minimum of 10 years with an option for renewal.

9.5 Summary of Costs

Table 9-4 Scenario 7 Facility Build Out

Full Build-Out		Year 1 O&M$			Year 1 Revenues $		
Facility	Total Facilities Capital	O&M	O&M – Haul	Regional Landfill Disposal	Other Revenues	Energy/ Materials Revenues	Other Tip Fee Revenues
AD Facility	$48,594,100	$2,212,600	---	---	$335,700	$197,100	$783,000
Transfer Station	$15,778,800	$978,400	$4,951,900	$7,839,300	$0	$0	$0
ASP Compost Facility	$24,579,500	$1,764,700	---	---	$0	$1,192,900	$1,658,800
Scale House & Scales	$2,189,600	$293,900	---	---	$0	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0	$0
RRC/HHM	$9,933,900	$1,407,400	---	---	$0	$647,900	$0
Maintenance Shop	$2,567,500	$385,800	---	---	$0	$0	$0
Citizen Drop-Off	$238,100	$6,500	---	---	$0	$0	$0
TOTALS	**$106,759,600**	**$9,587,000**	**$4,951,900**	**$7,839,300**	**$335,700**	**$2,037,900**	**$2,441,800**

Table 9-5 Scenario 7 Capital with Contingencies

SCENARIO 7 CAMPUS	Quantity	Unit	Unit Price	Total
Land Acquisition - Purchase	80	Acres	$25,000	$2,000,000
Land Acquisition - Legal/Support	25%	LS	$2,000,000	$500,000
Social Justice/Env Impact/Legal	1	RS	$7,000,000	$7,000,000
SUBTOTAL				**$9,500,000**
Facilities Capital				$77,451,600
Contingency, Permitting, Eng./Construction Observation/CQA				$24,542,000
Equipment/Mobile Equipment				$4,766,000
SUBTOTAL				**$106,759,600**
Estimated Financing Costs - All Other Facilities				$48,104,000
SUBTOTAL				**$48,104,000**
TOTAL CAPITAL $				**$164,363,600**

Scenario 7 requires land acquisition, permitting, and equipment. Contingencies were added to the capital costs of the facilities, including the AD facility as well as the ASP compost facility, scale house, and other additional buildings. With the estimated financing costs, the total capital costs equal approximately $164,363,600, shown in detail in Table 9-5 above.

For Scenario 7's total gross tipping fee estimate in Table 9-6, the capital costs include a full build-out of the facilities. The financing costs assume a constant annual 4% interest rate on Facilities Capital plus Contingencies shown in Table 9-5. The last cost considered includes the land acquisition and other costs around social justice and legal fees. The total gross tipping fee will be approximately $80.16 per ton, which does not consider other revenues obtained from the CRLCSWA FY2022 budget, materials sale, and energy revenue shown in

Table 9-7. With the additional revenue, the expected rounded tipping fee for CRLCSWA will be nearly $58 per ton.

TABLE 9-6 SCENARIO 7 COST TOTALS

	Capital	Annual O&M	Annual Haul	Annual Disposal	Total - Gross
Total Costs - Facilities	$106,759,600	$9,587,000	$4,951,900	$7,839,300	
Total Costs - Financing	$48,104,000	---	---	---	
Total Costs-Land/Legal/Env Impact	$9,500,000	---	---	---	
CRLCSWA Process & Transfer Tons	$13,076,023	$215,100	$215,100	$215,100	
$/Ton	**$12.57**	**$44.57**	**$23.02**	**$36.44**	**$80.16**

Scenario 7 assumes revenues from grants and investments, the sale of recyclables from the RRC, the sale of compost, compost tipping fees, food waste/organics tipping fees, and AD energy revenues. The estimated annual revenues can be seen in the table below.

TABLE 9-7 SCENARIO 7 ANNUAL REVENUES

	Annual Other Revenues	Annual Mat'l/ Energy Revenues	Other Tip Fee Revenues	Total – Revenues Before Fees
Revenues	$335,700	$2,037,900	$2,441,800	
Landfilled Tons	215,100	215,100	215,100	
$/Ton Revenue	**$1.56**	**$9.47**	**$11.35**	
Estimated Net Tip Fee				**$57.77**
Rounded Estimate Net Tip Fee ($/ton)				**$58**

The estimated net tipping fee is calculated as the difference between the annual revenues from budgets, materials sales, tipping fees on regional partners and industrial customers, and the energy market from the total gross costs of $80.16 per ton. The assumed tipping fee for the Scenario 7 waste campus is estimated to be $57.77 per ton. When rounded, the total estimated tipping fee will be $58 per ton to process organic-rich waste through the AD and ASP compost facility, transfer the remaining waste and haul it to the regional landfill.

10. Scenario 8 WTE Facility (R)

Scenario 8:
Direct Combustion
with Partnered Landfill

10.1 Description

Scenario 8 evaluates the addition of direct combustion of CRLCSWA MSW and regional partners' MSW and RDF with energy generation and the transfer of ash from combustion and non-processable materials to a regional partner landfill due to the future closure of the current Site #2 landfill and all associated facilities. This scenario includes soliciting 215,000 tons per year of RDF from producers in Minnesota and Ames, Iowa, along with 30,000 to 90,000 tons per year of MSW from other Iowa communities. A new sustainable waste campus, including the direct combustion facility, co-located transfer station, new RRC, and HHM facility, and composting facility, will need to be sited, permitted, constructed, owned, and operated by CRLCSWA. The rejects and non-processable materials will be transferred to a landfill under contract, and a potential 28E agreement will need to be negotiated between CRLCSWA and the other landfill for disposal. Scenario 8 assumes an aerobic composting facility (turned windrow or ASP) that is capable of composting green waste, food waste, and other organics that are collected and processed separately from mixed waste.

10.2 Summary

Direct combustion with mass burn WTE technology could be completed for much of the post-recycling MSW stream. The commercial waste and C&D waste streams would need to be evaluated to determine how much could be processed. Of these alternatives, this option, or possibly RDF processing, would result in the largest landfill diversion. This option would have the fewest pre-processing requirements for the waste stream. Economics are driven heavily by the recovered energy markets. Most facilities produce electricity, but steam sales usually offer better economics (if a steam customer could be identified). For the combustible portions of the waste stream, about an eighty percent reduction in weight and ninety percent volume reduction is possible. Residual metal not recovered with recycling can be captured, but disposal of ash and residues is currently required. Reuse of certain portions of the ash stream is in development and may be possible in the future; however, at this time, it should be assumed that the ash residue, approximately 25 percent of the processed waste stream, will need to be disposed of in a landfill. If regulations allow contact of ash with the waste within the landfill, it may be used for alternative landfill applications such as daily cover material or roadbed construction.

A mass-burn facility will require solid waste, Title V air emission permits, and will have some other permitting requirements for any wastewater in addition to certain other requirements. Based on a limited number of recent projects, facility capital development costs may be in the range of $350,000 to $450,000 per ton per day. In other words, a 750 tons per day (tpd) facility would likely have a capital cost between $263 million and $338 million. The operating cost may be in the range of $80 to $120 per ton of MSW processed.

[redacted]

TABLE 10-1 SCENARIO 8 INFRASTRUCTURE OPERATIONS

Infrastructure	Hours of Operation

Overall Campus	• Total site = 80 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	    o Facilities/Buildings, 20 years bond at an annual 4% interest rate
	    o Compost Facility, 20 years bond at an annual 4% interest rate
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

WTE	• CRLCSWA MSW directed to WTE facility, other CRLCSWA waste to Transfer Station
	• RDF/excess RDF from Ames, Iowa, and Minnesota facilities; estimate 215,000 TPY of RDF feedstock
	• MSW from other Iowa communities starting at 30,000 TPY
	• Permit by = Year 2034
	• First waste receipt = Year 2038
	• Rejects to onsite Transfer Station; Ash to Regional Landfill
	    o Rejects = 5% of CRLCSWA MSW + MSW from Iowa Communities; no rejects from RDF
	    o Ash = 25% of processed waste
	• Public Days/Hours Operation
	    o Monday – Friday: 7 am – 4 pm
	    o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours: 24-hours/day, 365 days per year

Transfer Station	• Sized for current CRLCSWA disaster debris, C&D waste, shingles, and rejects from WTE, although some materials like Special Waste may need to be direct hauled to a regional landfill
	• Public Days/Hours operation
	    o Monday – Friday: 7 am – 4 pm
	    o Saturday, by appointment only: 7 am – 2 pm
	• Work Hours:
	    o Monday – Friday: 6:30am-4:30/5pm
	    o Saturday: 6:30am-2:30pm

10.3 Waste Stream

TABLE 10-2 SCENARIO 8 WASTE STREAM VOLUMES

Facility	Year 1, TPY	Year 50, TPY
WTE Facility	435,592	583,007
Transfer Station	35,534	54,144
Diversion		
Organics-YW/Misc. Food	38,118	55,601
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
WTE - Ferrous Metals	8,491	11,292
WTE – Non-Ferrous Metals	1,061	1,412
Diversion Subtotal	**52,889**	**75,959**
WTE Volume Reduction	**308,869**	**410,751**
Landfill Tonnages	**163,457**	**227,068**
%Diversion/Reduction	**69%**	**68%**

Transfer station waste includes the rejects initially received at the WTE facility. WTE ash is assumed to bypass the onsite transfer station and be hauled directly from the ash management building to the regional landfill.

10.4 Planned Infrastructure

Table 10-3 Scenario 8 Land Requirements

Facility	Area (Acres)
Waste to Energy	20
Transfer Station	10
Regional Landfill	0
Aerobics Organic Composting	30
RRC/HHM	4
Scale House & Scales	10
Administration & Environmental Education Center	2
Maintenance Facility	2
Citizen Drop Off	2
Total	**80**
Parcel Size	**80**

10.4.1 Waste to Energy Facility

All CRLCSWA MSW and estimated regional MSW will be directed to the new WTE facility that requires 20 acres, including a 300-foot buffer. The 94,300 square foot power plant will be designed to receive over 500,000 tons per year and combust almost 490,000 tons per year by Year 25. The goal is to have the facility running at 90% capacity at 1,400 tons per day. There would be two units sized each for 700 tons per day capacity. The facility will have a tipping floor with 15 unloading bays pushing waste into the pit large enough for five days of storage. The ash management building will also be onsite, approximately 4,800 square foot in size.

10.4.2 Transfer Station

In total, the land area for the transfer station will need to be 10 acres, including a 300-foot buffer. The facility will be sized for CRLCSWA disaster debris, C&D waste, shingles, and rejects from the WTE. Ash from the WTE is assumed to be transferred directly from the ash management building described in Section 10.4.1 above. The transfer station is to be permitted by 2036 to start receiving waste 2038. The capacity of the transfer station is sized for 150 tons per day in a 6,200-square-foot building. The facility will have three unloading bays and one load-out hopper.

10.4.3 Regional Landfill

In this Scenario 8, waste from the transfer station and ash from the WTE facility will be hauled to a non-CRLCSWA landfill in the region based on the regional stakeholder discussion. There are multiple landfills within a 115-mile range with varying haul costs, which are shown in Attachment 1. This scenario will require RFPs and negotiations for a long-term/multi-year contract for disposal and possibly hauling. Contracts should be minimum of 10 years with an option for renewal.

10.5 Summary of Costs

TABLE 10-4 SCENARIO 8 FACILITY BUILD OUT

Full Build-Out		Year 1 O&M$			Year 1 Revenues $		
Facility	Total Facilities Capital	O&M	O&M – Haul	Regional Landfill Disposal	Other Revenues	Energy/ Materials Revenues	Other Tip Fee Revenues
WTE Facility	$816,752,000	$29,549,100	---	---	$335,700	$26,303,300	$16,135,000
Transfer Station	$5,239,600	$473,300	$3,351,700	$5,383,700	$0	$0	$0
Compost Facility	$9,052,700	$1,171,200	---	---	$0	$1,091,100	$0
Scale House & Scales	$2,189,600	$293,900	---	---	$0	$0	$0
Admin/ Educational Center	$2,878,100	$2,537,700	---	---	$0	$0	$0
RRC/HHM	$9,933,900	$1,407,400	---	---	$0	$647,900	$0
Maintenance Shop	$2,567,500	$385,800	---	---	$0	$0	$0
Citizen Drop-Off	$238,100	$6,500	---	---	$0	$0	$0
	$848,851,500	**$35,824,900**	**$3,351,700**	**$5,383,700**	**$335,700**	**$28,042,300**	**$16,135,000**

TABLE 10-5 SCENARIO 8 CAPITAL WITH CONTINGENCIES

SCENARIO 8 CAMPUS	Quantity	Unit	Unit Price	Total
Land Acquisition - Purchase	80	Acres	$25,000	$2,000,000
Land Acquisition - Legal/Support	25%	LS	$2,000,000	$500,000
Social Justice/Env Impact/Legal	2	RSK	$7,000,000	$14,000,000
SUBTOTAL				**$16,500,000**
Facilities Capital				$658,960,100
Contingency, Permitting, Eng./Construction Observation/CQA				$186,059,400
Equipment/Mobile Equipment				$3,832,000
SUBTOTAL				**$848,851,500**
Estimated Financing Costs - All Other Facilities				$398,541,000
SUBTOTAL				**$398,541,000**
TOTAL CAPITAL $				**$1,263,892,500**

Scenario 8 requires land acquisition, permitting, and equipment. Contingencies were added to the capital costs of the facilities, including the WTE facility as well as the transfer station, compost facility, scale house, and other additional buildings. With the estimated financing costs, the total capital costs equal approximately $1,263,892,500, shown in detail in

Table 10-5 above.

For Scenario 8's total gross tipping fee estimate in Table 10-6Table 3-6, the capital costs include a full build-out of the facilities. The financing costs assume a constant annual 4% interest rate on Facilities Capital plus Contingencies shown in

Table 10-5. The last cost considered includes the land acquisition and other costs around social justice and legal fees. The total gross tipping fee is estimated to be approximately $75.01 per ton, which does not consider other revenues obtained from the CRLCSWA FY2022 budget, materials sale, RDF and regional MSW tipping fees, and energy revenue shown in Table 10-7. With the additional revenue, the expected rounded tipping fee for CRLCSWA will be nearly $72 per ton.

TABLE 10-6 SCENARIO 8 COST TOTALS

	Capital	Annual O&M	Annual Haul	Regional LF Disposal	Total - Gross
Total Costs - Facilities	$848,851,500	$35,824,900	$3,351,700	$5,383,700	
Total Costs - Financing	$398,541,000	---	---	---	
Total Costs-Land/Legal/Env Impact	$16,500,000	---	---	---	
CRLCSWA Process & Transfer Tons	13,076,000	215,100	215,100	215,100	
$/Ton	**$96.66**	**$166.55**	**$15.58**	**$25.03**	**$278.79**

Scenario 8 assumes revenues from grants and investments, the sale of recyclables from the RRC, the sale of compost, compost tipping fees, WTE energy, recovered metals revenues, and WTE tipping fees to RDF and regional customers. The estimated annual revenues can be seen in the table below.

TABLE 10-7 SCENARIO 8 ANNUAL REVENUES

	Annual Other Revenues	Annual Mat'l/ Energy Revenues	Other Tip Fee Revenues	Total - Revenues Before CRLCSWA
Revenues	$335,700	$28,042,300	$16,135,000	
Landfilled Tons	215,100	215,100	215,100	
$/Ton Revenues	**$1.56**	**$130.37**	**$75.01**	**$206.94**
Estimated Net Tip Fee				**$71.85**
Rounded Estimated Net Tip Fee				**$72**

The estimated net tipping fee is calculated as the difference between the annual revenues from budgets, materials sales, tipping fees on regional partners MSW and RDF producers, and the energy market from the total gross costs of $278.79 per ton. The assumed tipping fee for the Scenario 8 waste campus is estimated to be $71.85 per ton. When rounded, the total estimated tipping fee will be $72 per ton to combust waste, transfer non-processible waste, and haul waste and ash to a regional landfill.

Project:	CRLCSWA Infrastructure Options
Date:	12/13/2021
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**OTHER SROI INPUTS**

SCENARIO 1
CRLCSWA NEW LANDFILL OPTION
OTHER SROI INPUTS (2021$)

Timing of Capital Costs

SCENARIO 1 CAMPUS	2022	2023	2024	2025	2026	2027
Land Acquisition/Legal/Env	0%	5%	10%	15%	20%	50%
New Landfill	0%	0%	0%	0%	0%	0%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 1 CAMPUS	2028	2029	2030	2031	2032	2033
New Landfill	0%	0%	0%	1%	1%	1%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 1 CAMPUS	2034	2035	2036	2037	2038	2039
New Landfill	2%	6%	8%	10%	2%	0%
Compost Facility	5%	10%	40%	30%	15%	0%
Scalehouse	0%	5%	45%	50%	0%	0%
Admin/Educational Center	0%	5%	30%	55%	10%	0%
RRC/HHW	5%	10%	30%	50%	5%	0%
Maintenance Shop	0%	5%	30%	55%	10%	0%
Citizen Drop-Off	0%	5%	60%	30%	5%	0%

Travel Distances

1 Assume travel of garbage trucks, citizens, yard waste drop-off, and other customers to Solid Waste Campus same for Scenarios 1-5.

2 Scenarios 1-5 assumes those utilizing the Solid Waste Campus facilities similar to current customers.

Project:	CRLCSWA Infrastructure Options
Date:	11/22/2021
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**SUMMARY**

SCENARIO 1
CRLCSWA NEW LANDFILL OPTION
SUMMARY (2021$)

Facility	Minimum Land Required (Acres)	Land Purchase (Acres)	Liner / Pad Areas (Acres)	Buildings Size (SF)	Year 1, TPY	Year 50, TPY
New Landfill	220	---	100	---	236,846	345,523
Compost Facility	30	---	21	---	38,118	55,601
Scalehouse	10	---	---	600	---	---
Admin/Educational Center	2	---	---	5,500	---	---
RRC/HHW	4	---	---	18,300	4,045	5,943
Maintenance Shop	2	---	---	17,200	---	---
Citizen Drop-Off	4	---	2	---	1,173	1,711
TOTAL	**272**	**320**	**---**	**41,600**	**---**	**---**

Diversion Tonnages		
Organics	38,118	55,601
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
Diversion Subtotal	**43,336**	**63,256**
Landfill Tonnages	**236,846**	**345,523**
% Diversion/Reduction from LF	**15%**	**15%**

	Full Build-Out	**Year 1 O&M$**		**Year 1 Revenues$**	
Facility	**Total Facilities Capital $**	**O&M $**	**Closure/Post-Closure Fund$**	**Other Revenues$**	**Energy/ Materials Revenues$**
New Landfill	$103,069,800	$2,928,200	$637,300	$335,700	$436,000
Compost Facility	$9,052,700	$1,142,600	---	$0	$1,091,100
Scalehouse	$2,189,600	$293,900	---	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	$0	$0
RRC/HHW	$9,933,900	$1,407,400	---	$0	$647,900
Maintenance Shop	$4,694,100	$566,000	---	$0	$0
Citizen Drop-Off	$1,615,300	$51,300	---	$0	$0
TOTAL	**$133,433,500**	**$8,927,100**	**$637,300**	**$335,700**	**$2,175,000**

SCENARIO 1 CAMPUS	**Quantity**	**Unit**	**Unit Price**	**Total**		
Land Acquisition - Purchase	320	Acres	$25,000	$8,000,000	*3 Qtr Sections*	
Land Acquisition - Legal/Support	25%	LS	$8,000,000	$2,000,000	*% Land Purchase*	
Social Justice/Env Impact/Legal	1	RS	$7,000,000	$7,000,000	*Risk Factor*	
SUBTOTAL				**$17,000,000**		
Facilities Capital - Landfill Only				$76,530,200		
Contingency, Permitting, Eng/Construction Observation/CQA - Landfill Only				$24,489,600		
Facilities Capital - All Other Facilities				$21,019,400		
Contingency, Permitting, Eng/Construction Observation/CQA - All Other Facilities				$7,194,300		
Equipment/Mobile Equipment				$4,200,000		
SUBTOTAL				**$133,433,500**		$150,433,500
Estimated Financing Costs - Landfill				$16,796,000	*9 cells, 7 yrs ea, 4%*	
Estimated Financing Costs - All Other Facilities				$13,307,000	*20 yrs, 4% APR*	
SUBTOTAL				**$30,103,000**		
TOTAL CAPITAL$				**$180,536,500**		

SCENARIO 1 TIPPING FEE ESTIMATE (2021$)

	Capital$[1]	**Annual O&M$[2]**	**Annual Closure/PC$[2]**	**Total - Gross**
Total Costs - Facilities	$133,433,500	$8,927,100	$637,300	
Total Costs - Financing	$30,103,000	---	---	
Total Costs-Land/Legal/Env Impac	$17,000,000	---	---	
Landfilled Tons	14,400,128	236,846	236,846	
$/Ton	**$12.54**	**$37.69**	**$2.69**	**$52.92**

	Annual Other Revenues[3]	**Annual Mat'l/ Energy Revenues[4]**	**Total - Revenues Before Fees**
Revenues	$335,700	$2,175,000	
Landfilled Tons	236,846	236,846	
	$1.42	**$9.18**	**$10.60**

ESTIMATED NET TIP FEE	**$42.32**
Rounded ESTIMATED NET TIP FEE	**$43.00**

Notes:
1. Capital costs include full build out of facilities for 50-year period divided by projected landfilled tons Year 2038-2087.
Financing costs assume constant annual 4% interest rate on Facilities Capital plus Contingency, Permitting, Engineering & Construction Observation/CQA.
Land acquisition costs including social justice, environmental impacts and legal.
2. Annual O&M costs include replacement reserves for equipment and rehab/rebuild of buildings over 50-year period. Divided by Year 2038 landfilled tons.
3. Other Revenues obtained from CRLCSWA FY2022 budget including grants, investments, non-cash adjustments, other misc. revenues.
Divided by Year 2038 landfilled tons.
4. Annual Material/Energy Revenues includes recycled materials revenues through RRC (from FY2022 budget), composting tip fees at $24/ton, compost sales at $24/ton, and estimated LFG-to-energy revenues. Divided by Year 2038 landfilled tons.

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MSW Landfill Sizing**

SCENARIO 1
CRLCSWA NEW MSW LANDFILL OPTION
SIZING LANDFILL

Landfill Sizing Components	**Calculations**		**Comments/Notes**		
Size	100	acres			
Width Est	2,000	feet	Check of dimensions =	100.1	acres
Length Est	2,180	feet			
Depth (top liner system)	30	feet	Liner Sideslopes 3:1		
Top Area:	4,356,000	SF			
Bottom Area:	3,640,000	SF			
VOLUME-below ground surface	**4,440,000**	**CY**			
Height (top of waste)	140	feet	Cap Sideslopes 4:1		
Top Area:	932,800	SF	Check top width/length=	966	feet
Bottom Area:	4,356,000	SF			
VOLUME-above ground surface	**13,710,000**	**CY**			
TOTAL WASTE VOLUME CAPACITY	**18,150,000**	**CY**			
Yr 2038-Yr 2088, Estimated Disposal	14,400,100	Tons	from calculation below		
Estimate Density, AUF	1,600	lbs/CY			
Minimum Required Volume:	**18,000,000**	**CY**		99%	of total available
Landfill Life:	**50**	**years**			
Conceptual Roadways:					
Entrance Roadways	3,000	LF	include w/ Scalehouse costs		
Perimeter Roadways	8,400	LF			
Minimum Site Area:	500' Buffer		1000' Buffer		
Site - Landfill, Buffer & Borrow	220	acres		384 acres	Qtr sect

Tonnage Projections-Total Disposed

Year	**CRLCSWA Projections**		**Annual % Increase**
2020	211,749	tons	0.46%
2030	221,763	tons	0.83%
2040	240,816	tons	0.77%
2050	260,043	tons	

YR	**Calculate Annual Tonnage Potential Disposal in New LF**	**Tons per Year**	**TPD**
1	2038	236,846	800
2	2039	238,823	807
3	2040	240,816	814
4	2041	242,673	820
5	2042	244,544	826
6	2043	246,430	833
7	2044	248,330	839
8	2045	250,245	845
9	2046	252,175	852
10	2047	254,119	859

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MSW Landfill Sizing**

11	2048	256,079	865
12	2049	258,053	872
13	2050	260,043	879
14	2051	262,048	885
15	2052	264,069	892
16	2053	266,105	899
17	2054	268,157	906
18	2055	270,225	913
19	2056	272,308	920
20	2057	274,408	927
21	2058	276,524	934
22	2059	278,656	941
23	2060	280,805	949
24	2061	282,970	956
25	2062	285,152	963
26	2063	287,351	971
27	2064	289,567	978
28	2065	291,800	986
29	2066	294,050	993
30	2067	296,317	1001
31	2068	298,602	1009
32	2069	300,905	1017
33	2070	303,225	1024
34	2071	305,563	1032
35	2072	307,919	1040
36	2073	310,294	1048
37	2074	312,686	1056
38	2075	315,097	1065
39	2076	317,527	1073
40	2077	319,975	1081
41	2078	322,443	1089
42	2079	324,929	1098
43	2080	327,435	1106
44	2081	329,960	1115
45	2082	332,504	1123
46	2083	335,068	1132
47	2084	337,651	1141
48	2085	340,255	1150
49	2086	342,879	1158
50	2087	345,523	1167
	2088		

TOTAL ESTIMATED TONS FOR POTENTIAL DISPOSAL	**14,400,128**	**tons**

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021 Revised: 12/14/2021			
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design			
Costs:	2021$	LF Size:	100 Acres	
Location:	Linn County, Iowa	Required Land:	220 Acres	
Worksheet:	**MSW Landfill Capital Cost**	**TOTAL LF CAP$**		**$103,069,800**

SCENARIO 1
CRLCSWA NEW MSW LANDFILL OPTION
CAPITAL COST ESTIMATE SUMMARY (1)(2)

Landfill Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations				$ -	
Hydrogeologic Characterization	1	LS	$ 250,000	$ 250,000	*Initial site investigations*
Supplemental Site Investigations	9	EA	$ 20,000	$ 180,000	*prior to each cell development*
Groundwater Monitoring Wells	9	EA	$ 8,000	$ 72,000	*2 to 3 upgradient, 6 downgradient*
Gas Migration Monitoring Probes	9	EA	$ 3,000	$ 27,000	
Site Work				$ -	
Mobilization/Demob	9	EA	$ 100,000	$ 900,000	*Number of cells construction; 1st cell 20-acres*
Clear & Grub	50	Acres	$ 2,000	$ 100,000	*Assume no demolition; half of LF area*
Bulk Excavation	4,440,000	CY	$ 3	$ 13,320,000	*Adequate quantity & quality of soils on-site*
Structural Fill	1,332,000	CY	$ 10	$ 13,320,000	*Assume 30% of bulk excavation quantities*
LF Perimeter Roadways	28,000	SY	$ 45	$ 1,260,000	*4" asphalt over 6" granular base, 8400LF*
Site Utilities				$ -	
Stormwater Pond	3	LS	$ 200,000	$ 600,000	
Site Drainage/Erosion Control	9	EA	$ 50,000	$ 450,000	*Number of cells construction*
Electrical - New Service to Site	1	LS	$ 1,500,000	$ 1,500,000	*From 1 mile away*
Water Supply & Fire Protection	1	LS	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Sanitary Sewer	1	LS	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Natural Gas System	-	LS	$ -	$ -	*Assume Not Available for Scenario 1*
Surveying	9	EA	$ 25,000	$ 225,000	
Screening, Landscaping, Signage	9	EA	$ 60,000	$ 540,000	*Allowance*
Fencing	12,400	LF	$ 35	$ 434,000	*Site Perimeter*
Liner & Leachate Collection System					
Composite Liner System	100	Acres	$ 250,000	$ 25,000,000	*Recompacted Clay, geomembrane, 12" granular, geotextile & protective cover*
Leachate Collection Pipes, Sumps, Pumps & Controls, Lift Station, Forcemain	8%	Liner $	$ 25,000,000	$ 2,000,000	
Leachate Lagoon	1	LS	$ 3,250,000	$ 3,250,000	*Estimate 10 acres lined + 30% for excavation*
Active Gas Collection System	100	Acres	$ -	$ -	*See Closure Costs - to begin within 2 or 5 years of first placement of waste*
Market Variability Factor	15%	Capital $	$ 66,548,000	$ 9,982,200	*Sitework, horizontal construction*
SUBTOTAL LANDFILL CAPITAL				**$ 76,530,200**	

Engineering (3)	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 76,530,200	$ 15,306,000
Engineering & Design	4%	Capital $	$ 76,530,200	$ 3,061,200
Permitting	2%	Capital $	$ 76,530,200	$ 1,530,600
Construction Observation/CQA	6%	Capital $	$ 76,530,200	$ 4,591,800
SUBTOTAL LANDFILL SOFT COSTS				**$ 24,489,600**

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Landfill Compactor	1	EA	$ 1,000,000	$ 1,000,000	*Replacement*
Track Dozer (D8 or similar)	1	EA	$ 800,000	$ 800,000	*Replacement*
Track Dozer (D6 or similar)	0	EA	$ 550,000	$ -	*Existing*
Excavator	0	EA	$ 1,000,000	$ -	*Existing*
Dump Trucks	0	EA	$ 200,000	$ -	*Existing*
Tanker Truck - Leachate Recirculation	1	EA	$ 250,000	$ 250,000	*New 4000-gallon tanker/water truck*
Water Truck	0	EA	$ 200,000	$ -	*Existing*
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*
SUBTOTAL				**$ 2,050,000**	

ASSUMPTIONS:

Project:	CRLCSWA Infrastructure Options				
Date:	11/23/2021 Revised: 12/14/2021				
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design				
Costs:	2021$	LF Size:	100	Acres	
Location:	Linn County, Iowa	Required Land:	220	Acres	
Worksheet:	**MSW Landfill Capital Cost**	**TOTAL LF CAP$**			**$103,069,800**

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed cell projects to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa		
Worksheet:	**MSW LF Closure & Post-Closure Costs**	**ANNUAL FUND PAY-IN**	**$637,300**

SCENARIO 1
CRLCSWA NEW MSW LANDFILL OPTION
CLOSURE & POST-CLOSURE COSTS ESTIMATE SUMMARY [1]

LF Closure Costs	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Direct Capital Costs					$ 15,850,000	
MSW Landfill Capping System [2]	100	Acres	$ 120,000	$ 12,000,000		*Financial assurance (FA) $/acre w/ market variability factor*
Active LFG Collection System [3]	100	Acres	$ 27,000	$ 2,700,000		*Estimated $/acre w/ market variability*
LFG Blower Skid/Flare [4]	1	LS	$ 1,150,000	$ 1,150,000		*Estimated w/ market variability factor*
Contingency	10%	Capital $	$ 15,850,000	$ 1,585,000	$ 1,585,000	*10% contingency matches FA*
Legal & Administrative	1	LS	$ 25,000	$ 25,000	$ 25,000	
Design/Engineering	8%	Capital $	$ 15,850,000	$ 1,268,000	$ 1,268,000	
Construction Observation / CQA	10%	Capital $	$ 15,850,000	$ 1,585,000	$ 1,585,000	
SUBTOTAL LF CLOSURE COSTS					**$ 20,313,000**	
ANNUAL CLOSURE FUND PAYMENT[7]					$406,300	

LF Post-Closure Costs	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Direct Post-Closure Operations					$ 10,500,000	
Annual Post-Closure [5]	30	Years	$ 250,000	$ 7,500,000		*FA $ increased for larger LF*
Active LFG System O&M [6]	30	Years	$ 100,000	$ 3,000,000		*FA $ increased for larger LF*
Contingency	10%	PC Ops$	$ 10,500,000	$ 1,050,000	$ 1,050,000	
SUBTOTAL LF POST-CLOSURE COSTS					**$ 11,550,000**	
ANNUAL POST-CLOSURE FUND PAYMENT[7]					$231,000	

ASSUMPTIONS:

(1) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Assumed projects to be comptetively bid.

Assumed construction to be during normal working hours.

(2) Estimate for composite capping system, terracing, letdown structures, vegetation, and supporting construction activities.

(3) Assumes installation of an active landfill gas collection system with extraction wells, piping, condensate management, system appurtenances, and general conditions.

(4) Assumes installation of landfill gas blower skid/flare and supporting site work, utilities, and general conditions.

(5) Estimate of post-closure care for cap and vegetation, leachate management, groundwater monitoring, LFG migration monitoring, stormwater and security.

(6) Estimate for LFG operations; repairs/maintenance of LFG collection wells, piping, blower, flare; and reporting requirements.

(7) Annual payment assumes site life of 50 years.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design		
Costs:	2021$	**LFG REVENUES$**	**$436,000**
Location:	Linn County, Iowa	**OTHER REVENUES$**	**$335,700**
Worksheet:	**MSW Landfill O&M Costs**	**ANNUAL LF O&M$**	**$2,928,200**

SCENARIO 1
CRLCSWA NEW MSW LANDFILL OPTION
OPERATIONS COST ESTIMATE SUMMARY [1]

LF Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 778,800	*FY2021 fully-burdened salary, escalated*
Scalehouse	0.0	FTE	$ 82,000	$ -		*Included w/ scalehouse operations*
LF Compactor Operator	2.0	FTE	$ 103,800	$ 207,600		
LF Equip Operators	3.0	FTE	$ 103,800	$ 311,400		
LF Leachate Recirculation	1.0	FTE	$ 103,800	$ 103,800		*New*
LF Spotters	3.0	FTE	$ 52,000	$ 156,000		*Estimate*
LF Utilities					$ 30,400	
Electricity	50,000	kWh	$ 0.15	$ 7,500		*Estimate for leachate & LFG*
Water	1	LS	$ 20,000	$ 20,000		*Estimate - dust control, etc.*
Leachate	0	gallons	$ 0.15	$ -		*Assume full management on site*
Heating Fuel	0	LS	$ -	$ -		*None at LF area - See SW Campus Bldgs*
Phones	12	months	$ 240	$ 2,900		*Estimate, Use by # primary staff*
Maintenance and Repairs					$ 784,100	
Active LFG System O&M	1	LS	$ 48,000	$ 48,000		*None first 10 yrs; amortize over 50 yr life*
LFG-to-Energy O&M	1	LS	$ 228,000	$ 228,000		*None first 10 yrs; amortize over 50 yr life*
Roadways, Land & Misc LF Maintenance	0.2%	Capital $	$ 76,530,200	$ 153,100		*Percentage of LF capital*
LF Mobile Equipment	14,200	hours	$ 25	$ 355,000		*Avg equip operating hours, total*
LF Environmental Compliance					$ 79,800	
Groundwater Monitoring	1	LS	$ 56,000	$ 56,000		*From FY2022 HDR contract*
Groundwater Lab Analysis	1	LS	$ 16,300	$ 16,300		*CRLCSWA FY2022 Budget*
Leachate Levels Monitoring	1	LS	$ 5,000	$ 5,000		*From FY2022 HDR contract*
LFG Monitoring	1	LS	$ 2,500	$ 2,500		*From FY2022 HDR contract*
Supplies	1	LS	$ 15,000	$ 15,000	$ 15,000	*CRLCSWA FY2022 Budget, prorated to LF*
Fuel	42,600	gallons	$ 3.50	$ 149,100	$ 149,100	*Assume 3 gallons per hour operating*
Consulting/Eng Services	1	LS	$ 236,500	$ 236,500	$ 236,500	*FY2022 Budget less Env Compliance*
LF Insurance	0.1%	Capital $	$ 76,530,200	$ 76,500	$ 76,500	*Percentage of LF total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL LF DIRECT OPERATIONS					**$ 2,150,200**	

LF Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 740,000	*Rounded*
Compactor	1	EA	$ 200,000	$ 200,000		*Capital cost divided by 5-yr life*
Track Dozer (D8 or similar)	1	EA	$ 160,000	$ 160,000		*Capital cost divided by 5-yr life*
Track Dozer (D6 or similar)	1	EA	$ 110,000	$ 110,000		*Capital cost divided by 5-yr life*
Excavator	1	EA	$ 142,857	$ 142,900		*Capital cost divided by 7-yr life*
Dump Trucks	2	EA	$ 28,571	$ 57,100		*Capital cost divided by 7-yr life*
Tanker Truck-Leachate Recirc	1	EA	$ 35,714	$ 35,700		*Capital cost divided by 7-yr life*
Water Truck	1	EA	$ 28,571	$ 28,600		*Capital cost divided by 7-yr life*
Pick-up Truck	1	EA	$ 5,714	$ 5,700		*Capital cost divided by 7-yr life*
Operating Cash Reserve	1	LS	$ 38,000	$ 38,000	$ 38,000	*CRLCSWA FY2021 Budget, rounded*

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design		
Costs:	2021$	**LFG REVENUES$**	**$436,000**
Location:	Linn County, Iowa	**OTHER REVENUES$**	**$335,700**
Worksheet:	**MSW Landfill O&M Costs**	**ANNUAL LF O&M$**	**$2,928,200**

Site #3 Other Developments	0	LS	$	250,000	$	-	$	-	*No Site #3 operations*
SUBTOTAL LF CASH RESERVES							**$**	**778,000**	

Other Revenues	**Quantity**	**Unit**		**Unit Price**		**Annual Costs**		**Total**	
Grants/Investments/ Other	1	LS	$	281,300	$	281,300	$	281,300	*CRLCSWA FY2022 Budget*
Non-Cash Adjustments	1	LS	$	25,000	$	25,000	$	25,000	*CRLCSWA FY2022 Budget*
Other Misc. Revenue	1	LS	$	29,400	$	29,400	$	29,400	*CRLCSWA FY2022 Budget*
New LF Gas-to-Energy	1	LS	$	436,000	$	436,000	$	436,000	*None first 10 yrs; amortize over 50 yr life*
SUBTOTAL OTHER REVENUES							**$**	**771,700**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
COMPOST FACILITY SIZING

Compost Feedstock	***Initial Development, Year 2038***	***Long Term, Year 2087***	
Incoming Organics (tons)	38,118	55,601	*From SW Volumes Memo 6-10-2021*
% as Food Waste	10%	10%	*Food target percent for windrow ops*
Processing Days per Year	296	296	
Tons per Day	129	188	
Yard Waste Density (lb/cy)	650	650	
Yard Waste C:N Ratio	25	25	
Yard Waste Moisture Content	40%	40%	
Food Waste Density (lb/cy)	1,000	1,000	
Food Waste C:N Ratio	45	45	
Food Waste Moisture Content	60%	60%	
Target C:N Ratio	30 to 45	30 to 45	
Target Moisture Content	60%	60%	
Net Bulk Density at Arrival (lb/cy)	685	685	
Target Bulk Density (lb/cy)	850	850	
Net C:N Ratio	27	27	
Net Moisture Content	42%	42%	
Water to Add Initially (gal/yr)	**1,647,378**	**2,402,939**	
Annual Infeed Volume Processed (cy)	**111,295**	**162,340**	
Finished Compost Volume (cy)	61,212	89,287	
Density of Finished Compost (lb/cy)	800	800	
Finished Compost (tons)	**24,485**	**35,715**	
Composting Parameters			
Composting Period (days)	120	120	*6 months total from incoming to screening*
Curing Period (days)	40	40	*Recommended*
Storage Period, Pre-Screening (days)	30	30	
Storage Period, Post-Screening (days)	30	30	*Total 60 days compost storage*
Initial Windrow Shrinkage Factor	10%	10%	
Compost Shrinkage Factor	30%	30%	
Curing Shrinkage Factor	5%	5%	
Unloading/Receiving Area			
Yard Waste Daily Pile Volume (cy)	357	520	
2x YW for Peak Day (cy)	713	1040	*Daily yard waste*
YW Pile Height (ft)	10	10	
YW Pile Area (sf)	*1,926*	*2,809*	
Wood & Leaves Pile Volumes (cy)	10,556	15,397	*Assume 10% of annual raw material*

Project:	CRLCSWA Infrastructure Options	
Date:	11/9/2021	
Facility:	New Aerobic Organics Compost Site - Windrows - No Design	
Costs:	2021$	
Location:	Linn County, Iowa	
Worksheet:	**Aerobic Organics Composting - Sizing**	

Wood/Leaves Pile Height (ft)	10	10	*For raw material mixing ratios*
Wood/Leaves Pile Area (sf)	*28,501*	*41,573*	*Storage piles for wood chips & leaves*
Food Waste Pile Volume (cy)	26	38	
2x FW for Peak Day (cy)	52	75	*Daily food waste*
FW Pile Height (ft)	5	5	
FW Pile Area (sf)	*278*	*406*	
Hours per Day YW/FW Receipt	9	9	
Vehicles Peaking Factor	1.5	1.5	
Vehicles Payload (avg tons/vehicle)	2	2	*Assumption*
Unloading Time for Loads (minutes)	10	10	*Assumption*
No. Vehicles per Hour (vph)	11	16	
Total Number Unloading Bays	2	3	
Area per Unloading Bay (sf)	720	720	
Unloading Bay Space (sf)	*1,440*	*2,160*	
Maneuvering Space (sf)	*3,600*	*5,400*	
Total Unloading/Receiving Space (sf)	**35,745**	**52,347**	

Compost Pad			
Average Volume on Compost Pad (cy)	32,931	48,035	
Compost Windrow Length (ft)	200	200	
Compost Windrow Height (ft)	6	6	*To confirm w/ CRLCSWA*
Compost Windrow Width (ft)	14	14	*To confirm w/ CRLCSWA*
Volume per Row (cy)	373	373	
Number of Rows	89	129	
Spacing Between Windrows (ft)	8	8	
Total Compost Pad Area (sf)	**391,600**	**567,600**	

Compost Curing Pad			
Average Volume on Curing Pad (cy)	7,318	10,674	
Curing Windrow Length (ft)	100	100	
Curing Windrow Height (ft)	7	7	*To confirm w/ CRLCSWA*
Curing Windrow Width (ft)	16	16	*To confirm w/ CRLCSWA*
Volume per Row (cy)	249	249	
Number of Rows	30	43	
Spacing Between Windrows (ft)	6	6	
Total Curing Pad Area (sf)	**66,000**	**94,600**	

Storage Pad1 - PreScreening		
Average Volume on Storage Pad (cy)	5,031	7,339
Storage Windrow/Pile Height (ft)	15	15
Total Storage Pad1 Area (sf)	**12,937**	**18,871**

Finished Compost Screening Area		
Loading Traffic Area Width (ft)	50	50
Loading Traffic Area Length (ft)	100	100
Loading Traffic Area (sf)	*5,000*	*5,000*
Mixing Bin/Screen w/ Stockpile Width (ft)	75	75

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

Mixing Bin/Screen w/ Stockpile Length (ft)	100	100	
Mixing Bin/Screen w/ Stockpile Area (sf)	*7,500*	*7,500*	
Total Screening Area (sf)	**12,500**	**12,500**	
Storage Pad2 - Post-Screening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	
Total Storage Pad2 Area (sf)	**12,937**	**18,871**	
Traffic Lanes for Operations			
Traffic Lane Width (ft)	20	20	
Cummulative Processing Area (sf)	531,719	764,789	
Square Root (ft)	729	875	
Traffic Lane Length =	2,917	3,498	
Total Operations Traffic Lanes Area (sf)	**58,335**	**69,962**	
Retention/Leachate Pond			
Area Contributing to Pond (sf)	590,054	834,751	*Total of Areas above*
100-Yr 24 hr Stor Event Rainfall Intensity I	0.310	0.310	PF Map: Contiguous US (noaa.gov)
Area A (acres)	13.5	19.2	
Run-off Factor C	0.60	0.60	
Flow Rate Q (cfs)	2.5	3.6	*using Rational Formula Q=CIA*
Time to Retain (hours)	24	24	
Volume of Water to Retain (cf)	217,394	307,547	
Depth of Pond (ft)	6	6	
Side Slopes of Pond #:1	4	4	
Pond Area at 1/2 Depth (sf)	36,232	51,258	*Volume divided by Depth*
Length & Width at 1/2 Depth (ft)	190	226	
Total Pond Area (sf)	**45,945**	**62,701**	*at grade*
SUMMARY OF COMPOST AREAS			
Unloading/Receiving Area	35,745	52,347	
Compost Pad	391,600	567,600	
Compost Curing Pad	66,000	94,600	
Storage Pad1 - Pre-Screening	12,937	18,871	
Finished Compost Screening Area	12,500	12,500	
Storage Pad2 - Post-Screening	12,937	18,871	
Traffic Lanes for Operations	58,335	69,962	
Retention/Leachate Pond	45,945	62,701	
TOTAL REQUIRED AREA (sf)	**635,999**	**897,452**	
TOTAL REQUIRED AREA (acres)	**14.60**	**20.60**	
Site - Composting & Buffer (acres)	**23**	**30**	*Assume 100' buffer*

Project:	CRLCSWA Infrastructure Options				
Date:	11/9/2021				
Facility:	New Aerobic Organics Compost Site - Windrows - No Design				
Costs:	2021$	Facility Size:	21	Acres	
Location:	Linn County, Iowa	Required Land:	30	Acres	
Worksheet:	**Composting Capital Costs**	**TOTAL COMPOST CAP$**			**$9,052,700**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
CAPITAL COST ESTIMATE SUMMARY (1)(2)

Compost Site Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations	1	LS	$ 50,000	$ 50,000	*Assumption*
Site Work					
Mobilization/Demob	1	LS	$ 50,000	$ 50,000	
Clear & Grub	11	Acres	$ 2,000	$ 22,000	*Assume no demolition; half compost area*
Grading/Excavation	67,800	CY	$ 3	$ 203,400	*Assume 2' across compost area*
Structural Fill	20,300	CY	$ 10	$ 203,000	*Assume 30% of excavation quantities*
Roadways	9,100	SY	$ 45	$ 409,500	*4" asphalt over 6" granular base*
Site Utilities					
Stormwater Pond	-	LS	$ 200,000	$ -	*See Compost Leachate Lagoon*
Site Drainage/Erosion Control	1	EA	$ 25,000	$ 25,000	
Electrical - Service to Site	-	LS	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Water Supply & Fire Protection	1	LS	$ 100,000	$ 100,000	*Extend water supply to compost facility*
Sanitary Sewer	-	EA	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Natural Gas System	-	LS	$ -	$ -	*NA*
Surveying	1	EA	$ 10,000	$ 10,000	*For composting area only*
Landscaping, Signage	1	EA	$ 20,000	$ 20,000	*For composting area only*
Fencing	4,600	LF	$ 35	$ 161,000	*Around composting area*
Pads & Leachate Collection					
Composting & Curing Pads	73,600	SY	$ 45	$ 3,312,000	*Asphalt Pad - Full Buildout*
Screening/Storage Areas	5,600	SY	$ 25	$ 140,000	*Compacted Gravel Pad - Full Buildout*
Compost Leachate Lagoon, Lined	1	LS	$ 500,000	$ 500,000	*Approximate 2 acres*
Market Variability Factor	15%	Capital $	$ 5,205,900	$ 781,000	*Sitework, horizontal construction*
SUBTOTAL COMPOST SITE CAPITAL				**$ 5,986,900**	

Engineering (3)	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 5,986,900	$ 1,197,400
Engineering & Design	4%	Capital $	$ 5,986,900	$ 239,500
Permitting	2%	Capital $	$ 5,986,900	$ 119,700
Construction Observation/CQA	6%	Capital $	$ 5,986,900	$ 359,200
SUBTOTAL COMPOST SOFT COSTS				**$ 1,915,800**

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Windrow Turner	1	EA	$ 750,000	$ 750,000	*Replacement*
Loader (large)	1	EA	$ 400,000	$ 400,000	*Replacement*
Water Truck	0	EA	$ 200,000	$ -	*Share w/ Landfill or Primary Facility*
Screen Compost Finish	0	EA	$ 300,000	$ -	*Existing*
Grinder/Shredder	0	EA	$ 600,000	$ -	*Existing*
Conveyors	0	EA	$ 75,000	$ -	*NA - included w/ screener or grinder*
SUBTOTAL				**$ 1,150,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing co: Does not include financing costs.

Assumed cell projects to be c Assumed cell projects to be competitively bid under one general contract.

Assumed construction to be c Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	New Aerobic Organics Compost Site - Windrows - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**COMPOST REV$**	**$1,091,100**
Worksheet:	**Composting O&M Costs**	**TOTAL COMPOST O&M$**	**$1,142,600**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
OPERATIONS COST ESTIMATE SUMMARY (1)

Compost Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 511,800	*FY2021 fully-burdened salary, escalated*
Scalehouse	0.0	FTE	$ 82,000	$ -		*Included in LF, TS, MWP, AD or WTE*
Windrow Turner Operator	1.5	FTE	$ 103,800	$ 155,700		
Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
Misc. Equip Operator	2.0	FTE	$ 100,200	$ 200,400		*Water truck, grinder, screen, turner, loader*
Utilities					$ 27,400	
Electricity	0	kWh	$ 0.15	$ -		*NA*
Water	1	LS	$ 25,000	$ 25,000		*130 gal/ton for composting, dust control*
Leachate	0	gallons	$ 0.15	$ -		*NA - Compost leachate NPDES Discharge*
Heating Fuel	0	LS	$ 2,500	$ -		*NA*
Phones	12	months	$ 200	$ 2,400		*Estimate based on # labor*
Maintenance and Repairs					$ 153,500	
Roadways, Pads Repair & Misc Maintenance	0.3%	Capital $	$ 5,986,900	$ 18,000		*Percentage of Compost capital*
Windrow Turner	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Loader	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Truck/Screen Equipment	2,368	hours	$ 15	$ 35,500		*80% of personnel hours*
Grinder	208	hours	$ 25	$ 5,200		*Estimate 4 hours per week*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	21,936	gallons	$ 3.50	$ 76,800	$ 76,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Insurance	0.1%	Capital $	$ 5,986,900	$ 6,000	$ 6,000	*Percentage of compost total capital*
Compost Lab Testing	1	LS	$ 5,000	$ 5,000	$ 5,000	*Portion from CRLCSWA FY2022 Budget*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL COMPOST DIRECT OPERATIONS					**$ 785,500**	

Compost Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 357,100	*Rounded*
Windrow Turner	1	EA	$ 150,000	$ 150,000		*Capital cost divided by 5-yr life*
Loader	1	EA	$ 57,143	$ 57,100		*Capital cost divided by 7-yr life*
Water Truck	0	EA	$ 28,600	$ -		*Included in LF, MWP, AD or WTE*
Screen Compost Finish	1	EA	$ 30,000	$ 30,000		*Capital cost divided by 10-yr life*
Grinder/Shredder	1	EA	$ 120,000	$ 120,000		*Capital cost divided by 5-yr life*
Conveyors	0	EA	$ 7,500	$ -		*Included w/ screen or grinder*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included in LF*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 composting*
SUBTOTAL LF CASH RESERVES					**$ 357,100**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Compost Sales	7,345	Ton	$ 24	$ 176,300	$ 176,300	*Assume 30% compost sales to businesses*
Tip Fees	38,118	Ton	$ 24	$ 914,800	$ 914,800	*Current CRLCSWA unit price*
Non-Cash Adjustments	0	LS	$ 25,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
SUBTOTAL OTHER REVENUES					**$ 1,091,100**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	10 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Scalehouse & Scales Capital Costs**	**TOTAL CAP$**		**$2,189,600**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
SCALEHOUSE CAPITAL COST ESTIMATE SUMMARY (1)(2)

Scalehouse Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scalehouse	600	SF	$ 250	$ 150,000	*Approx. current size*
Entrance & Queuing Roads	13,300	SY	$ 60	$ 798,000	*Concrete 4" over 6" granular base, 3000LF*
Scale Approach, Parking	1,200	SY	$ 60	$ 72,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 15,000	$ 15,000	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,035,000	$ 310,500	*Vertical construction*
SUBTOTAL				**$ 1,345,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,345,500	$ 269,100	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,345,500	$ 161,500	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,345,500	$ 13,500	*Percentage of total capital*
SUBTOTAL				**$ 444,100**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scales	3	EA	$ 125,000	$ 375,000	*New*
Software	1	EA	$ 25,000	$ 25,000	*Software used for LF, Compost, RRC, etc.*
SUBTOTAL				**$ 400,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Admin/Educational Center Capital Cost**	**TOTAL CAP$**		**$2,878,100**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
ADMIN CAPITAL COST ESTIMATE SUMMARY (1)(2)

Administration & Educational Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Two-Story Building	5,500	SF	$ 250	$ 1,375,000	*Building footprint SF; same size as current*
Access Road & Parking	2,300	SY	$ 45	$ 103,500	*Asphalt 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 137,500	$ 137,500	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,616,000	$ 484,800	*Vertical construction*
SUBTOTAL				**$ 2,100,800**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 2,100,800	$ 420,200	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 2,100,800	$ 336,100	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 2,100,800	$ 21,000	*Percentage of total capital*
SUBTOTAL				**$ 777,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**
None at Admin Center				
SUBTOTAL				**$ -**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/23/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$	Land:	4 Acres
Location:	Linn County, Iowa		
Worksheet:	**Resource Recovery Center Capital Cost**	**TOTAL CAP$**	**$9,933,900**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
RRC CAPITAL COST ESTIMATE SUMMARY (1)(2)

RRC Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
HHM Canopy - Covered Drive	2,000	SF	$ 25	$ 50,000	*CRLCSWA current size*
HHM Facility	8,000	SF	$ 300	$ 2,400,000	*CRLCSWA current size*
RRC Bldg	6,700	SF	$ 250	$ 1,675,000	*Size for just recyclables transfer*
RRC Office/Breakroom/Restrooms	3,600	SF	$ 200	$ 720,000	*CRLCSWA current size*
Access Road, Parking & Maneuvering	5,600	SY	$ 60	$ 336,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 239,750	$ 239,800	*5% of buildings cost*
Market Variability Factor	30%	Capital $	$ 5,420,800	$ 1,626,200	*Vertical construction*
SUBTOTAL				**$ 7,047,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 7,047,000	$ 1,409,400	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 7,047,000	$ 986,600	*Percentage of total capital*
Permitting (Local & IDNR)	2%	Capital $	$ 7,047,000	$ 140,900	*Percentage of total capital*
SUBTOTAL				**$ 2,536,900**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Baler	0	EA	$ 1,000,000	$ -	*Assumes RRC recyclabes transfer only*
Forklift	1	EA	$ 50,000	$ 50,000	*For HHM Facility*
Skid Loader	0	EA	$ 50,000	$ -	*Existing*
Mid-Size Loader	1	EA	$ 300,000	$ 300,000	*Share w/ Citizen Drop-Off and Bunkers*
Roll-off Containers	0	EA	$ 8,000	$ -	*Existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from Citizen Drop-Off*
Trailers	0	EA	$ 30,000	$ -	*Assume provided by end market*
Trucks	0	EA	$ 115,000	$ -	*Assume provided by end market*
SUBTOTAL				**$ 350,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Sizing for RRC Building

RRC Transfer Sizing	**Year 1**	**Year 50**	
Incoming Recyclables, TPY	4,045	5,943	*Single stream recyclables/drop box handled by CRLCSWA*
Incoming Recyclables, TPD	16	23	*5 days/week*
Incoming Recyclables, TPH	2	3	*8 hours/day*
Number of Unloading Bays	2	2	*Avg 3 tons/veh, 2x peak factor, 15 min unload + 1 extra*
Recyclables - Floor Storage (CY)	247	363	*126 lbs/CY, 1 day worth*
Recyclables - Trailer Payload	7	7	*tons/trailer* *126 lbs/CY*
Area Needed (SF):			
Tipping Floor	3,700	4,400	*Recyclables piled avg 4' high + unloading area*
Transfer Loadout Area	1,200	1,200	*60' x 1 trailer load-out lane*
Flex Area	1,000	1,100	*20% extra*
RRC Transfer Building (SF)	**5,900**	**6,700**	

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Maintenance Shop Capital Cost**	**TOTAL CAP$**		**$4,694,100**

SCENARIO 1
CRLCSWA SOLID WASTE CAMPUS FACILITIES
MAINT SHOP CAPITAL COST ESTIMATE SUMMARY (1)(2)

Maintenance Facility Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Maintenance Facility	17,200	SF	$ 150	$ 2,580,000	*CRLCSWA current sizes, LF+Site #3 compost*
Access Road & Maneuvering Area	1,200	SY	$ 45	$ 54,000	*Asphalt 4" over 6" granular base*
Market Variability Factor	30%	Capital $	$ 2,634,000	$ 790,200	*Percentage of capital w/out land vertical construction*
SUBTOTAL				**$ 3,424,200**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 3,424,200	$ 684,800	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 3,424,200	$ 410,900	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 3,424,200	$ 34,200	*Percentage of total capital*
SUBTOTAL				**$ 1,129,900**	

Maintenance Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
5-ton Overhead Crane w/ Hoist	1	EA	$ 40,000	$ 40,000	*Crane vendors $35K w/ $5k installed*
Maint/Repair Equipment	1	EA	$ 100,000	$ 100,000	*Estimate*
SUBTOTAL				**$ 140,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$	Land:	4 Acres
Location:	Linn County, Iowa		
Worksheet:	**Citizen Drop-Off Center Capital Cost**	**TOTAL CAP$**	**$1,615,300**

SCENARIO 1
CRLCSWA SOLID WASTE CAMPUS FACILITIES
DROP-OFF CAPITAL COST ESTIMATE SUMMARY (1)(2)

Citizen Drop-Off Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Materials Bunkers Area	1,700	SY	$ 60	$ 102,000	*Concrete for tires, white goods, scrap metal*
Concrete Bunker Walls	80	CY	$ 600	$ 48,000	*3 bunkers 60'x 35' each*
Bulk Excavation & Structural Fill	25,200	CY	$ 13	$ 327,600	*Suitable on-site soils; unloading area 4'*
Waste Unloading Area	6,300	SY	$ 60	$ 378,000	*Current access/maneuvering, Concrete*
Roll-Off Area	1,200	SY	$ 60	$ 72,000	*7 roll-off bays, Concrete*
Concrete Z-Wall	70	CY	$ 600	$ 42,000	*7 roll-off bays*
Market Variability Factor	15%	Capital $	$ 969,600	$ 145,400	*Sitework, horizontal construction*
SUBTOTAL				**$ 1,115,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,115,000	$ 223,000	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 1,115,000	$ 156,100	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,115,000	$ 11,200	*Percentage of total capital*
SUBTOTAL				**$ 390,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Roll-off Containers	0	EA	$ 8,000	$ -	*7 garbage and 1 glass; existing*
Roll-off Truck	1	EA	$ 110,000	$ 110,000	*Share w/ RRC*
Skid Loader	0	EA	$ 50,000	$ -	*Share from RRC*
Mid-Size Loader	0	EA	$ 300,000	$ -	*Share from RRC*
SUBTOTAL				**$ 110,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,856,300**

SCENARIO 1
CRLCSWA SOLID WASTE CAMPUS FACILITIES OPTION
OPERATIONS COST ESTIMATE SUMMARY (1)

Scalehouse Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 246,000	
Scalehouse Personnel	3.0	FTE	$ 82,000	$ 246,000		
Utilities					$ 4,300	
Electricity	6,000	kWh	$ 0.15	$ 900		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 1,000	$ 1,000		*Estimate - small building*
Heating Fuel	1	LS	$ 1,000	$ 1,000		*Estimate 1-2 Therms/SF/year*
Phones	12	months	$ 120	$ 1,400		*Estimate*
Maintenance and Repairs					$ 9,000	
Building	1%	Capital $	$ 150,000	$ 1,500		*Percentage of building capital*
Scales	2%	Capital $	$ 375,000	$ 7,500		*Percentage of scales capital*
Mobile Equipment	0	hours	$ 15	$ -		*None*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 525,000	$ 1,600	$ 1,600	*Percentage of building & scales total capital*
Cash Reserves Bldg/Equip Replacement					$ 31,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Scales	3	EA	$ 8,333	$ 25,000		*Capital divided by 15-yr life*
Scalehouse Building	1	EA	$ 6,000	$ 6,000		*Capital divided by 25-yr life*
SUBTOTAL SCALEHOUSE & SCALES					**$ 293,900**	

Administration & Educational Center Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Agency Labor:					$ 1,583,500	*Estimate 40% from CRLCSWA FY2022 Budget*
Executive Director	1	FTE				
Site Engineer	1	FTE				
Director of Education	1	FTE				
Hazardous Materials Manager	1	FTE				
Operations Foreman	1	FTE				
Admin Personnel	2	FTE				
Utilities					$ 47,500	
Electricity	110,000	kWh	$ 0.15	$ 16,500		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 5,000	$ 5,000		*Estimate - office building*
Natural Gas/Heating Fuel	1	LS	$ 8,000	$ 8,000		*Estimate 1 Therms/SF/year*
Phones	12	months	$ 1,500	$ 18,000		*Estimate*
Maintenance and Repairs					$ 34,500	
Building & Grounds	0.5%	Capital $	$ 2,100,800	$ 10,500		*Percentage of capital*
Mobile Equipment	936	hours	$ 5	$ 4,700		*Assume pick-up trucks maintenance*
Office Equipment	1	LS	$ 19,300	$ 19,300		*CRLCSWA FY2022 Budget*
Agency Purchased Services	1	LS	$ 511,700	$ 511,700	$ 511,700	*CRLCSWA FY2022 Budget*
Agency Supplies & Materials	1	LS	$ 20,900	$ 20,900	$ 20,900	*CRLCSWA FY2022 Budget*
Agency Other Costs	1	LS	$ 46,000	$ 46,000	$ 46,000	*CRLCSWA FY2022 Budget*
Other Operating Costs - Services					$ 222,500	

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,856,300**

	Quantity	Unit	Unit Price	Annual Costs	Total	Notes
ECICOG	1	LS	$ 10,000	$ 10,000		*CRLCSWA FY2022 Budget*
Public Education	1	LS	$ 37,500	$ 37,500		*CRLCSWA FY2022 Budget*
Media Advertising	1	LS	$ 125,000	$ 125,000		*CRLCSWA FY2022 Budget*
Comprehensive Planning	1	LS	$ 50,000	$ 50,000		*Annual estimate over period*
Fuel	2,808	gallons	$ 3.50	$ 9,800	$ 9,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 2,100,800	$ 6,300	$ 6,300	*Percentage of capital*
Cash Reserves Bldg/Equip Replacement					$ 55,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Admin Building	1	EA	$ 55,000	$ 55,000		*Capital divided by 25 years*
SUBTOTAL ADMINISTRATION & EDUCATIONAL CENTER					**$ 2,537,700**	

Resource Recovery Center/HHW Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor					$ 486,300	
Hazardous Materials Manager						*Included w/ Agency Labor in Admin/Ed Center*
RRC Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
HHW Facility Receiving	1.5	FTE	$ 82,000	$ 123,000		
HHW Facility Chemists	2.0	FTE	$ 103,800	$ 207,600		
Utilities					$ 59,600	
Electricity	274,500	kWh	$ 0.15	$ 41,200		*15 kWh/SF, mixed use*
Water & Sewer	1	LS	$ 3,000	$ 3,000		*Estimate*
Natural Gas/Heating Fuel	1	LS	$ 13,000	$ 13,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 200	$ 2,400		*Estimate*
Maintenance and Repairs					$ 43,000	
Building & Grounds	0.5%	Capital $	$ 7,047,000	$ 35,200		*Percentage of capital*
Mobile Equipment	520	hours	$ 15	$ 7,800		*Loader, assume 2 hrs per day*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	1,560	gallons	$ 3.50	$ 5,500	$ 5,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 7,047,000	$ 21,100	$ 21,100	*Percentage of building total capital*
Cash Reserves Bldg/Equip Replacement					$ 243,300	
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Loader	1	EA	$ 42,900	$ 42,900		*Capital cost divided by 7-yr life*
Roll-offs	2	EA	$ 800	$ 1,600		*Capital cost divided by 10-yr life*
RRC/HHW Buildings	1	EA	$ 193,800	$ 193,800		*Capital cost divided by 25-yr life*
Disposal/Management Services					$ 543,600	
HHW Disposal	1	LS	$ 90,000	$ 90,000		*CRLCSWA FY2022 Budget*
Electronics Disposal	1	LS	$ 67,700	$ 67,700		*CRLCSWA FY2022 Budget*
Batteries/Flourescents/Medical Waste	1	LS	$ 13,200	$ 13,200		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 24,900	$ 24,900		*CRLCSWA FY2022 Budget*
Tires	1	LS	$ 48,300	$ 48,300		*CRLCSWA FY2022 Budget*
Recycling Services	1	LS	$ 299,500	$ 299,500		*CRLCSWA FY2022 Budget*
SUBTOTAL RESOURCE RECOVERY CENTER					**$ 1,407,400**	

Maintenance Facility Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 311,400	
Mechanic/Maintenance	3.0	FTE	$ 103,800	$ 311,400		*Servicing all facilities' mobile equipment*
Utilities					$ 34,400	
Electricity	120,400	kWh	$ 0.15	$ 18,100		*Assume 7 kWh/SF repair shop*
Water & Sewer	1	LS	$ 2,500	$ 2,500		*Estimate*
Heating Fuel	1	LS	$ 12,000	$ 12,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 150	$ 1,800		*Estimate*
Maintenance and Repairs					$ 24,100	
Building & Grounds	0.5%	Capital $	$ 3,424,200	$ 17,100		*Percentage of capital*
Crane/Equipment	5%	Capital $	$ 140,000	$ 7,000		*Percentage of equipment capital*

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,856,300**

	Quantity	Unit	Unit Price	Annual Costs	Total	
Mobile Equipment	0	hours	$ 15	$ -		*Included w/ LF, TS, MWP, AD or WTE*
Supplies	1	LS	$ 78,600	$ 78,600	$ 78,600	*FY2022 Budget, Tools & Equipment, Shop*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 3,424,200	$ 10,300	$ 10,300	*Percentage of total capital*
Cash Reserves Bldg/Equip Replacement					$ 107,200	
Overhead Crane	1	EA	$ 4,000	$ 4,000		*Capital over 10-year life*
Maintenance Building	1	EA	$ 103,200	$ 103,200		*Capital over 25-year life*
SUBTOTAL MAINTENANCE FACILITY					**$ 566,000**	

Citizen Drop-Off Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:	Included with Labor for LF, TS, MWP, AD or WTE					*Shared Labor*
Utilities					$ -	
Electricity	0	kWh	$ 0.15	$ -		*Outdoors*
Water & Sewer	0	LS	$ -	$ -		*NA*
Heating Fuel	0	LS	$ -	$ -		*NA*
Phones	0	months	$ -	$ -		*NA*
Maintenance and Repairs					$ 19,800	
Paving/Pad Repairs	1%	Capital $	$ 450,000	$ 4,500		*Percentage of pad capital*
Mobile Equipment	1,020	hours	$ 15	$ 15,300		*Roll-off truck, 1 load/hr*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	3,060	gallons	$ 3.50	$ 10,700	$ 10,700	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 450,000	$ 1,400	$ 1,400	*Percentage of construction capital*
Cash Reserves Equipment Replacement						
Roll-off Containers	8	EA	$ 800	$ 6,400	$ 6,400	*Capital over 10-year life*
Roll-off Truck	1	EA	$ 11,000	$ 11,000	$ 11,000	*Capital over 10-year life*
SUBTOTAL CITIZEN DROP-OFF					**$ 51,300**	

Miscellaneous Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
RRC/HHW Materials					$ 647,900	
Scrap Metal	1	LS	$ 18,000	$ 18,000		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 74,700	$ 74,700		*CRLCSWA FY2022 Budget*
Waste Tires	1	LS	$ 53,900	$ 53,900		*CRLCSWA FY2022 Budget*
Electronic Waste	1	LS	$ 114,300	$ 114,300		*CRLCSWA FY2022 Budget*
HHW	1	LS	$ 57,200	$ 57,200		*CRLCSWA FY2022 Budget*
Commingled Recycling	1	LS	$ 271,400	$ 271,400		*CRLCSWA FY2022 Budget*
Recycling Services Revenue Share	1	LS	$ 58,400	$ 58,400		*CRLCSWA FY2022 Budget*
Other Misc. Revenue	0	LS	$ 29,400	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
SUBTOTAL MISC REVENUES					**$ 647,900**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Table 4 - CRLCSWA Material Handling Projections (In Tons)

Material	Fiscal Year FY2020	FY2030	FY2040	FY2050	Year 1 FY2038	Year 50 FY2087
Population	228,600	254,900	276,800	298,900		
Materials Landfilled						
MSW	160,086	178,430	193,760	209,230	190,592	278,007
Disaster Debris	0	2,549	2,768	2,989	2,723	3,972
Special Waste	16,612	20,392	22,144	23,912	21,782	31,772
C&D	25,960	17,843	19,376	20,923	19,059	27,801
Shingles	9,091	2,549	2,768	2,989	2,723	3,972
Subtotal Materials Landfilled	**211,749**	**221,763**	**240,816**	**260,043**	**236,879**	**345,523**
Materials Recycled						
Organics	29,710	35,686	38,752	41,846	38,118	55,601
Single Stream/Drop Box/City	11,872	12,745	13,840	14,945	13,614	19,858
Scrap Metal/White Goods	876	1,098	1,193	1,288	1,173	1,711
Subtotal Materials Recycled	**42,458**	**49,529**	**53,785**	**58,079**	**52,905**	**77,170**
Total Materials	254,207	271,292	294,601	318,122	289,784	422,693
Average Annual Increase %		0.65%	0.83%	0.77%		0.77%

Note: Single Stream includes the City of Cedar Rapids recyclables which go directly to private MRF.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021 Revised: 12/14/2021			
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design			
Costs:	2021$	LF Size:	100 Acres	
Location:	Linn County, Iowa	Required Land:	220 Acres	
Worksheet:	**MSW Landfill Capital Cost**	**TOTAL LF Ph1 CAP$**		**$33,348,000**

SCENARIO 1
CRLCSWA NEW MSW LANDFILL OPTION - PHASE 1
CAPITAL COST ESTIMATE SUMMARY (1)(2)

Landfill Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations				$ -	
Hydrogeologic Characterization	1	LS	$ 250,000	$ 250,000	*Initial site investigations*
Supplemental Site Investigations	1	EA	$ 20,000	$ 20,000	*prior to each cell development*
Groundwater Monitoring Wells	9	EA	$ 8,000	$ 72,000	*2 to 3 upgradient, 6 downgradient*
Gas Migration Monitoring Probes	9	EA	$ 3,000	$ 27,000	
Site Work				$ -	
Mobilization/Demob	1	EA	$ 100,000	$ 100,000	*Number of cells construction; 1st cell 20-acres*
Clear & Grub	25	Acres	$ 2,000	$ 50,000	*Assume no demolition; half of LF area*
Bulk Excavation	986,667	CY	$ 3	$ 2,960,000	*Adequate quantity & quality of soils on-site*
Structural Fill	296,000	CY	$ 10	$ 2,960,000	*Assume 30% of bulk excavation quantities*
LF Perimeter Roadways	3,111	SY	$ 45	$ 140,000	*4" asphalt over 6" granular base, 8400LF*
Site Utilities				$ -	
Stormwater Pond	1	LS	$ 200,000	$ 200,000	
Site Drainage/Erosion Control	1	EA	$ 50,000	$ 50,000	*Number of cells construction*
Electrical - New Service to Site	1	LS	$ 1,500,000	$ 1,500,000	*From 1 mile away*
Water Supply & Fire Protection	1	LS	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Sanitary Sewer	1	LS	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Natural Gas System	-	LS	$ -	$ -	*Assume Not Available for Scenario 1*
Surveying	1	EA	$ 25,000	$ 25,000	
Screening, Landscaping, Signage	1	EA	$ 60,000	$ 60,000	*Allowance*
Fencing	12,400	LF	$ 35	$ 434,000	*Site Perimeter*
Liner & Leachate Collection System					
Composite Liner System	20	Acres	$ 250,000	$ 5,000,000	*Recompacted Clay, geomembrane, 12" granular, geotextile & protective cover*
Leachate Collection Pipes, Sumps, Pumps & Controls, Lift Station, Forcemain	8%	Liner $	$ 5,000,000	$ 400,000	
Leachate Lagoon	1	LS	$ 3,250,000	$ 3,250,000	*Estimate 10 acres lined + 30% for excavation*
Active Gas Collection System	20	Acres	$ -	$ -	*See Closure Costs - to begin within 2 or 5 years of first placement of waste*
Market Variability Factor	15%	Capital $	$ 20,618,000	$ 3,092,700	*Sitework, horizontal construction*
SUBTOTAL LANDFILL CAPITAL				**$ 23,710,700**	

Engineering (3)	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 23,710,700	$ 4,742,100
Engineering & Design	4%	Capital $	$ 23,710,700	$ 948,400
Permitting	2%	Capital $	$ 23,710,700	$ 474,200
Construction Observation/CQA	6%	Capital $	$ 23,710,700	$ 1,422,600
SUBTOTAL LANDFILL SOFT COSTS				**$ 7,587,300**

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Landfill Compactor	1	EA	$ 1,000,000	$ 1,000,000	*Replacement*
Track Dozer (D8 or similar)	1	EA	$ 800,000	$ 800,000	*Replacement*
Track Dozer (D6 or similar)	0	EA	$ 550,000	$ -	*Existing*
Excavator	0	EA	$ 1,000,000	$ -	*Existing*
Dump Trucks	0	EA	$ 200,000	$ -	*Existing*
Tanker Truck - Leachate Recirculation	1	EA	$ 250,000	$ 250,000	*New 4000-gallon tanker/water truck*
Water Truck	0	EA	$ 200,000	$ -	*Existing*
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*
SUBTOTAL				**$ 2,050,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021 Revised: 12/14/2021			
Facility:	SCENARIO 1: New MSW Landfill Concept - No Design			
Costs:	2021$	LF Size:	100 Acres	
Location:	Linn County, Iowa	Required Land:	220 Acres	
Worksheet:	**MSW Landfill Capital Cost**	**TOTAL LF Ph1 CAP$**		**$33,348,000**

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed cell projects to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options
Date:	12/21/2021
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**OTHER SROI INPUTS**

SCENARIO 2
CRLCSWA TS w/ REGIONAL LANDFILL OPTION
OTHER SROI INPUTS (2021$)

Timing of Capital Costs

SCENARIO 2 CAMPUS	2022	2023	2024	2025	2026	2027
Land Acquisition/Legal/Env	0%	0%	5%	10%	15%	20%
Transfer Station	0%	0%	0%	0%	0%	0%
TS Scalehouse	0%	0%	0%	0%	0%	0%
Land Acquisition/Legal/Env	0%	0%	5%	10%	15%	20%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 2 CAMPUS	2028	2029	2030	2031	2032	2033
Land Acquisition/Legal/Env	50%	0%	0%	0%	0%	0%
Transfer Station	0%	0%	0%	0%	0%	0%
TS Scalehouse	0%	0%	0%	0%	0%	0%
Land Acquisition/Legal/Env	50%	0%	0%	0%	0%	0%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 2 CAMPUS	2034	2035	2036	2037	2038	2039
Transfer Station	2%	5%	40%	50%	3%	0%
TS Scalehouse	0%	5%	45%	50%	0%	0%
Compost Facility	5%	10%	40%	30%	15%	0%
Scalehouse	0%	5%	45%	50%	0%	0%
Admin/Educational Center	0%	5%	30%	55%	10%	0%
RRC/HHW	5%	10%	30%	50%	5%	0%
Maintenance Shop	0%	5%	30%	55%	10%	0%
Citizen Drop-Off	0%	5%	60%	30%	5%	0%

Travel Distances

TS Trailer Payload =	20	tons per load	
One-way Distance =	115	miles	Need to go further out to find landfill(s) with capacity
Average Speed =	65	mph	
Transferred Waste, Year 2038 =	215,097	tons waste	
Calculated # Loads in Year 2038 =	10755	trailer loads	

Project:	CRLCSWA Infrastructure Options
Date:	11/22/2021 Revised: 12/20/2021
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**SUMMARY**

SCENARIO 2
CRLCSWA TS w/ REGIONAL LANDFILL OPTION
SUMMARY (2021$)

CAMPUS 1 - Transfer Station Campus

Facility	Minimum Land Required (Acres)	Land Purchase (Acres)	Pad Areas (Acres)	Building Size (SF)	Year 1, TPY	Year 50, TPY
Transfer Station	15	---	---	42,400	215,097	313,750
Scalehouse	0	---	---	600	---	---
TOTAL	**15**	**15**	**---**	**43,000**	**---**	**---**
			TS to Landfill Tonnages		**215,097**	**313,750**

Facility	Full Build-Out Total Facilities Capital $	Year 1 O&M$ O&M $	O&M - Haul$ (115-mile oneway)	LF Disposal @ $38/ton	Year 1 Revenues $ Other Revenues$	Energy/ Materials Revenues$
Transfer Station	$28,908,000	$1,620,000	$5,139,700	$8,173,700	$335,700	$0
Scalehouse	$1,141,300	$282,700	---	---	$0	$0
	$30,049,300	**$1,902,700**	**$5,139,700**	**$8,173,700**	**$335,700**	**$0**

SCENARIO 2 TS CAMPUS	Quantity	Unit	Unit Price	Total	
Land Acquisition - Purchase	15	Acres	$50,000	$750,000	*industrial site*
Land Acquisition - Legal/Support	25%	LS	$750,000	$187,500	*% Land Purchase*
Social Justice/Env Impact/Legal	0.1	RS	$7,000,000	$700,000	*Risk Factor*
SUBTOTAL				**$1,637,500**	
Facilities Capital				$21,398,000	
Contingency, Permitting, Eng/Construction Observation/CQA				$7,476,300	
Equipment/Mobile Equipment				$1,175,000	
SUBTOTAL				**$30,049,300**	
Estimated Financing Costs - Transfer Station Campus				$13,618,000	*20 yrs, 4% APR*
SUBTOTAL				**$13,618,000**	
TOTAL CAPITAL$				**$45,304,800**	

CAMPUS 2 - Solid Waste Services Campus

Facility	Minimum Land Required (Acres)	Land Purchase (Acres)	Pad Areas (Acres)	Building Size (SF)	Year 1, TPY	Year 50, TPY
Compost Facility	30	---	21	---	38,118	55,601
Scalehouse	10	---	---	600	---	---
Admin/Educational Center	2	---	---	5,500	---	---
RRC/HHW	4	---	---	18,300	4,045	5,943
Maintenance Shop	2	---	---	9,000	---	---
Citizen Drop-Off	2	---	0.4	---	1,173	1,711
TOTAL	**50**	**50**	**---**	**33,400**	**---**	**---**

Diversion Tonnages		
Organics	38,118	55,601
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
Diversion Subtotal	**43,336**	**63,256**

% Diversion/Reduction from LF	17%	17%

Facility	Full Build-Out Total Facilities Capital $	Year 1 O&M$ O&M $	O&M - Haul$	LF Disposal @ $/ton	Year 1 Revenues $ Other Revenues$	Energy/ Materials Revenues$
Compost Facility	$15,914,100	$1,192,000	---	---	$0	$1,091,100
Scalehouse	$1,939,600	$189,000	---	---	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0
RRC/HHW	$9,933,900	$1,407,400	---	---	$0	$647,900
Maintenance Shop	$2,567,500	$346,800	---	---	$0	$0
Citizen Drop-Off	$234,700	$6,500	---	---	$0	$0
	$33,467,900	**$5,679,400**	**$0**	**$0**	**$0**	**$1,739,000**

SCENARIO 2 CAMPUS	Quantity	Unit	Unit Price	Total	
Land Acquisition - Purchase	50	Acres	$25,000	$1,250,000	*< 1/2 Qtr Section*
Land Acquisition - Legal/Support	25%	LS	$1,250,000	$312,500	*% Land Purchase*
Social Justice/Env Impact/Legal	0.1	RS	$7,000,000	$700,000	*Risk Factor*
SUBTOTAL				**$2,262,500**	
Facilities Capital				$23,675,900	
Contingency, Permitting, Eng/Construction Observation/CQA				$8,002,000	
Equipment/Mobile Equipment				$1,790,000	
SUBTOTAL				**$33,467,900**	
Estimated Financing Costs - All Facilities				$14,940,000	*20 yrs, 4% APR*
SUBTOTAL				**$14,940,000**	
TOTAL CAPITAL$				**$50,670,400**	

SCENARIO 2 TIPPING FEE ESTIMATE (2021$)

	Capital$[1]	Annual O&M$[2]	Annual Haul$[2]	Total - Gross
Total Costs - Facilities	$63,517,200	$7,582,100	$5,139,700	
Total Costs - Financing	$28,558,000	---	---	
Total Costs-Land/Legal/Env Impa	$3,900,000	---	---	
Transferred Tons	13,076,008	215,097	215,097	
$/Ton	**$7.34**	**$35.25**	**$23.89**	**$66.48**

	Annual Other Revenues[3]	Annual Mat'l/ Energy Revenues[4]	Total - Revenues Before Fees
Revenues	$335,700	$1,739,000	
Transferred Tons	215,097	215,097	
	$1.56	**$8.08**	**$9.65**

ESTIMATED NET TIP FEE Before Landfill Disposal ($/Ton)	**$56.84**
ASSUMED LANDFILL TIP FEE ($/Ton)	**$38.00**
	$94.84
Rounded ESTIMATED TIP FEE ($/Ton)	**$95.00**

Notes:
1. Capital costs include full build out of facilities over 50-year period divided by projected transferred tons Year 2038-2087.
2. Annual O&M costs include replacement reserves for equipment and rehab/rebuild of buildings. Divided by Year 2038 transferred tons.
3. Other Revenues obtained from CRLCSWA FY2022 budget including grants, investments, non-cash adjustments, other misc. revenues. Divided by Year 2038 transferred tons.
4. Annual Material/Energy Revenues includes recycled materials revenues through RRC (from FY2022 budget), composting tip fees at $24/ton, and compost sales at $24/ton. Divided by Year 2038 transferred tons.

Project:	CRLCSWA Infrastructure Options
Date:	12/13/2021
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Transfer Station Sizing**

SCENARIO 2
CRLCSWA TS w/ REGIONAL LANDFILL OPTION
SIZING TRANSFER STATION FACILITY

Waste Flow (Tons)	Year 1 FY2038	Year 25 FY2063	Year 50 FY2087		
Waste thru Transfer Station					
MSW	190,592	234,299	278,006		Split into MSW and ICI MSW
Disaster Debris	2,723	3,347	3,972		
C&D	19,059	23,430	27,801		
Shingles	2,723	3,347	3,972		
TS Waste, TPY	215,097	264,423	313,750		
TS Waste, TPD	730	900	1060	296	*days/year*
TS Waste, TPH	80	100	120	9	*receiving hours/day*
Waste to Landfill					
Direct to Landfill:					
Special Waste	21,782	26,777	31,772		
From TS Facility:					
TS Waste	215,097	264,423	313,750		
Landfilled Waste	236,879	291,200	345,522		
% of Scenario 1 Landfilled	100.0%		100.0%		

TS Building Sizing	Year 1 FY2038	Year 25 FY2063	Year 50 FY2088		
Sizing Assumptions					
Unloading Bays	11	14	16		*Avg 3 tons/veh, peak factor 2.0, 12 min unload*
Minimum Width (ft)	220	280	320		*20 ft per bay, accounting for structure*
Waste Storage on Tip Floor (CY)	4,152	5,105	6,057	350	*lbs/CY and 1 day waste*
Load-out Hoppers	2	2	2		*20-ton payloads & 20 minutes to load*
Estimated Square Feet					
Tipping Floor	22,200	27,800	32,400		*Waste piled avg 10' high + unloading area*
TS Load-out Area	4,320	4,320	4,320		*2 lanes w/ load-out hopper each; 120' tunnel*
Sizing Contingency	7,960	9,640	11,020	30%	*Contingency on the TS sizing area*
Office/Breakroom/Restrooms	500	600	700	2%	*of TS sizing area*
TS Building SF	34,980	42,360	48,440		
Estimate TS Land Requirements (Acres)					
Building	0.8	1.0	1.1		
Surrounding Area	13.4	13.9	14.3	300	*ft buffer area*
Entrance Area	0.0	0.0	0.0		*Included w/ scalehouse*
Required Land (Acres)	14.2	14.9	15.4		
Contingency Acres	3.6	3.7	3.9	25%	
	17.8	18.6	19.3		

Tonnage Projections-Total Transferred

Year	CRLCSWA Projections		Annual % Increase
2020	-	tons	0.46%
2030	201,371	tons	0.83%
2040	218,672	tons	0.77%
2050	236,131	tons	

YR	Calculate Annual Tonnage Transferred	Tons per Year	TPD
1	2038	215,097	727
2	2039	216,862	733
3	2040	218,672	739
4	2041	220,358	744
5	2042	222,057	750
6	2043	223,770	756
7	2044	225,495	762
8	2045	227,234	768
9	2046	228,986	774
10	2047	230,752	780
11	2048	232,531	786
12	2049	234,324	792
13	2050	236,131	798
14	2051	237,952	804
15	2052	239,787	810
16	2053	241,636	816
17	2054	243,499	823
18	2055	245,376	829
19	2056	247,269	835
20	2057	249,175	842
21	2058	251,097	848
22	2059	253,033	855
23	2060	254,984	861
24	2061	256,950	868
25	2062	258,931	875
26	2063	260,928	882
27	2064	262,940	888
28	2065	264,968	895
29	2066	267,011	902
30	2067	269,070	909
31	2068	271,144	916
32	2069	273,235	923
33	2070	275,342	930
34	2071	277,465	937
35	2072	279,605	945
36	2073	281,761	952
37	2074	283,933	959
38	2075	286,123	967
39	2076	288,329	974
40	2077	290,552	982
41	2078	292,793	989
42	2079	295,051	997
43	2080	297,326	1004
44	2081	299,618	1012
45	2082	301,929	1020
46	2083	304,257	1028
47	2084	306,603	1036
48	2085	308,967	1044
49	2086	311,350	1052
50	2087	313,750	1060
	2088		
	TOTAL ESTIMATED TONS FOR POTENTIAL TRANSFER	**13,076,008**	**tons**

Project:	CRLCSWA Infrastructure Options			
Date:	12/13/2021 Revised: 12/20/2021			
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading			
Costs:	2021$	TS Size:	900 TPD	
Location:	Linn County, Iowa	Required Land:	15 Acres	
Worksheet:	**Transfer Station Capital Cost**	**TOTAL TS CAP$**		**$28,908,000**

SCENARIO 2
CRLCSWA TRANSFER STATION w/ REGIONAL LANDFILL OPTION
CAPITAL COST ESTIMATE SUMMARY [(1)(2)]

Transfer Station Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Transfer Station Building	42,400	SF	$ 300	$ 12,720,000	*Bldg, foundations, floors, concrete walls, etc.*
Site Investigations	1	LS	$ 200,000	$ 200,000	*Geotech*
Site Work					
Mobilization/Demob	1	LS	$ 300,000	$ 300,000	
Clear & Grub	8	Acres	$ 2,000	$ 16,000	*Assume no demolition; half of area*
Bulk Excavation/Quantities	22,000	CY	$ 3	$ 66,000	*Adequate quantity & quality of soils on-site*
Structural Fill	22,000	CY	$ 10	$ 220,000	*Assume 100% of bulk excavation quantities*
Roadways	18,000	SY	$ 45	$ 810,000	*4" asphalt over 6" granular base, 4000LF*
Manuevering Pad	800	CY	$ 600	$ 480,000	*9" reinforced concrete slab on grade*
Stormwater Pond	1	LS	$ 200,000	$ 200,000	
Site Drainage/Erosion Control	1	EA	$ 50,000	$ 50,000	
Site Utilities					
Electrical - New Service to Site	1	LS	$ 300,000	$ 300,000	*On-site utilities*
Water Supply & Fire Protection	1	LS	$ 200,000	$ 200,000	*On-site utilities*
Sanitary Sewer	1	EA	$ 200,000	$ 200,000	*On-site utilities*
Natural Gas System	-	LS	$ -	$ -	*Assume Not Available for Scenario 2*
Surveying	1	EA	$ 25,000	$ 25,000	
Screening, Landscaping, Signage	1	EA	$ 60,000	$ 60,000	*Allowance*
Fencing	3,200	LF	$ 35	$ 112,000	*Site Perimeter*
Market Variability Factor	30%	Capital $	$ 15,959,000	$ 4,787,700	*Vertical construction*
SUBTOTAL TRANSFER STATION				**$ 20,746,700**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	LS	$ 20,746,700	$ 4,149,300	*Without Land*
Eng., Design, Constr. Admin & CQA	14%	LS	$ 20,746,700	$ 2,904,500	*Percentage of total capital less land*
Permitting (Local & IDNR)	1%	LS	$ 20,746,700	$ 207,500	*Percentage of total capital less land*
SUBTOTAL				**$ 7,261,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Loader	2	EA	$ 400,000	$ 800,000	*New*
Yard Tractor	1	EA	$ 100,000	$ 100,000	*New*
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*
Transfer Trucks & Trailers - See Haul Costs					*Included in haul cost per ton*
SUBTOTAL				**$ 900,000**	

ASSUMPTIONS:

1. No sales tax is included. Assumed facility is tax exempt.
2. Costs rounded to nearest thousand.
3. Does not include financing costs.
4. Assumed project to be competitively bid under one general contract.
5. Assumed construction to be during normal working hours.
6. The construction costs are used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading		
Costs:	2021$ Initial Size: 900 TPD		
Location:	Linn County, Iowa	**OTHER REVENUES$**	**$335,700**
Worksheet:	**Transfer Station O&M Costs**	**ANNUAL O&M$**	**$1,620,000**

SCENARIO 2
CRLCSWA TRANSFER STATION w/ REGIONAL LANDFILL OPTION
OPERATIONS COST ESTIMATE SUMMARY (1)

TS Direct Operations	Quantity	Unit	Unit Price	Annual Costs	Total	
Labor:					$ 515,600	*FY2021 fully-burdened salary, escalated*
Scalehouse	0.0	FTE	$ 82,000	$ -		*Included w/ scalehouse operations*
TS Loader Operators	3.0	FTE	$ 103,800	$ 311,400		
TS Yard Tractor Operator /Misc. Equipment	1.0	FTE	$ 100,200	$ 100,200		
TS Spotters/Laborers	2.0	FTE	$ 52,000	$ 104,000		
Drivers - See Haul Costs						*Included in haul costs per ton*
TS Utilities					$ 51,500	
Electricity	296,800	kWh	$ 0.15	$ 44,500		*7 kWh/SF estimate avg warehouse/office*
Water & Sewer	1	LS	$ 3,500	$ 3,500		*Estimate - large commercial, industrial*
Heating Fuel	1	LS	$ 2,500	$ 2,500		*Estimate*
Phones	12	months	$ 80	$ 1,000		*Estimate*
Maintenance and Repairs					$ 226,200	
Building	1%	Capital $	$ 12,720,000	$ 127,200		*Percentage of TS total capital*
Mobile Equipment	6,600	hours	$ 15	$ 99,000		*Avg equip operating hours (2 loaders & yard tractor); not include trucks or trailers*
Supplies	1	LS	$ 35,000	$ 35,000	$ 35,000	*Estimate*
Fuel	19,800	gallons	$ 3.50	$ 69,300	$ 69,300	*Assume 3 gallons per hour operating*
Professional Services & Eng.	1	LS	$ 25,000	$ 25,000	$ 25,000	*Estimate-inspection, permitting, legal*
TS Insurance	0.1%	Capital $	$ 20,746,700	$ 20,700	$ 20,700	*Percentage of TS total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL TS DIRECT OPERATIONS					**$ 943,300**	

TS Cash Reserves	Quantity	Unit	Unit Price	Annual Costs	Total	
Equipment Replacement					$ 129,900	
Loaders	2	EA	$ 57,100	$ 114,200		*Capital cost divided by 7-yr life*
Yard Tractor	1	EA	$ 10,000	$ 10,000		*Capital cost divided by 10-yr life*
Pick-up Truck	1	EA	$ 5,714	$ 5,700		*Capital cost divided by 7-yr life*
Trucks & Trailers - See Haul Costs						*Included in haul costs per ton*
TS Building Rehab/Replace	1	EA	$ 508,800	$ 508,800	$ 508,800	*Building capital divided by 25-yr life*
Operating Cash Reserve	1	LS	$ 38,000	$ 38,000	$ 38,000	*CRLCSWA FY2021 Budget, rounded*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*Estimate from Agency, NA if compost w/ TS*
SUBTOTAL TS CASH RESERVES					**$ 676,700**	

Other Revenues	Quantity	Unit	Unit Price	Annual Costs	Total	
Grants/Investments/ Other	1	LS	$ 281,300	$ 281,300	$ 281,300	*CRLCSWA FY2022 Budget*
Non-Cash Adjustments	1	LS	$ 25,000	$ 25,000	$ 25,000	*CRLCSWA FY2022 Budget*
Other Misc. Revenue	1	LS	$ 29,400	$ 29,400	$ 29,400	*CRLCSWA FY2022 Budget*
SUBTOTAL OTHER REVENUES					**$ 335,700**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.5 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options			
Date:	11/9/2021			
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading			
Costs:	2021$	TS Size:	900	*Year 1*
Location:	Linn County, Iowa	**$38/TON, LF DISPOSAL$**		**$8,173,700**
Worksheet:	**Transfer Station Haul Costs**	**ANNUAL HAUL$ (115-mile)**		**$5,139,700**

SCENARIO 2
CRLCSWA TRANSFER STATION w/ REGIONAL LANDFILL OPTION
TS HAUL COST ESTIMATE SUMMARY

	30-Mile Radius	80-Mile Radius	115-Mile Radius	*Comments*
Number of Trailer Loads	10,755	10,755	10,755	*Assumes average 20 ton payload*
Tonnage (tpy):	**215,097**	**215,097**	**215,097**	*Year 1*
Load & Unload Time (minutes):	30	30	30	*Estimate*
One-Way Distance (miles)	**30**	**80**	**115**	
Average Speed (mph):	50	60	65	*From route mapping in area*
Average Trips/Year:	10,755	10,755	10,755	
Average Trips/Month:	897	897	897	
Average Trips/Week:	207	207	207	
Hours Per Trip	1.7	3.2	4.0	
Weekly Freight Hours:	352	656	836	
Wkly Prorated Veh Inspect/Breaks:	6.0	6.0	6.0	*1 hour per day*
Annual Freight Hours:	18,299	34,086	43,470	*Freight hours only for vehicle fuel, oil & grease cost*
Total Miles/Yr	645,300	1,720,800	2,473,650	

Annual Costs Assumptions:				
Driver Labor				
Drivers (based on total time)	9	17	22	
Driver annual salary	$60,400	$60,400	$60,400	*Bureau of Labor Statistics-CR, Iowa, heavy truck driver*
Fringe benefits (% of salary)	35%	35%	35%	*Included in annual salary*
Fuel, Oil & Grease				
Fuel Cost per Gallon	$3.50	$3.50	$3.50	*Diesel Fuel 2020-US EIA, Mid-West average*
Miles per Gallon	6.5	6.5	6.5	*North American Council for Freight Efficiency*
Oil & Grease ($/freight hour)	$0.50	$0.50	$0.50	*Estimate*
Tires				
New Tires Price	$425	$425	$425	*Estimate*
# New Tires Per 50,000 Miles	18	18	18	*6 tires on tractor & 12 tires on trailers*
Maintenance & Repairs				
Mechanic Labor annual salary	$78,700	$78,700	$78,700	*Bureau of Labor Statistics-CR, Iowa, heavy equip mech*
Mechanic Labor % per Truck	2%	2%	2%	
Parts, Repairs, Overhaul ($/mile)	$0.25	$0.25	$0.25	
Truck Amortization				
Number of Tractors	9	17	21	*Update based on loads/day*
Capital Cost - per semi-truck	$115,000	$115,000	$115,000	*New truck price based on historic vendor/project data*
Resale Value (% of truck $)	30%	30%	30%	*Used trucks good condition $25K to $40K*
Replacement Schedule (years)	7	7	7	
Interest Rate	4%	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	0.1666	
Trailer Amortization				
Number of Trailers	10	19	23	*Includes spares at 10%*
Capital Cost -- per trailer	$70,000	$70,000	$70,000	*Walking floor - new*
Resale Value (% of purchase $)	15%	15%	15%	*Used trailers good condition $7K to $10K*
Replacement Schedule (years)	7	7	7	
Interest Rate	4%	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	0.1666	
Insurance, License & Taxes (per yr/truck) @ 2.5% $ Capital Cost	$2,900	$2,900	$2,900	*Estimate % of capital cost of truck*
Overhead & Profit - Contract Haul @ % of O&M	20%	20%	20%	*Contingency or OHP on contract haul*

Annual Haul Cost to Disposal:	30-Mile Radius	80-Mile Radius	115-Mile Radius	Comments

Project:	CRLCSWA Infrastructure Options			
Date:	11/9/2021			
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading			
Costs:	2021$	TS Size:	900	*Year 1*
Location:	Linn County, Iowa	**$38/TON, LF DISPOSAL$**		**$8,173,700**
Worksheet:	**Transfer Station Haul Costs**	**ANNUAL HAUL$ (115-mile)**		**$5,139,700**

Driver Labor	$543,600	$1,026,800	$1,328,800	Time Based
Fuel, Oil & Grease	$356,600	$943,600	$1,353,700	Mileage & Time Based
Tires	$98,700	$263,300	$378,500	Mileage Based
Maintenance & Repairs	$175,500	$457,000	$651,500	Mileage & Time Based
Truck Amortization	$120,700	$228,000	$281,700	100% Utilized
Trailer Amortization	$99,100	$188,400	$228,000	100% Utilized
Insurance, Licensing & Taxes	$26,100	$49,300	$60,900	No. trucks
Overhead & Profit	$284,100	$631,300	$856,600	
MSW Haul Cost to Landfill	**$1,704,400**	**$3,787,700**	**$5,139,700**	
Total Haul Cost/Ton	**$7.92**	**$17.61**	**$23.89**	

Transfer Trucks Capital Cost	$1,035,000	$1,955,000	$2,415,000
Transfer Trailers Capital Cost	$700,000	$1,330,000	$1,610,000
Total Truck/Trailers Capital	**$1,735,000**	**$3,285,000**	**$4,025,000**

Project:	CRLCSWA Infrastructure Options			
Date:	12/20/2021			
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading			
Costs:	2021$	Land:	-	Acres, Included w/ TS
Location:	Linn County, Iowa			
Worksheet:	**Scalehouse & Scales Capital Costs**	**TOTAL CAP$**		**$1,141,300**

SCENARIO 2
CRLCSWA TRANSFER STATION w/ REGIONAL LANDFILL OPTION
TS SCALEHOUSE CAPITAL COST ESTIMATE SUMMARY (1)(2)

Scalehouse Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scalehouse	600	SF	$ 250	$ 150,000	*Approx. current size*
Entrance & Queuing Roads	4,400	SY	$ 60	$ 264,000	*Concrete 4" over 6" granular base, 1000LF*
Road, Scale Approach, Parking	1,200	SY	$ 60	$ 72,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 15,000	$ 15,000	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 501,000	$ 150,300	*Vertical construction*
SUBTOTAL				**$ 651,300**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 651,300	$ 130,300	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 651,300	$ 78,200	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 651,300	$ 6,500	*Percentage of total capital*
SUBTOTAL				**$ 215,000**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scales	2	EA	$ 125,000	$ 250,000	*New*
Software	1	EA	$ 25,000	$ 25,000	*Software used for LF, Compost, RRC, etc.*
SUBTOTAL				**$ 275,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Scalehouse located on same site as the transfer station.

Project:	CRLCSWA Infrastructure Options		
Date:	12/20/2021		
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading		
Costs:	2021$		
Location:	Linn County, Iowa		
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$282,700**

SCENARIO 2
CRLCSWA TRANSFER STATION w/ REGIONAL LANDFILL OPTION
TS SCALEHOUSE OPERATIONS COST ESTIMATE SUMMARY (1)

Scalehouse Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 246,000	
Scalehouse Personnel	3	FTE	$ 82,000	$ 246,000		
Utilities					$ 4,300	
Electricity	6,000	kWh	$ 0.15	$ 900		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 1,000	$ 1,000		*Estimate - small building*
Heating Fuel	1	LS	$ 1,000	$ 1,000		*Estimate 1-2 Therms/SF/year*
Phones	12	months	$ 120	$ 1,400		*Estimate*
Maintenance and Repairs					$ 6,500	
Building	1%	Capital $	$ 150,000	$ 1,500		*Percentage of building capital*
Scales	2%	Capital $	$ 250,000	$ 5,000		*Percentage of scales capital*
Mobile Equipment	0	hours	$ 15	$ -		*None*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 400,000	$ 1,200	$ 1,200	*Percentage of building & scales total capital*
Cash Reserves Bldg/Equip Replacement					$ 22,700	
Mobile Equipment	0	EA	$ -	$ -		*None*
Scales	2	EA	$ 8,333	$ 16,700		*Capital divided by 15-yr life*
Scalehouse Building	1	EA	$ 6,000	$ 6,000		*Capital divided by 25-yr life*
SUBTOTAL SCALEHOUSE & SCALES					**$ 282,700**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
COMPOST FACILITY SIZING

Compost Feedstock	***Initial Development, Year 2038***	***Long Term, Year 2088***	
Incoming Organics (tons)	38,118	55,601	*From SW Volumes Memo 6-10-2021*
% as Food Waste	10%	10%	*Food target percent for windrow ops*
Processing Days per Year	296	296	
Tons per Day	129	188	
Yard Waste Density (lb/cy)	650	650	
Yard Waste C:N Ratio	25	25	
Yard Waste Moisture Content	40%	40%	
Food Waste Density (lb/cy)	1,000	1,000	
Food Waste C:N Ratio	45	45	
Food Waste Moisture Content	60%	60%	
Target C:N Ratio	30 to 45	30 to 45	
Target Moisture Content	60%	60%	
Net Bulk Density at Arrival (lb/cy)	685	685	
Target Bulk Density (lb/cy)	850	850	
Net C:N Ratio	27	27	
Net Moisture Content	42%	42%	
Water to Add Initially (gal/yr)	**1,647,378**	**2,402,932**	
Annual Infeed Volume Processed (cy)	**111,295**	**162,339**	
Finished Compost Volume (cy)	61,212	89,287	
Density of Finished Compost (lb/cy)	800	800	
Finished Compost (tons)	**24,485**	**35,715**	
Composting Parameters			
Composting Period (days)	120	120	*6 months from incoming to screening*
Curing Period (days)	40	40	*Recommended*
Storage Period, Pre-Screening (days)	30	30	
Storage Period, Post-Screening (days)	30	30	*Total 60 days compost storage*
Initial Windrow Shrinkage Factor	10%	10%	
Compost Shrinkage Factor	30%	30%	
Curing Shrinkage Factor	5%	5%	
Unloading/Receiving Area			
Yard Waste Daily Pile Volume (cy)	357	520	
2x YW for Peak Day (cy)	713	1040	*Daily yard waste*
YW Pile Height (ft)	10	10	
YW Pile Area (sf)	*1,926*	*2,809*	
Wood & Leaves Pile Volumes (cy)	10,556	15,397	*Assume 10% of annual raw material*
Wood/Leaves Pile Height (ft)	10	10	*For raw material mixing ratios*
Wood/Leaves Pile Area (sf)	*28,501*	*41,573*	*Storage piles for wood chips & leaves*
Food Waste Pile Volume (cy)	26	38	
2x FW for Peak Day (cy)	52	75	*Daily food waste*
FW Pile Height (ft)	5	5	

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

FW Pile Area (sf)	*278*	*406*	
Hours per Day YW/FW Receipt	9	9	
Vehicles Peaking Factor	1.5	1.5	
Vehicles Payload (avg tons/vehicle)	2	2	*Assumption*
Unloading Time for Loads (minutes)	10	10	*Assumption*
No. Vehicles per Hour (vph)	11	16	
Total Number Unloading Bays	2	3	
Area per Unloading Bay (sf)	720	720	
Unloading Bay Space (sf)	*1,440*	*2,160*	
Maneuvering Space (sf)	*3,600*	*5,400*	
Total Unloading/Receiving Space (sf)	**35,745**	**52,347**	
Compost Pad			
Average Volume on Compost Pad (cy)	32,931	48,035	
Compost Windrow Length (ft)	200	200	
Compost Windrow Height (ft)	6	6	*To confirm w/ CRLCSWA*
Compost Windrow Width (ft)	14	14	*To confirm w/ CRLCSWA*
Volume per Row (cy)	373	373	
Number of Rows	89	129	
Spacing Between Windrows (ft)	8	8	
Total Compost Pad Area (sf)	**391,600**	**567,600**	
Compost Curing Pad			
Average Volume on Curing Pad (cy)	7,318	10,674	
Curing Windrow Length (ft)	100	100	
Curing Windrow Height (ft)	7	7	*To confirm w/ CRLCSWA*
Curing Windrow Width (ft)	16	16	*To confirm w/ CRLCSWA*
Volume per Row (cy)	249	249	
Number of Rows	30	43	
Spacing Between Windrows (ft)	6	6	
Total Curing Pad Area (sf)	**66,000**	**94,600**	
Storage Pad1 - PreScreening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	
Total Storage Pad1 Area (sf)	**12,937**	**18,871**	
Finished Compost Screening Area			
Loading Traffic Area Width (ft)	50	50	
Loading Traffic Area Length (ft)	100	100	
Loading Traffic Area (sf)	*5,000*	*5,000*	
Mixing Bin/Screen w/ Stockpile Width (ft)	75	75	
Mixing Bin/Screen w/ Stockpile Length (ft)	100	100	
Mixing Bin/Screen w/ Stockpile Area (sf)	*7,500*	*7,500*	
Total Screening Area (sf)	**12,500**	**12,500**	
Storage Pad2 - Post-Screening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

Total Storage Pad2 Area (sf)	**12,937**	**18,871**	
Traffic Lanes for Operations			
Traffic Lane Width (ft)	20	20	
Cummulative Processing Area (sf)	531,719	764,789	
Square Root (ft)	729	875	
Traffic Lane Length =	2,917	3,498	
Total Operations Traffic Lanes Area (sf)	**58,335**	**69,962**	
Retention/Leachate Pond			
Area Contributing to Pond (sf)	590,054	834,751	*Total of Areas above*
100-Yr 24 hr Stor Event Rainfall Intensity I	0.310	0.310	PF Map: Contiguous US (noaa.gov)
Area A (acres)	13.5	19.2	
Run-off Factor C	0.60	0.60	
Flow Rate Q (cfs)	2.5	3.6	*using Rational Formula Q=CIA*
Time to Retain (hours)	24	24	
Volume of Water to Retain (cf)	217,394	307,547	
Depth of Pond (ft)	6	6	
Side Slopes of Pond #:1	4	4	
Pond Area at 1/2 Depth (sf)	36,232	51,258	*Volume divided by Depth*
Length & Width at 1/2 Depth (ft)	190	226	
Total Pond Area (sf)	**45,945**	**62,701**	*at grade*
SUMMARY OF COMPOST AREAS			
Unloading/Receiving Area	35,745	52,347	
Compost Pad	391,600	567,600	
Compost Curing Pad	66,000	94,600	
Storage Pad1 - Pre-Screening	12,937	18,871	
Finished Compost Screening Area	12,500	12,500	
Storage Pad2 - Post-Screening	12,937	18,871	
Traffic Lanes for Operations	58,335	69,962	
Retention/Leachate Pond	45,945	62,701	
TOTAL REQUIRED AREA (sf)	**635,999**	**897,452**	
TOTAL REQUIRED AREA (acres)	**14.60**	**20.60**	
Site - Composting & Buffer (acres)	**23**	**30**	*Assume 100' buffer*

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021 Revised: 12/20/2021		
Facility:	New Aerobic Organics Compost Site - Windrows - No Design		
Costs:	2021$	Facility Size:	21 Acres
Location:	Linn County, Iowa	Required Land:	30 Acres
Worksheet:	**Composting Capital Costs**	**TOTAL COMPOST CAP$**	**$15,914,100**

SCENARIO 2
CRLCSWA AEROBIC ORGANICS COMPOSTING
CAPITAL COST ESTIMATE SUMMARY (1)(2)

Compost Site Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations	1	LS	$ 50,000	$ 50,000	*Assumption*
Site Work					
Mobilization/Demob	1	LS	$ 50,000	$ 50,000	
Clear & Grub	11	Acres	$ 2,000	$ 22,000	*Assume no demolition; half compost area*
Grading/Excavation	67,800	CY	$ 3	$ 203,400	*Assume 2' across compost area*
Structural Fill	20,300	CY	$ 10	$ 203,000	*Assume 30% of excavation quantities*
Roadways	9,100	SY	$ 45	$ 409,500	*4" asphalt over 6" granular base*
Site Utilities					
Stormwater Pond	-	LS	$ 200,000	$ -	*See Compost Leachate Lagoon*
Site Drainage/Erosion Control	1	EA	$ 25,000	$ 25,000	
Electrical - Service to Site	1	LS	$ 1,500,000	$ 1,500,000	*From 1 mile away*
Water Supply & Fire Protection	1	LS	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Sanitary Sewer	1	EA	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Natural Gas System	-	LS	$ -	$ -	*NA*
Surveying	1	EA	$ 10,000	$ 10,000	*For composting area only*
Landscaping, Signage	1	EA	$ 20,000	$ 20,000	*For composting area only*
Fencing	4,600	LF	$ 35	$ 161,000	*Around composting area*
Pads & Leachate Collection					
Composting & Curing Pads	73,600	SY	$ 45	$ 3,312,000	*Asphalt Pad - Full Buildout*
Screening/Storage Areas	5,600	SY	$ 25	$ 140,000	*Compacted Gravel Pad - Full Buildout*
Compost Leachate Lagoon, Lined	1	LS	$ 500,000	$ 500,000	*Approximate 2 acres*
Market Variability Factor	15%	Capital $	$ 9,725,900	$ 1,459,000	*Sitework, horizontal construction*
SUBTOTAL COMPOST SITE CAPITAL				**$ 11,184,900**	

Engineering (3)	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 11,184,900	$ 2,237,000
Engineering & Design	4%	Capital $	$ 11,184,900	$ 447,400
Permitting	2%	Capital $	$ 11,184,900	$ 223,700
Construction Observation/CQA	6%	Capital $	$ 11,184,900	$ 671,100
SUBTOTAL COMPOST SOFT COSTS				**$ 3,579,200**

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Windrow Turner	1	EA	$ 750,000	$ 750,000	*Replacement*
Loader (large)	1	EA	$ 400,000	$ 400,000	*Replacement*
Water Truck	0	EA	$ 200,000	$ -	*Existing*
Screen Compost Finish	0	EA	$ 300,000	$ -	*Existing*
Grinder/Shredder	0	EA	$ 600,000	$ -	*Existing*
Conveyors	0	EA	$ 75,000	$ -	*NA - included w/ screener or grinder*
SUBTOTAL				**$ 1,150,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.
(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing co: Does not include financing costs.
Assumed cell projects to be cc Assumed cell projects to be competitively bid under one general contract.

Project:	CRLCSWA Infrastructure Options			
Date:	11/9/2021 Revised: 12/20/2021			
Facility:	New Aerobic Organics Compost Site - Windrows - No Design			
Costs:	2021$	Facility Size:	21 Acres	
Location:	Linn County, Iowa	Required Land:	30 Acres	
Worksheet:	**Composting Capital Costs**	**TOTAL COMPOST CAP$**		**$15,914,100**

Assumed construction to be d Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	New Aerobic Organics Compost Site - Windrows - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**COMPOST REV$**	**$1,091,100**
Worksheet:	**Composting O&M Costs**	**TOTAL COMPOST O&M$**	**$1,192,000**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
OPERATIONS COST ESTIMATE SUMMARY [(1)]

Compost Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 511,800	*FY2021 fully-burdened salary, escalated*
Scalehouse	0.0	FTE	$ 82,000	$ -		*Included in LF, TS, MWP, AD or WTE*
Windrow Turner Operator	1.5	FTE	$ 103,800	$ 155,700		
Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
Misc. Equip Operator	2.0	FTE	$ 100,200	$ 200,400		*Water truck, grinder, screen, turner, loader*
Utilities					$ 27,400	
Electricity	0	kWh	$ 0.15	$ -		*NA*
Water	1	LS	$ 25,000	$ 25,000		*130 gal/ton for composting, dust control*
Leachate	0	gallons	$ 0.15	$ -		*NA - Compost leachate NPDES Discharge*
Heating Fuel	0	LS	$ 2,500	$ -		*NA*
Phones	12	months	$ 200	$ 2,400		*Estimate based on # labor*
Maintenance and Repairs					$ 169,100	
Roadways, Pads Repair & Misc Maintenance	0.3%	Capital $	$ 11,184,900	$ 33,600		*Percentage of Compost capital*
Windrow Turner	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Loader	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Truck/Screen Equipment	2,368	hours	$ 15	$ 35,500		*80% of personnel hours*
Grinder	208	hours	$ 25	$ 5,200		*Estimate 4 hours per week*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	21,936	gallons	$ 3.50	$ 76,800	$ 76,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Insurance	0.1%	Capital $	$ 11,184,900	$ 11,200	$ 11,200	*Percentage of compost total capital*
Compost Lab Testing	1	LS	$ 5,000	$ 5,000	$ 5,000	*Portion from CRLCSWA FY2022 Budget*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL COMPOST DIRECT OPERATIONS					**$ 806,300**	

Compost Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 385,700	*Rounded*
Windrow Turner	1	EA	$ 150,000	$ 150,000		*Capital cost divided by 5-yr life*
Loader	1	EA	$ 57,143	$ 57,100		*Capital cost divided by 7-yr life*
Water Truck	1	EA	$ 28,600	$ 28,600		*Shared w/ TS for roads dust control*
Screen Compost Finish	1	EA	$ 30,000	$ 30,000		*Capital cost divided by 10-yr life*
Grinder/Shredder	1	EA	$ 120,000	$ 120,000		*Capital cost divided by 5-yr life*
Conveyors	0	EA	$ 7,500	$ -		*Included w/ screen or grinder*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 composting*
SUBTOTAL LF CASH RESERVES					**$ 385,700**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Compost Sales	7,345	Ton	$ 24	$ 176,300	$ 176,300	*Assume 30% compost sales to businesses*
Tip Fees	38,118	Ton	$ 24	$ 914,800	$ 914,800	*Current CRLCSWA unit price*
Non-Cash Adjustments	0	LS	$ 25,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
SUBTOTAL OTHER REVENUES					**$ 1,091,100**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options		
Date:	11/23/2021 Revised: 12/20/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$	Land:	10 Acres
Location:	Linn County, Iowa		
Worksheet:	**Scalehouse & Scales Capital Costs**	**TOTAL CAP$**	**$1,939,600**

SCENARIO 2
CRLCSWA SOLID WASTE CAMPUS FACILITIES
SCALEHOUSE CAPITAL COST ESTIMATE SUMMARY (1)(2)

Scalehouse Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scalehouse	600	SF	$ 250	$ 150,000	*Approx. current size*
Entrance & Queuing Roads	13,300	SY	$ 60	$ 798,000	*Concrete 4" over 6" granular base, 3000LF*
Road, Scale Approach, Parking	1,200	SY	$ 60	$ 72,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 15,000	$ 15,000	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,035,000	$ 310,500	*Vertical construction*
SUBTOTAL				**$ 1,345,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,345,500	$ 269,100	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,345,500	$ 161,500	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,345,500	$ 13,500	*Percentage of total capital*
SUBTOTAL				**$ 444,100**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scales	1	EA	$ 125,000	$ 125,000	*New*
Software	1	EA	$ 25,000	$ 25,000	*Software used for LF, Compost, RRC, etc.*
SUBTOTAL				**$ 150,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Scalehouse serves the Compost Facility, RRC/HHW, Maintenance Facility and Citizen Drop-Off of white goods and scrap metal.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Admin/Educational Center Capital Cost**	**TOTAL CAP$**		**$2,878,100**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
ADMIN CAPITAL COST ESTIMATE SUMMARY (1)(2)

Administration & Educational Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Two-Story Building	5,500	SF	$ 250	$ 1,375,000	*Building footprint SF; same size as current*
Access Road & Parking	2,300	SY	$ 45	$ 103,500	*Asphalt 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 137,500	$ 137,500	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,616,000	$ 484,800	*Vertical construction*
SUBTOTAL				**$ 2,100,800**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 2,100,800	$ 420,200	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 2,100,800	$ 336,100	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 2,100,800	$ 21,000	*Percentage of total capital*
SUBTOTAL				**$ 777,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**
None at Admin Center				
SUBTOTAL				**$ -**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	4 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Resource Recovery Center Capital Cost**	**TOTAL CAP$**		**$9,933,900**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
RRC CAPITAL COST ESTIMATE SUMMARY (1)(2)

RRC Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
HHM Canopy - Covered Drive	2,000	SF	$ 25	$ 50,000	*CRLCSWA current size*
HHM Facility	8,000	SF	$ 300	$ 2,400,000	*CRLCSWA current size*
RRC Bldg	6,700	SF	$ 250	$ 1,675,000	*Size for just recyclables transfer*
RRC Office/Breakroom/Restrooms	3,600	SF	$ 200	$ 720,000	*CRLCSWA current size*
Access Road, Parking & Maneuvering	5,600	SY	$ 60	$ 336,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 239,750	$ 239,800	*5% of buildings cost*
Market Variability Factor	30%	Capital $	$ 5,420,800	$ 1,626,200	*Vertical construction*
SUBTOTAL				**$ 7,047,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 7,047,000	$ 1,409,400	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 7,047,000	$ 986,600	*Percentage of total capital*
Permitting (Local & IDNR)	2%	Capital $	$ 7,047,000	$ 140,900	*Percentage of total capital*
SUBTOTAL				**$ 2,536,900**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Baler	0	EA	$ 1,000,000	$ -	*Assumes RRC recyclabes transfer only*
Forklift	1	EA	$ 50,000	$ 50,000	*For HHM Facility*
Skid Loader	0	EA	$ 50,000	$ -	*Existing*
Mid-Size Loader	1	EA	$ 300,000	$ 300,000	*Share w/ Citizen Drop-Off and Bunkers*
Roll-off Containers	0	EA	$ 8,000	$ -	*Existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from Citizen Drop-Off*
Trailers	0	EA	$ 30,000	$ -	*Assume provided by end market*
Trucks	0	EA	$ 115,000	$ -	*Assume provided by end market*
SUBTOTAL				**$ 350,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Sizing for RRC Building

RRC Transfer Sizing	**Year 1**	**Year 50**	
Incoming Recyclables, TPY	4,045	5,943	*Single stream recyclables/drop box handled by CRLCSWA*
Incoming Recyclables, TPD	16	23	*5 days/week*
Incoming Recyclables, TPH	2	3	*8 hours/day*
Number of Unloading Bays	2	2	*Avg 3 tons/veh, 2x peak factor, 15 min unload + 1 extra*
Recyclables - Floor Storage (CY)	247	363	*126 lbs/CY, 1 day worth*
Recyclables - Trailer Payload	7	7	*tons/trailer* *126 lbs/CY*
Area Needed (SF):			
Tipping Floor	3,700	4,400	*Recyclables piled avg 4' high + unloading area*
Transfer Loadout Area Area	1,200	1,200	*60' x 1 trailer load-out lane*
Flex Area	1,000	1,100	*20% extra*
RRC Transfer Building (SF)	**5,900**	**6,700**	

Project:	CRLCSWA Infrastructure Options		
Date:	11/23/2021		
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading		
Costs:	2021$	Land:	2 Acres
Location:	Linn County, Iowa		
Worksheet:	**Maintenance Shop Capital Cost**	**TOTAL CAP$**	**$2,567,500**

SCENARIO 2
CRLCSWA TRANSFER STATION w/ REGIONAL LANDFILL OPTION
MAINT SHOP CAPITAL COST ESTIMATE SUMMARY (1)(2)

Maintenance Facility Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Maintenance Facility	9,000	SF	$ 150	$ 1,350,000	*CRLCSWA current sizes, Site #3 compost*
Access Road & Maneuvering Area	1,200	SY	$ 45	$ 54,000	*Asphalt 4" over 6" granular base*
Market Variability Factor	30%	Capital $	$ 1,404,000	$ 421,200	*Percentage of capital w/out land vertical construction*
SUBTOTAL				**$ 1,825,200**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,825,200	$ 365,000	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,825,200	$ 219,000	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,825,200	$ 18,300	*Percentage of total capital*
SUBTOTAL				**$ 602,300**	

Maintenance Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
5-ton Overhead Crane w/ Hoist	1	EA	$ 40,000	$ 40,000	*Crane vendors $35K w/ $5k installed*
Maint/Repair Equipment	1	EA	$ 100,000	$ 100,000	*Estimate*
SUBTOTAL				**$ 140,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Citizen Drop-Off Center Capital Cost**	**TOTAL CAP$**		**$234,700**

SCENARIO 2
CRLCSWA TRANSFER STATION w/ REGIONAL LANDFILL OPTION
DROP-OFF CAPITAL COST ESTIMATE SUMMARY (1)(2)

Citizen Drop-Off Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Materials Bunkers Area	1,700	SY	$ 60	$ 102,000	*Concrete for tires, white goods, scrap metal*
Concrete Bunker Walls	80	CY	$ 600	$ 48,000	*3 bunkers 60'x 35' each*
Bulk Excavation & Structural Fill	0	CY	$ 13	$ -	*Suitable on-site soils*
Waste Unloading Area	0	SY	$ 60	$ -	*No separate citizen drop-off for trash*
Roll-Off Area	0	SY	$ 60	$ -	*No separate citizen drop-off for trash*
Concrete Z-Wall	0	CY	$ 600	$ -	*No separate citizen drop-off for trash*
Market Variability Factor	15%	Capital $	$ 150,000	$ 22,500	*Sitework, horizontal construction*
SUBTOTAL				**$ 172,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 172,500	$ 34,500	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 172,500	$ 24,200	*Percentage of total capital*
Permitting (Local)	2%	Capital $	$ 172,500	$ 3,500	*Percentage of total capital*
SUBTOTAL				**$ 62,200**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Roll-off Containers	0	EA	$ 8,000	$ -	*1 glass; existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*None*
Skid Loader	0	EA	$ 50,000	$ -	*Share from RRC*
Mid-Size Loader	0	EA	$ 300,000	$ -	*Share from RRC*
SUBTOTAL				**$ -**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021 Revised: 12/20/2021		
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,487,400**

SCENARIO 2
CRLCSWA TRANSFER STATION w/ REGIONAL LANDFILL OPTION
OPERATIONS COST ESTIMATE SUMMARY (1)

Scalehouse Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 164,000	
Scalehouse Personnel	2	FTE	$ 82,000	$ 164,000		*Reduced for less traffic w/out TS on-site*
Utilities					$ 3,900	
Electricity	6,000	kWh	$ 0.15	$ 900		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 1,000	$ 1,000		*Estimate - small building*
Heating Fuel	1	LS	$ 1,000	$ 1,000		*Estimate 1-2 Therms/SF/year*
Phones	12	months	$ 80	$ 1,000		*Estimate*
Maintenance and Repairs					$ 4,000	
Building	1%	Capital $	$ 150,000	$ 1,500		*Percentage of building capital*
Scales	2%	Capital $	$ 125,000	$ 2,500		*Percentage of scales capital*
Mobile Equipment	0	hours	$ 15	$ -		*None*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 275,000	$ 800	$ 800	*Percentage of building & scales total capital*
Cash Reserves Bldg/Equip Replacement					$ 14,300	
Mobile Equipment	0	EA	$ -	$ -		*None*
Scales	1	EA	$ 8,333	$ 8,300		*Capital divided by 15-yr life*
Scalehouse Building	1	EA	$ 6,000	$ 6,000		*Capital divided by 25-yr life*
SUBTOTAL SCALEHOUSE & SCALES					**$ 189,000**	

Administration & Educational Center	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Agency Labor:					$ 1,583,500	*Estimate 40% from CRLCSWA FY2022 Budget*
Executive Director	1	FTE				
Site Engineer	1	FTE				
Director of Education	1	FTE				
Hazardous Materials Manager	1	FTE				
Operations Foreman	1	FTE				
Admin Personnel	2	FTE				
Utilities					$ 47,500	
Electricity	110,000	kWh	$ 0.15	$ 16,500		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 5,000	$ 5,000		*Estimate - office building*
Natural Gas/Heating Fuel	1	LS	$ 8,000	$ 8,000		*Estimate 1 Therms/SF/year*
Phones	12	months	$ 1,500	$ 18,000		*Estimate*
Maintenance and Repairs					$ 34,500	
Building & Grounds	0.5%	Capital $	$ 2,100,800	$ 10,500		*Percentage of capital*
Mobile Equipment	936	hours	$ 5	$ 4,700		*Assume pick-up trucks maintenance*
Office Equipment	1	LS	$ 19,300	$ 19,300		*CRLCSWA FY2022 Budget*
Agency Purchased Services	1	LS	$ 511,700	$ 511,700	$ 511,700	*CRLCSWA FY2022 Budget*
Agency Supplies & Materials	1	LS	$ 20,900	$ 20,900	$ 20,900	*CRLCSWA FY2022 Budget*
Agency Other Costs	1	LS	$ 46,000	$ 46,000	$ 46,000	*CRLCSWA FY2022 Budget*
Other Operating Costs - Services					$ 222,500	
ECICOG	1	LS	$ 10,000	$ 10,000		*CRLCSWA FY2022 Budget*
Public Education	1	LS	$ 37,500	$ 37,500		*CRLCSWA FY2022 Budget*
Media Advertising	1	LS	$ 125,000	$ 125,000		*CRLCSWA FY2022 Budget*
Comprehensive Planning	1	LS	$ 50,000	$ 50,000		*Annual estimate over period*
Fuel	2,808	gallons	$ 3.50	$ 9,800	$ 9,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 2,100,800	$ 6,300	$ 6,300	*Percentage of capital*
Cash Reserves Bldg/Equip Replacement					$ 55,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Admin Building	1	EA	$ 55,000	$ 55,000		*Capital divided by 25 years*
SUBTOTAL ADMINISTRATION & EDUCATIONAL CENTER					**$ 2,537,700**	

Resource Recovery Center/HHW Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor					$ 486,300	

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021 Revised: 12/20/2021		
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,487,400**

Hazardous Materials Manager						*Included w/ Agency Labor in Admin/Ed Center*
RRC Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
HHW Facility Receiving	1.5	FTE	$ 82,000	$ 123,000		
HHW Facility Chemists	2.0	FTE	$ 103,800	$ 207,600		
Utilities					$ 59,600	
Electricity	274,500	kWh	$ 0.15	$ 41,200		*15 kWh/SF, mixed use*
Water & Sewer	1	LS	$ 3,000	$ 3,000		*Estimate*
Natural Gas/Heating Fuel	1	LS	$ 13,000	$ 13,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 200	$ 2,400		*Estimate*
Maintenance and Repairs					$ 43,000	
Building & Grounds	0.5%	Capital $	$ 7,047,000	$ 35,200		*Percentage of capital*
Mobile Equipment	520	hours	$ 15	$ 7,800		*Loader, assume 2 hrs per day*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	1,560	gallons	$ 3.50	$ 5,500	$ 5,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 7,047,000	$ 21,100	$ 21,100	*Percentage of building total capital*
Cash Reserves Bldg/Equip Replacement					$ 243,300	
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Loader	1	EA	$ 42,900	$ 42,900		*Capital cost divided by 7-yr life*
Roll-offs	2	EA	$ 800	$ 1,600		*Capital cost divided by 10-yr life*
RRC/HHW Buildings	1	EA	$ 193,800	$ 193,800		*Capital cost divided by 25-yr life*
Disposal/Management Services					$ 543,600	
HHW Disposal	1	LS	$ 90,000	$ 90,000		*CRLCSWA FY2022 Budget*
Electronics Disposal	1	LS	$ 67,700	$ 67,700		*CRLCSWA FY2022 Budget*
Batteries/Flourescents/Medical Waste	1	LS	$ 13,200	$ 13,200		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 24,900	$ 24,900		*CRLCSWA FY2022 Budget*
Tires	1	LS	$ 48,300	$ 48,300		*CRLCSWA FY2022 Budget*
Recycling Services	1	LS	$ 299,500	$ 299,500		*CRLCSWA FY2022 Budget*
SUBTOTAL RESOURCE RECOVERY CENTER					**$ 1,407,400**	

Maintenance Facility Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 207,600	
Mechanic/Maintenance	2	FTE	$ 103,800	$ 207,600		*Servicing all facilities' mobile equipment*
Utilities					$ 20,300	
Electricity	63,000	kWh	$ 0.15	$ 9,500		*Assume 7 kWh/SF repair shop*
Water & Sewer	1	LS	$ 2,500	$ 2,500		*Estimate*
Heating Fuel	1	LS	$ 6,500	$ 6,500		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 150	$ 1,800		*Estimate*
Maintenance and Repairs					$ 16,100	
Building & Grounds	0.5%	Capital $	$ 1,825,200	$ 9,100		*Percentage of capital*
Crane/Equipment	5%	Capital $	$ 140,000	$ 7,000		*Percentage of equipment capital*
Mobile Equipment	0	hours	$ 15	$ -		*Included w/ LF, TS, MWP, AD or WTE*
Supplies	1	LS	$ 39,300	$ 39,300	$ 39,300	*1/2 FY2022 Budget, Tools & Equip, Shop*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 1,825,200	$ 5,500	$ 5,500	*Percentage of total capital*
Cash Reserves Bldg/Equip Replacement					$ 58,000	
Overhead Crane	1	EA	$ 4,000	$ 4,000		*Capital over 10-year life*
Maintenance Building	1	EA	$ 54,000	$ 54,000		*Capital over 25-year life*
SUBTOTAL MAINTENANCE FACILITY					**$ 346,800**	

Citizen Drop-Off Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:	Included with Labor for LF, TS, MWP, AD or WTE					*Shared Labor*
Utilities					$ -	
Electricity	0	kWh	$ 0.15	$ -		*Outdoors*
Water & Sewer	0	LS	$ -	$ -		*NA*
Heating Fuel	0	LS	$ -	$ -		*NA*
Phones	0	months	$ -	$ -		*NA*
Maintenance and Repairs					$ 2,400	
Paving/Pad Repairs	1%	Capital $	$ 102,000	$ 1,000		*Percentage of pad capital*
Mobile Equipment	96	hours	$ 15	$ 1,400		*Assume 8 hours/month*

Project:	CRLCSWA Infrastructure Options			
Date:	11/9/2021 Revised: 12/20/2021			
Facility:	SCENARIO 2: Transfer Station Concept - No Design; Open-Top Loading			
Costs:	2021$			
Location:	Linn County, Iowa		**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**		**ANNUAL O&M$**	**$4,487,400**

Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	288	gallons	$ 3.50	$ 1,000	$ 1,000	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 102,000	$ 300	$ 300	*Percentage of construction capital*
Cash Reserves Equipment Replacement						
Roll-off Containers	1	EA	$ 800	$ 800	$ 800	*Capital over 10-year life*
Roll-off Truck	0	EA	$ 11,000	$ -	$ -	*Capital over 10-year life*
SUBTOTAL CITIZEN DROP-OFF					**$ 6,500**	

Miscellaneous Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
RRC/HHW Materials					$ 647,900	
Scrap Metal	1	LS	$ 18,000	$ 18,000		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 74,700	$ 74,700		*CRLCSWA FY2022 Budget*
Waste Tires	1	LS	$ 53,900	$ 53,900		*CRLCSWA FY2022 Budget*
Electronic Waste	1	LS	$ 114,300	$ 114,300		*CRLCSWA FY2022 Budget*
HHW	1	LS	$ 57,200	$ 57,200		*CRLCSWA FY2022 Budget*
Commingled Recycling	1	LS	$ 271,400	$ 271,400		*CRLCSWA FY2022 Budget*
Recycling Services Revenue Share	1	LS	$ 58,400	$ 58,400		*CRLCSWA FY2022 Budget*
Other Misc. Revenue	0	LS	$ 29,400	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
SUBTOTAL MISC REVENUES					**$ 647,900**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%
4. Facilities located on second campus for solid waste services.

Material	Fiscal Year FY2020	FY2030	FY2040	FY2050	Year 1 FY2038	Year 50 FY2087
Population	228,600	254,900	276,800	298,900		
Materials Landfilled						
MSW	160,086	178,430	193,760	209,230	190,592	278,006
Disaster Debris	0	2,549	2,768	2,989	2,723	3,972
Special Waste	16,612	20,392	22,144	23,912	21,782	31,772
C&D	25,960	17,843	19,376	20,923	19,059	27,801
Shingles	9,091	2,549	2,768	2,989	2,723	3,972
Subtotal Materials Landfilled	**211,749**	**221,763**	**240,816**	**260,043**	**236,879**	**345,522**
Materials Recycled						
Organics	29,710	35,686	38,752	41,846	38,118	55,601
Single Stream/Drop Box/City	11,872	12,745	13,840	14,945	13,614	19,858
Scrap Metal/White Goods	876	1,098	1,193	1,288	1,173	1,711
Subtotal Materials Recycled	**42,458**	**49,529**	**53,785**	**58,079**	**52,905**	**77,170**
Total Materials	254,207	271,292	294,601	318,122	289,784	422,692
Annual MSW Percent Increase		0.65%	0.83%	0.77%		0.77%

Project:	CRLCSWA Engineering Services
Estimator:	Lori Calub - HDR Engineering, Inc.
Date:	3/6/2020 UPDATED 11/9/2021
Estimate Basis:	Transfer Station Concept - No Design; Open-Top Loading
Costs:	2021$
Location:	CRLCSWA Site #2 Landfill, Marion, Iowa

Transfer Station Capital Cost References

	TPY Sizing	*Top Load TS Bldg Size - SF*	*TPY / SF*	*Year*	*Capital $ - Total*	*Capital $ - Site, TS Bldg & Scales-bldg*	*$/SF*	*2021 $/SF*
Actuals:								
MWA NWTS	230,000	24,000	9.6	2014	$ 10,500,000	$ 9,975,000	$ 416	$ 477
Columbus, NE	35,000	7,000	5.0	2013	$ 3,600,000	$ 3,420,000	$ 489	$ 572
Studies:								
Spokane, WA	91,000	37,620	2.4	2013	$ 12,770,000	$ 12,131,500	$ 322	$ 378
York, NE	35,000	8,000	4.4	2019	$ 3,900,000	$ 3,900,000	$ 488	$ 507
Larimer, CO	340,000	28,200	12.1	2017	$ 11,400,000	$ 11,400,000	$ 404	$ 438
AVERAGE			**6.7**					**$ 474**

Notes:

1. Assumed Annual Escalation to Year 2020 = 2%
2. Total capital costs from studies include 20% to 25% contingency.

CRLCSWA Transfer Station Sizing	*FY2038*	*FY2063*	*FY2088*	
Incoming Waste (TPY)				
MSW	190,592	234,299	278,006	
C&D, Shingles, Debris	24,505	30,124	35,744	
Total TPY	215,097	264,423	313,750	
Tons Per Day	727	893	1060	
Average Building Size (SF)	32,167	39,544	46,921	
Building Size per MWA NWTS (SF)	22,445	27,592	32,739	No citizen self-haul at MWA NWTS

Project:	CRLCSWA Infrastructure Options
Date:	12/27/2021
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**OTHER SROI INPUTS**

SCENARIO 3
CRLCSWA MWP-RDF w/ NEW LANDFILL OPTION
OTHER SROI INPUTS (2021$)

Timing of Capital Costs

SCENARIO 3 CAMPUS	2022	2023	2024	2025	2026	2027
Land Acquisition/Legal/Env	0%	0%	5%	10%	10%	10%
MWP-RDF Facility	0%	0%	0%	0%	0%	0%
New Landfill	0%	0%	0%	0%	0%	0%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 3 CAMPUS	2028	2029	2030	2031	2032	2033
Land Acquisition/Legal/Env	15%	50%	0%	0%	0%	0%
MWP-RDF Facility	0%	0%	0%	1%	2%	2%
New Landfill	0%	0%	0%	1%	1%	1%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 3 CAMPUS	2034	2035	2036	2037	2038	2039
MWP-RDF Facility	2%	7%	40%	45%	1%	0%
New Landfill	2%	6%	8%	10%	2%	0%
Compost Facility	5%	10%	40%	30%	15%	0%
Scalehouse	0%	5%	45%	50%	0%	0%
Admin/Educational Center	0%	5%	30%	55%	10%	0%
RRC/HHW	5%	10%	30%	50%	5%	0%
Maintenance Shop	0%	5%	30%	55%	10%	0%
Citizen Drop-Off	0%	5%	60%	30%	5%	0%

Travel Distances

RDF Trailer Payload =	18	tons per load	
One-way Distance =	50	miles	Assumes cement kilns or other end-markets available
Average Speed =	55	mph	
RDF Production, Year 2038 =	133,414	tons RDF	
Calculated # Loads in Year 2038 =	7412	trailer loads	

Recovered Materials to Markets Assumptions:
1. Ferrous & Non-Ferrous Metals to local scrap dealers in Cedar Rapids, Iowa.
2. Plastics to MRF in Cedar Rapids, Iowa for baling.
3. OCC to MRF in Cedar Rapids, Iowa for baling.

Project:	CRLCSWA Infrastructure Options
Date:	11/23/2021 Revised: 12/13/2021
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**SUMMARY**

SCENARIO 3
CRLCSWA MWP-RDF w/ NEW LANDFILL OPTION
SUMMARY (2021$)

Facility	Minimum Land Required (Acres)	Land Purchase (Acres)	Liner / Pad Areas (Acres)	Building Size (SF)	Year 1, TPY	Year 50, TPY
MWP-RDF Facility	21	---	---	112,000	190,592	278,007
New Landfill	141	---	50	---	94,684	138,130
Compost Facility	30	---	21	---	38,118	55,601
Scalehouse	10	---	---	600	---	---
Admin/Educational Center	2	---	---	5,500	---	---
RRC/HHW	4	---	---	18,300	4,045	5,943
Maintenance Shop	2	---	---	17,200	---	---
Citizen Drop-Off	2	---	0.4	---	1,173	1,711
TOTAL	**212**	**320**	**---**	**153,600**	**---**	**---**

Diversion Tonnages		
Organics	38,118	55,601
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
MWP - Ferrous Metals	1,906	2,780
MWP - NonFerrous Metals	762	1,112
MWP - Plastics #1	381	556
MWP - Plastics #2	191	278
MWP - OCC	1,906	2,780
RDF	133,414	194,605
Diversion Subtotal	**181,897**	**265,367**
Landfill Tonnages	**94,684**	**138,130**
% Diversion/Reduction from LF	**66%**	**66%**

	Full Build-Out	Year 1 O&M$			Year 1 Revenues $	
Facility	Total Facilities Capital $	O&M $	O&M - Haul$	Closure/ Post-Closure Fund$	Other Revenues$	Energy/ Materials Revenues$
MWP-RDF Facility	$156,207,200	$8,869,800	$1,832,000	$0	$335,700	$307,000
New Landfill	$49,599,000	$2,185,100	---	$381,120	$0	$436,000
Compost Facility	$9,052,700	$1,171,200	---	$0	$0	$1,091,100
Scalehouse	$2,189,600	$293,900	---	---	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0
RRC/HHW	$9,933,900	$1,407,400	---	$0	$0	$647,900
Maintenance Shop	$4,694,100	$566,000	---	---	$0	$0
Citizen Drop-Off	$238,100	$6,500	---	---	$0	$0
	$234,792,700	**$17,037,600**	**$1,832,000**	**$381,120**	**$335,700**	**$2,482,000**

SCENARIO 3 CAMPUS	Quantity	Unit	Unit Price	Total	
Land Acquisition - Purchase	320	Acres	$25,000	$8,000,000	*3 Qtr Sections*
Land Acquisition - Legal/Support	25%	LS	$8,000,000	$2,000,000	*% Land Purchase*
Social Justice/Env Impact/Legal	1	RS	$7,000,000	$7,000,000	*Risk Factor*
SUBTOTAL				**$17,000,000**	
Facilities Capital				$177,590,100	
Contingency, Permitting, Eng/Construction Observation/CQA				$52,488,600	
Equipment/Mobile Equipment				$4,714,000	
SUBTOTAL				**$234,792,700**	

Estimated Financing Costs - Landfill	$11,075,000	*5 cells, 10 yrs ea, 4%*
Estimated Financing Costs - All Other Facilities	$86,087,000	*20 yrs, 4% APR*
SUBTOTAL	**$97,162,000**	
TOTAL CAPITAL$	**$348,954,700**	

SCENARIO 3 TIPPING FEE ESTIMATE (2021$)

	Capital$[1]	Annual O&M$[2]	Annual Haul$[2]	Annual Closure/PC$[2]	Total - Gross
Total Costs - Facilities	$234,792,700	$17,037,600	$1,832,000	$381,120	
Total Costs - Financing	$97,162,000	---	---	---	
Total Costs-Land/Legal/Env Impac	$17,000,000	---	---	---	
Processed & Landfilled Tons	14,400,160	236,879	236,879	236,879	
$/Ton	**$24.23**	**$71.93**	**$7.73**	**$1.61**	**$103.89**

	Annual Other Revenues[3]	Annual Mat'l/ Energy Revenues[4]	Total - Revenues Before Fees
Revenues	$335,700	$2,482,000	
Landfilled Tons	236,879	236,879	
	$1.42	**$10.48**	**$11.90**

ESTIMATED NET TIP FEE	**$92.00**
Rounded ESTIMATED NET TIP FEE	**$92.00**

Notes:

1. Capital costs include full build out of facilities for 50-year period divided by projected processed & landfilles tons Year 2038-2087.
   Financing costs assume constant annual 4% interest rate on Facilities Capital plus Contingency, Permitting, Engineering & Construction Observation/CQA.
   Land acquisition costs including social justice, environmental impacts and legal.
2. Annual O&M costs include replacement reserves for equipment and rehab/rebuild of buildings over 50-year period. Divided by Year 2038 processed & landfille
3. Other Revenues obtained from CRLCSWA FY2022 budget including grants, investments, non-cash adjustments, other misc. revenues.
   Divided by Year 2038 processed & landfilled tons.
4. Annual Material/Energy Revenues includes recycled materials revenues through RRC (from FY2022 budget), composting tip fees at $24/ton, compost sales at $24/ton, MWP-RDF net materials revenues, and estimated LFG-to-energy revenues. Divided by Year 2038 processed & landfilled tons.

Project:	CRLCSWA Infrastructure Options
Date:	11/10/2021 Revised: 12/13/2021
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MWP-RDF Sizing**

SCENARIO 3
CRLCSWA MWP-RDF w/ NEW LANDFILL OPTION
SIZING MIXED WASTE PROCESSING-RDF FACILITY

Waste Flow (Tons)	Year 1 FY2038	Year 25 FY2063	Year 50 FY2087		Assumptions/Comments
Waste thru MWP-RDF Facility					
MSW	190,592	234,299	278,007		
Initial Rejects	19,059	23,430	27,801	10%	*of MSW*
Processed Waste, TPY	171,533	210,869	250,206		
Processed Waste, TPD	570	690	820	306	*days/year*
Processed Waste, TPH	71	86	103	8	*hours/day (1 shift); increase shifts by Year 25*
Processed Waste/Line/Shift, TPH	36	43	51	2	*process lines; increase shifts by Year 25*
Ferrous Metals Recovery	1,906	2,343	2,780	1.0%	*50% of Ferrous from MSW Composition*
Non-Ferrous Metals Recovery	762	937	1,112	0.4%	*30% of Non-Ferrous from MSW Composition*
Plastics #1	381	469	556	0.2%	*10% of #1 Plastics - Flexible AI system*
Plastics #2	191	234	278	0.1%	*10% of #2 Plastics - Flexible AI system*
Papers	0	0	0	0.0%	*0% of recyclable papers*
OCC	1,906	2,343	2,780	1.0%	*30% of OCC/Kraft from MSW Composition*
Diversion - Recyclables, TPY	5,146	6,326	7,506		
Shrinkage	1,906	2,343	2,780	1.0%	*of MSW*
PVC Removal	1,715	2,109	2,502	0.9%	*30% of Other Plastic Products in MSW*
Process Residue/Fines	29,351	36,082	42,813	15.4%	*of MSW, Adjust % until Remaining = RDF*
Remaining MSW, TPY	133,414	164,010	194,605	70.0%	*Remaining MSW should = RDF output*
RDF	133,414	164,010	194,605	70%	*of MSW*
Number of RDF Loads per Day	24	30	35	18	*tons per trailer*
Waste to Landfill					
Direct to Landfill:					
Disaster Debris	2,723	3,347	3,972		
Special Waste	21,782	26,777	31,772		
C&D	19,059	23,430	27,801		
Shingles	2,723	3,347	3,972		
From MWP-RDF Facility:					
Initial Rejects	19,059	23,430	27,801		
Process Residue/Fines	29,351	36,082	42,813		
Landfilled Waste	94,697	116,413	138,130		
% of Scenario 1 Landfilled	40.0%	40.0%	40.0%		

MWP-RDF Building Sizing	Year 1 FY2038	Year 25 FY2063	Year 50 FY2087		Assumptions/Comments
Sizing Assumptions					
Unloading Bays	10	12	14		*Avg 3 tons/veh, peak factor 2.0, 12 min unload*
Minimum Width (ft)	200	240	280		*20 ft per bay, accounting for structure*
Waste Storage on Tip Floor (CY)	3,559	4,375	5,192	350	*lbs/CY and 1 day waste*
Recovered Material Storage (CY)	792	973	1,155	250	*lbs/CY & 1 week*
RDF Storage (CY)	10,263	12,616	14,970	500	*lbs/CY & 1 week*
Estimated Square Feet					
Tipping Floor	19,600	23,800	28,000		*Waste piled avg 10' high + unloading area*
Processing System Area	42,000	42,000	42,000		*Assume 300' L x 140' W for 2 process lines*
Recovered Material Storage	3,560	4,380	5,200	6	*ft high average*
RDF Storage	23,090	28,390	33,680	12	*ft high average*
RDF & Recyclables Load-out	7,200	7,200	7,200		*100' x loadout bays; 2 trailers+2 roll-offs*
Rejects/Fines Loadout Area	2,160	2,160	2,160		*60' x loadout bays; 2 roll-offs, trucks, trailers*
Office/Breakroom/Restrooms	1,950	2,160	2,360	2.0%	*of area from tip floor thru loadout*
Spare Parts/Shop Room	1,950	2,160	2,360	2.0%	*of area from tip floor thru loadout*
Building SF	101,510	112,250	122,960		
Estimate MWP-RDF Land Requirements (Acres)					
Building	2.3	2.6	2.8		
Surrounding Area	17.0	17.5	17.9	300	*ft buffer area*
Entrance Area	0.0	0.0	0.0		*Included w/ scalehouse*
Required Land (Acres)	19.4	20.1	20.7		
Contingency Acres	4.8	5.0	5.2	25%	
	24.2	25.1	25.9		*Land purchase acres*

Tonnage Projections-Total Processed or Landfilled

Project:	CRLCSWA Infrastructure Options
Date:	11/10/2021 Revised: 12/13/2021
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MWP-RDF Sizing**

Year	CRLCSWA Projections		Annual % Increase
2020	-	tons	0.46%
2030	221,763	tons	0.83%
2040	240,816	tons	0.77%
2050	260,043	tons	

YR	Calculate Annual Tonnage Processed/Landfilled	Tons per Year	TPD
1	2038	236,879	800
2	2039	238,823	807
3	2040	240,816	814
4	2041	242,673	820
5	2042	244,544	826
6	2043	246,430	833
7	2044	248,330	839
8	2045	250,245	845
9	2046	252,175	852
#	2047	254,119	859
#	2048	256,079	865
#	2049	258,053	872
#	2050	260,043	879
#	2051	262,048	885
#	2052	264,069	892
#	2053	266,105	899
#	2054	268,157	906
#	2055	270,225	913
#	2056	272,308	920
#	2057	274,408	927
#	2058	276,524	934
#	2059	278,656	941
#	2060	280,805	949
#	2061	282,970	956
#	2062	285,152	963
#	2063	287,351	971
#	2064	289,567	978
#	2065	291,800	986
#	2066	294,050	993
#	2067	296,317	1001
#	2068	298,602	1009
#	2069	300,905	1017
#	2070	303,225	1024
#	2071	305,563	1032
#	2072	307,919	1040
#	2073	310,294	1048
#	2074	312,686	1056
#	2075	315,097	1065
#	2076	317,527	1073
#	2077	319,975	1081
#	2078	322,443	1089
#	2079	324,929	1098
#	2080	327,435	1106
#	2081	329,960	1115
#	2082	332,504	1123
#	2083	335,068	1132
#	2084	337,651	1141
#	2085	340,255	1150
#	2086	342,879	1158
#	2087	345,523	1167
	2088		
	TOTAL ESTIMATED FOR POTENTIAL PROCESSED/LF	**14,400,160**	**tons**

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021 Revised: 12/13/2021			
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design			
Costs:	2021$	Process Size:	690 TPD	
Location:	Linn County, Iowa	Required Land:	21 Acres	
Worksheet:	**MWP-RDF Capital Cost**	**TOTAL MWP-RDF CAP$**		**$156,207,200**

SCENARIO 3
CRLCSWA MWP-RDF w/ NEW LANDFILL OPTION
MWP-RDF CAPITAL COST ESTIMATE SUMMARY [(1)(2)]

MWP-RDF Capital	**Quantity**	**Unit**	**Unit Price**	**Total**		
MWP-RDF Building	112,000	SF	$ 200	$ 22,400,000	*Includes building, foundations, floors, HVAC*	
Equipment-RDF Process	2	EA	$ 10,000,000	$ 20,000,000	*Shredders, magnets, screens, eddy current*	
Equipment-AI/Optical Sorters, Robotics	2	EA	$ 15,000,000	$ 30,000,000	*On both process lines*	
Equipment-Install & Start-up	20%	LS	$ 50,000,000	$ 10,000,000	*Vendor cost*	
Dust Collection System	1	EA	$ 3,000,000	$ 3,000,000		
Site Investigations	1	LS	$ 250,000	$ 250,000	*Geotech*	
Site Work						
Mobilization/Demob	1	LS	$ 300,000	$ 300,000		
Clear & Grub	11	Acres	$ 2,000	$ 21,000	*Assume no demolition; half of area*	
Bulk Excavation/Grading	16,600	CY	$ 3	$ 49,800	*Adequate quantity & quality of soils on-site*	
Structural Fill	16,600	CY	$ 10	$ 166,000	*Assume 100% of bulk excavation quantities*	
Roadways	4,000	SY	$ 45	$ 180,000	*4" asphalt over 6" granular base*	
Stormwater Pond	1	LS	$ 200,000	$ 200,000		
Site Drainage/Erosion Control	1	EA	$ 50,000	$ 50,000		
Site Utilities						
Electrical - New Service to Site	1	LS	$ 2,000,000	$ 2,000,000	*From 1 mile away; extra for MWP-RDF*	1.3%
Water Supply & Fire Protection	1	LS	$ 1,560,000	$ 1,560,000	*From 1 mile away*	1.0%
Sanitary Sewer	1	EA	$ 1,560,000	$ 1,560,000	*From 1 mile away*	1.0%
Natural Gas System	1	LS	$ 1,500,000	$ 1,500,000	*Estimate, From 1 mile away*	1.0%
Surveying	1	EA	$ 25,000	$ 25,000		
Screening, Landscaping, Signage	1	EA	$ 60,000	$ 60,000	*Allowance*	
Fencing	3,800	LF	$ 35	$ 133,000	*Site Perimeter*	
Market Variability Factor	30%	Capital $	$ 93,454,800	$ 28,036,400	*Vertical construction*	
SUBTOTAL MWP-RDF CONSTRUCTION				**$ 121,491,200**		

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	LS	$ 61,491,200	$ 12,298,200	*Without Land & Equip*
Contingency - Process/Sort Equip	10%	LS	$ 60,000,000	$ 6,000,000	*Process equipment only*
Eng., Design, Constr. Admin & CQA	12%	LS	$ 121,491,200	$ 14,578,900	*Percentage of total capital less land*
Permitting (Local & IDNR)	1%	LS	$ 121,491,200	$ 1,214,900	*Percentage of total capital less land*
SUBTOTAL MWP-RDF SOFT COSTS				**$ 34,092,000**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Loader (large)	1	EA	$ 400,000	$ 400,000	
Skid Loader	1	EA	$ 50,000	$ 50,000	
Roll-Off Truck	1	EA	$ 110,000	$ 110,000	
Roll-Off Containers	8	EA	$ 8,000	$ 64,000	*Rejects & Process Residue/Fines, Mat'ls*
Forklift	0	EA	$ 50,000	$ -	
Yard Tractor	0	EA	$ 100,000	$ -	
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*
Transfer Trucks & Trailers - See Haul Costs					*Included in haul cost per ton*
SUBTOTAL				**$ 624,000**	

ASSUMPTIONS:

1. No sales tax is included. Assumed facility is tax exempt.
2. Costs rounded to nearest thousand.
3. Does not include financing costs.
4. Assumed project to be competitively bid under one general contract.
5. Assumed construction to be during normal working hours.
6. The construction costs are used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Project:	CRLCSWA Infrastructure Options				
Date:	11/23/2021				
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design				
Costs:	2021$	Process Size	690 TPD	**MAT'L REV$**	**$307,000**
Location:	Linn County, Iowa			**OTHER REVENUES$**	**$335,700**
Worksheet:	**MWP-RDF O&M Costs**			**ANNUAL MWP-RDF O&M$**	**$8,869,800**

SCENARIO 3
CRLCSWA MWP-RDF w/ NEW LANDFILL OPTION
MWP-RDF OPERATIONS COST ESTIMATE SUMMARY (1)

MWP-RDF Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 1,148,600	*FY2021 fully-burdened salary, escalated*
Scalehouse Personnel	0	FTE	$ 82,000	$ -		*Included w/ Scalehouse operations*
MWP-RDF Manager	1	FTE	$ 124,800	$ 124,800		*Estimated rate*
Loader Operator	3	FTE	$ 103,800	$ 311,400		
Spotters/Laborers	2	FTE	$ 52,000	$ 104,000		*Estimated rate, at tipping floor*
Sorters	0	FTE	$ 41,600	$ -		*No manual sorting; robotics/AI assumed*
Process Operators	3	FTE	$ 100,200	$ 300,600		*Estimate*
Roll-Off/Misc. Equip	1	FTE	$ 100,200	$ 100,200		*Estimate*
Maintenance/Mechanic	2	FTE	$ 103,800	$ 207,600		*Maintain building & process equipment*
Transfer Drivers - See Haul Costs						*Included in haul costs per ton*
Utilities					$ 370,300	
Electricity	2,240,000	kWh	$ 0.15	$ 336,000		*20 kWh/SF estimate*
Water & Sewer	1	LS	$ 5,000	$ 5,000		*Estimate - limited commercial/industrial*
Natural Gas/Heating Fuel	1	LS	$ 24,000	$ 24,000		*Avg 0.3 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 440	$ 5,300		*Estimate based on FTE*
Maintenance and Repairs					$ 833,500	
Building	1%	Capital $	$ 22,400,000	$ 224,000		*Percentage of building capital*
Process Equipment	1%	Capital $	$ 20,000,000	$ 200,000		*Percentage of process equipment capital*
AI/Optical & Robotics	1%	Capital $	$ 30,000,000	$ 300,000		*Percentage of equipment capital*
Mobile Equipment	7,300	hours	$ 15	$ 109,500		*Avg mobile equip operating hrs; not include transfer*
Supplies	1	LS	$ 100,000	$ 100,000	$ 100,000	*Estimate*
Fuel	21,900	gallons	$ 3.50	$ 76,700	$ 76,700	*Assume 3 gallons per hour operating*
Consulting/Eng Services	1	LS	$ 200,000	$ 200,000	$ 200,000	*Estimate-MWP-RDF plus existing facilities*
MWP-RDF Facility Insurance	0.1%	Capital $	$ 121,491,200	$ 121,500	$ 121,500	*Percentage of MWP total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL MWP-RDF DIRECT OPERATIONS					**$ 2,850,600**	

MWP-RDF Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Mobile Equipment Replacement					$ 85,200	
Loaders	1	EA	$ 57,143	$ 57,100		*Capital cost divided by 7-yr life*
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Roll-Off Truck	1	EA	$ 11,000	$ 11,000		*Capital cost divided by 10-yr life*
Roll-Off Containers	8	EA	$ 800	$ 6,400		*Capital cost divided by 10-yr life*
Forklift	0	EA	$ 5,000	$ -		*Capital cost divided by 10-yr life*
Yard Tractor	0	EA	$ 10,000	$ -		*Capital cost divided by 10-yr life*
Pick-up Truck	1	EA	$ 5,714	$ 5,700		*Capital cost divided by 7-yr life*
Trucks & Trailers - See Haul Costs						*Included in haul costs per ton*
Process Equipment					$ 5,000,000	
RDF Process Equipment	2	EA	$ 1,000,000	$ 2,000,000		*Capital cost divided by 10-yr life*
Optical & Robotics Equip	2	EA	$ 1,500,000	$ 3,000,000		*Capital cost divided by 10-yr life*
Building Replacement	1	EA	$ 896,000	$ 896,000	$ 896,000	*Bldg capital cost divided by 25-yr life*
Operating Cash Reserve	1	LS	$ 38,000	$ 38,000	$ 38,000	*CRLCSWA FY2021 Budget, rounded*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*Estimate from Agency, NA if compost w/ MWP*
SUBTOTAL CASH RESERVES					**$ 6,019,200**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Grants/Investments/ Other	1	LS	$ 281,300	$ 281,300	$ 281,300	*CRLCSWA FY2022 Budget*
Non-Cash Adjustments	1	LS	$ 25,000	$ 25,000	$ 25,000	*CRLCSWA FY2022 Budget*
Other Misc. Revenue	1	LS	$ 29,400	$ 29,400	$ 29,400	*CRLCSWA FY2022 Budget*
Ferrous Recovered Mat'ls Rev	1,906	Tons	$ 140	$ 266,800	$ 266,800	*Source: Price of Scrap Metals.com Iowa*
Non-Ferrous Recovered Mat'ls Rev	762	Tons	$ 660	$ 503,200	$ 503,200	*Source: Price of Scrap Metals.com Iowa*
Plastics #1 Mat'ls Rev	381	Tons	$ 470	$ 179,200	$ 179,200	*Source: Resource Recycling, national avg July 2021*
Plastics #2 Mat'ls Rev	191	Tons	$ 1,630	$ 310,700	$ 310,700	*Source: Resource Recycling, national avg July 2021*
OCC Recovered Mat'ls Rev	1,906	Tons	$ 130	$ 247,800	$ 247,800	*Source: Resource Recycling, national avg July 2021*

Project:	CRLCSWA Infrastructure Options				
Date:	11/23/2021				
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design				
Costs:	2021$	Process Size	690 TPD	**MAT'L REV$**	**$307,000**
Location:	Linn County, Iowa			**OTHER REVENUES$**	**$335,700**
Worksheet:	**MWP-RDF O&M Costs**			**ANNUAL MWP-RDF O&M$**	**$8,869,800**

RDF Revenue	133,414	Tons	($9)	($1,200,700)	($1,200,700)	*RDF 6000 BTU/lb, Coal Offset $0.75/MMBTU*
SUBTOTAL OTHER REVENUES					**$ 642,700**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   No Shifts = 1 8 hours per shift
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options
Date:	11/23/2021
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**RDF Haul Costs** **ANNUAL HAUL$** **$1,832,000**

SCENARIO 3
CRLCSWA MWP-RDF w/ NEW LANDFILL OPTION
RDF HAUL COST ESTIMATE SUMMARY

	50-Mile Radius	100-Mile Radius	*Comments*
Number of Trailer Loads	7,412	7,412	*Assumes average 18 ton payload for RDF*
Tonnage (tpy):	**133,414**	**133,414**	*Year 1 - RDF Production*
Load & Unload Time (minutes):	30	30	*Estimate*
One-Way Distance (miles)	**50**	**100**	
Average Speed (mph):	55	60	*From route mapping in area*
Average Trips/Year:	7,412	7,412	
Average Trips/Month:	618	618	
Average Trips/Week:	143	143	
Hours Per Trip	2.3	3.8	
Weekly Freight Hours:	332	548	
Wkly Prorated Veh Inspect/Breaks:	6.0	6.0	*1 hour per day*
Annual Freight Hours:	17,238	28,505	*Freight hours only for vehicle fuel, oil & grease cost*
Total Miles/Yr	741,200	1,482,400	

Annual Costs Assumptions:			
Driver Labor			
Drivers (based on total time)	9	14	
Driver annual salary	$62,200	$62,200	*Bureau of Labor Statistics-CR, Iowa, heavy truck driver*
Fringe benefits (% of salary)	35%	35%	*Included in annual salary*
Fuel, Oil & Grease			
Fuel Cost per Gallon	$3.50	$3.50	*Diesel Fuel 2021-US EIA, Mid-West average*
Miles per Gallon	6.5	6.5	*North American Council for Freight Efficiency*
Oil & Grease ($/freight hour)	$0.50	$0.50	*Estimate*
Tires			
New Tires Price	$425	$425	*Estimate*
# New Tires Per 50,000 Miles	18	18	*6 tires on tractor & 12 tires on trailers*
Maintenance & Repairs			
Mechanic Labor annual salary	$81,000	$81,000	*Bureau of Labor Statistics-CR, Iowa, heavy equip mech*
Mechanic Labor % per Truck	2%	2%	
Parts, Repairs, Overhaul ($/mile)	$0.25	$0.25	
Truck Amortization			
Number of Tractors	9	14	*Update based on loads/day*
Capital Cost - per semi-truck	$115,000	$115,000	*New truck price based on historic vendor/project data*
Resale Value (% of truck $)	30%	30%	*Used trucks good condition $25K to $40K*
Replacement Schedule (years)	7	7	
Interest Rate	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	
Trailer Amortization			
Number of Trailers	10	15	*Includes spares at 10%*
Capital Cost -- per trailer	$70,000	$70,000	*Walking floor - new*
Resale Value (% of purchase $)	15%	15%	*Used trailers good condition $7K to $10K*
Replacement Schedule (years)	7	7	
Interest Rate	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	
Insurance, License & Taxes (per yr/truck) @ 2.5% $ Capital Cost	$2,900	$2,900	*Estimate % of capital cost of truck*

Project:	CRLCSWA Infrastructure Options		
Date:	11/23/2021		
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa		
Worksheet:	**RDF Haul Costs**	**ANNUAL HAUL$**	**$1,832,000**

Overhead & Profit - Contract Haul @ % of O&M 20% 20% *Contingency or OHP on contract haul*

Annual Haul Cost to Market:	50-Mile Radius	100-Mile Radius	Comments
Driver Labor	$559,800	$870,800	Time Based
Fuel, Oil & Grease	$407,700	$812,500	Mileage & Time Based
Tires	$113,400	$226,800	Mileage Based
Maintenance & Repairs	$199,900	$393,300	Mileage & Time Based
Truck Amortization	$120,700	$187,800	100% Utilized
Trailer Amortization	$99,100	$148,700	100% Utilized
Insurance, Licensing & Taxes	$26,100	$40,600	No. trucks
Overhead & Profit	$305,300	$536,100	
RDF Haul Cost to Kiln/Other	**$1,832,000**	**$3,216,600**	
Total Haul Cost/Ton	**$13.73**	**$24.11**	

Transfer Trucks Capital Cost	$1,035,000	$1,610,000
Transfer Trailers Capital Cost	$700,000	$1,050,000
Total Truck/Trailers Capital	**$1,735,000**	**$2,660,000**

Project:	CRLCSWA Infrastructure Options
Date:	11/10/2021
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MSW Landfill Sizing**

SCENARIO 3
CRLCSWA MWP-RDF W/ NEW LANDFILL OPTION
SIZING LANDFILL

Landfill Sizing Components	**Calculations**		**Comments/Notes**		
Size	50	acres			
Width Est	1455	feet	Check of dimensions =	50.1	acres
Length Est	1500	feet			
Depth (top liner system)	30	feet	Liner Sideslopes 3:1		
Ground Surface Area:	2,178,000	SF			
Bottom Area:	1,683,000	SF			
VOLUME-below ground surface	**2,150,000**	**CY**			
Height (top of waste)	110	feet	Cap Sideslopes 4:1		
Top Area:	356,500	SF	Check top width/length=	597	feet
Ground Surface Area:	2,178,000	SF			
VOLUME-above ground surface	**5,160,000**	**CY**			
TOTAL WASTE VOLUME CAPACITY	**7,310,000**	**CY**			
Yr 2038-Yr 2088, Estimated Disposal	5,756,740	Tons	from calculation below		
Estimate Density, AUF	1,600	lbs/CY			
Minimum Required Volume:	**7,196,000**	**CY**		98%	of total
Landfill Life:	**50**	**years**			
Conceptual Roadways:					
Entrance Roadways	0	LF	Main entrance w/ Scalehouse		
Perimeter Roadways	5910	LF			
Minimum Site Area:	500' Buffer		1000' Buffer		
Site - Landfill, Buffer & Borrow	141	acres		278	acres

Tonnage Projections-Total Disposed

Year	**CRLCSWA Projections**		**Scenario 3 Landfilled Waste**		**Annual Increase**
2030	221,763	tons	88,654	tons	0.83%
2040	240,816	tons	96,271	tons	0.77%
2050	260,043	tons	103,957	tons	0.77%

YR	**Calculate Annual Tonnage Potential Disposal in New LF**	**Tons per Year**	**TPD**
1	2038	94,684	320
2	2039	95,474	323
3	2040	96,271	325
4	2041	97,013	328
5	2042	97,761	330
6	2043	98,515	333
7	2044	99,275	335
8	2045	100,040	338
9	2046	100,812	341

Project:	CRLCSWA Infrastructure Options
Date:	11/10/2021
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MSW Landfill Sizing**

10	2047	101,589	343
11	2048	102,373	346
12	2049	103,162	349
13	2050	103,957	351
14	2051	104,759	354
15	2052	105,567	357
16	2053	106,381	359
17	2054	107,201	362
18	2055	108,028	365
19	2056	108,861	368
20	2057	109,700	371
21	2058	110,546	373
22	2059	111,398	376
23	2060	112,257	379
24	2061	113,123	382
25	2062	113,995	385
26	2063	114,874	388
27	2064	115,760	391
28	2065	116,653	394
29	2066	117,552	397
30	2067	118,459	400
31	2068	119,372	403
32	2069	120,293	406
33	2070	121,220	410
34	2071	122,155	413
35	2072	123,097	416
36	2073	124,046	419
37	2074	125,003	422
38	2075	125,967	426
39	2076	126,938	429
40	2077	127,917	432
41	2078	128,903	435
42	2079	129,897	439
43	2080	130,899	442
44	2081	131,908	446
45	2082	132,925	449
46	2083	133,950	453
47	2084	134,983	456
48	2085	136,024	460
49	2086	137,073	463
50	2087	138,130	467
	2088		
TOTAL ESTIMATED TONS FOR POTENTIAL DISPOSAL		**5,756,741**	**tons**

Project:	CRLCSWA Infrastructure Options			
Date:	11/10/2021			
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design			
Costs:	2021$	LF Size:	50 Acres	
Location:	Linn County, Iowa	Land:	141 Acres	
Worksheet:	**MSW Landfill Capital Cost**	**TOTAL LF CAP$**		**$49,599,000**

SCENARIO 3
CRLCSWA MWP-RDF W/ NEW LANDFILL OPTION
CAPITAL COST ESTIMATE SUMMARY (1)(2)

Landfill Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations					
Hydrogeologic Characterization	1	LS	$ 200,000	$ 200,000	*Initial site investigations*
Supplemental Site Investigations	5	EA	$ 20,000	$ 100,000	*prior to each cell development*
Groundwater Monitoring Wells	7	EA	$ 8,000	$ 56,000	
Gas Migration Monitoring Probes	7	EA	$ 3,000	$ 21,000	
Site Work					
Mobilization/Demob	5	EA	$ 100,000	$ 500,000	*Number of cells construction*
Clear & Grub	25	Acres	$ 2,000	$ 50,000	*Assume no demolition; half of LF area*
Bulk Excavation	2,150,000	CY	$ 3	$ 6,450,000	*Adequate quantity & quality of soils on-site*
Structural Fill	645,000	CY	$ 10	$ 6,450,000	*Assume 30% of bulk excavation quantities*
Roadways	20,000	SY	$ 45	$ 900,000	*4" asphalt over 6" granular base*
Site Utilities					
Stormwater Pond	1	LS	$ 250,000	$ 250,000	*Estimate*
Site Drainage/Erosion Control	5	EA	$ 50,000	$ 250,000	*Number of cells construction*
Electrical Service	1	LS	$ 100,000	$ 100,000	*Extend electrical to landfill*
Water Supply & Fire Protection	1	LS	$ 100,000	$ 100,000	*Extend water supply to landfill*
Sanitary Sewer	-	EA	$ -	$ -	*Included w/ MWP-RDF Facility*
Natural Gas System	-	LS	$ -	$ -	*NA for Landfill*
Surveying	5	EA	$ 25,000	$ 125,000	
Screening, Landscaping, Signage	5	EA	$ 60,000	$ 300,000	*Allowance*
Fencing	9,900	LF	$ 35	$ 346,500	*LF site perimeter*
Liner & Leachate Collection System					
Composite Liner System	50	Acres	$ 250,000	$ 12,500,000	*Recompacted Clay, geomembrane, 12" granular, geotextile & protective cover*
Leachate Collection Pipes, Sumps, Pumps & Controls, Lift Station, Forcemain	8%	Liner $	$ 12,500,000	$ 1,000,000	
Leachate Lagoon	1	LS	$ 1,625,000	$ 1,625,000	*Estimate 5 acres lined + 30% for excavation*
Active Gas Collection System	50	Acres	$ -	$ -	*See Closure Costs - to begin within 2 or 5 years of first placement of waste*
Market Variability Factor	15%	Capital $	$ 31,323,500	$ 4,698,500	*Sitework, horizontal construction*
SUBTOTAL LANDFILL CAPITAL				**$ 36,022,000**	

Engineering (3)	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 36,022,000	$ 7,204,400
Engineering & Design	4%	Capital $	$ 36,022,000	$ 1,440,900
Permitting	2%	Capital $	$ 36,022,000	$ 720,400
Construction Observation/CQA	6%	Capital $	$ 36,022,000	$ 2,161,300
SUBTOTAL LANDFILL SOFT COSTS				**$ 11,527,000**

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Landfill Compactor	1	EA	$ 1,000,000	$ 1,000,000	*Replacement*
Track Dozer (D8 or similar)	1	EA	$ 800,000	$ 800,000	*Replacement*
Track Dozer (D6 or similar)	0	EA	$ 550,000	$ -	*Existing*
Excavator	0	EA	$ 1,000,000	$ -	*Existing*
Dump Trucks	0	EA	$ 200,000	$ -	*Existing*
Tanker Truck - Leachate Recirculation	1	EA	$ 250,000	$ 250,000	*New 4000-gallon tanker/water truck*
Water Truck	0	EA	$ 200,000	$ -	*Existing*
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*

Project:	CRLCSWA Infrastructure Options			
Date:	11/10/2021			
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design			
Costs:	2021$	LF Size:	50 Acres	
Location:	Linn County, Iowa	Land:	141 Acres	
Worksheet:	**MSW Landfill Capital Cost**	**TOTAL LF CAP$**		**$49,599,000**

SUBTOTAL **$ 2,050,000**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed cell projects to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options
Date:	11/10/2021
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MSW LF Closure & Post-Closure Costs** **ANNUAL FUND PAY-IN** **$381,120**

SCENARIO 3
CRLCSWA MWP-RDF W/ NEW LANDFILL OPTION
CLOSURE & POST-CLOSURE COSTS ESTIMATE SUMMARY (1)

LF Closure Costs	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Direct Capital Costs					$ 8,500,000	
MSW Landfill Capping System (2)	50	Acres	$ 120,000	$ 6,000,000		*Financial assurance $/acre w/ market variability*
Active LFG Collection System (3)	50	Acres	$ 27,000	$ 1,350,000		*Estimated $/acre w/ market variability*
LFG Blower Skid/Flare (4)	1	LS	$ 1,150,000	$ 1,150,000		*Estimate w/ market variability factor*
Contingency	10%	Capital $	$ 8,500,000	$ 850,000	$ 850,000	*10% contingency matches financial assurance*
Legal & Administrative	1	LS	$ 25,000	$ 25,000	$ 25,000	
Design/Engineering	8%	Capital $	$ 8,500,000	$ 680,000	$ 680,000	
Construction Observation / CQA	10%	Capital $	$ 8,500,000	$ 850,000	$ 850,000	
SUBTOTAL LF CLOSURE COSTS					**$ 10,905,000**	
ANNUAL CLOSURE FUND PAYMENT(7)					$218,100	

LF Post-Closure Costs	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Direct Post-Closure Operations					$ 7,410,000	
Annual Post-Closure (5)	30	Years	$ 167,000	$ 5,010,000		*Financial assurance $*
Active LFG System O&M (6)	30	Years	$ 80,000	$ 2,400,000		*Financial assurance $*
Contingency	10%	PC Ops$	$ 7,410,000	$ 741,000	$ 741,000	*10% contingency matches financial assurance*
SUBTOTAL LF POST-CLOSURE COSTS					**$ 8,151,000**	
ANNUAL POST-CLOSURE FUND PAYMENT(7)					$ 163,020	

ASSUMPTIONS:

(1) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.
Assumed projects to be comptetively bid.
Assumed construction to be during normal working hours.
(2) Estimate for composite capping system, terracing, letdown structures, vegetation, and supporting construction activities.
(3) Assumes installation of an active landfill gas collection system with extraction wells, piping, condensate management, system appurtenances, and general conditions.
(4) Assumes installation of landfill gas blower skid/flare and supporting site work, utilities, and general conditions.
(5) Estimate of post-closure care for cap and vegetation, leachate management, groundwater monitoring, LFG migration monitoring, stormwater and security.
(6) Estimate for LFG operations; repairs/maintenance of LFG collection wells, piping, blower, flare; and reporting requirements.
(7) Annual payment assumes site life of 50 years.

Project:	CRLCSWA Infrastructure Options		
Date:	11/10/2021		
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**LFG REVENUES$**	**$436,000**
Worksheet:	**MSW Landfill O&M Costs**	**ANNUAL LF O&M$**	**$2,185,100**

SCENARIO 3
CRLCSWA MWP-RDF W/ NEW LANDFILL OPTION
LF OPERATIONS COST ESTIMATE SUMMARY (1)

LF Direct Operations	Quantity	Unit	Unit Price	Annual Costs	Total	
Labor:					$ 619,400	*FY2021 fully-burdened salary, escalated*
Scalehouse Personnel	0	FTE	$ 82,000	$ -		*Included in Scalehouse operations*
LF Compactor Operator	2	FTE	$ 103,800	$ 207,600		
LF Equip Operators	2	FTE	$ 103,800	$ 207,600		
LF Leachate Recir/Misc.	1	FTE	$ 100,200	$ 100,200		
LF Spotters/Laborers	2	FTE	$ 52,000	$ 104,000		*Estimated rate*
LF Utilities					$ 16,200	
Electricity	25,000	kWh	$ 0.15	$ 3,800		*Assume for leachate & LFG management*
Water	1	LS	$ 10,000	$ 10,000		*Estimate - dust control, etc.*
Leachate	0	gallons	$ 0.15	$ -		*Assume full management on site*
Heating Fuel	0	LS	$ -	$ -		*None at LF area - See SW Campus Bldgs*
Phones	12	months	$ 200	$ 2,400		*Estimate, Use by # primary staff*
Maintenance and Repairs					$ 608,000	
Active LFG System O&M	1	LS	$ 48,000	$ 48,000		*None first 10 yrs; amortize over 50 yr life*
LFG-to-Energy O&M	1	LS	$ 228,000	$ 228,000		*None first 10 yrs; amortize over 50 yr life*
Roadways, Land & Misc LF Maintenance	0.2%	Capital $	$ 36,022,000	$ 72,000		*Percentage of LF capital*
Mobile Equipment	10,400	hours	$ 25	$ 260,000		*Avg equip operating hours, total*
LF Environmental Compliance					$ 79,800	
Groundwater Monitoring	1	LS	$ 56,000	$ 56,000		*From FY2022 HDR contract*
Groundwater Lab Analysis	1	LS	$ 16,300	$ 16,300		*CRLCSWA FY2022 Budget*
Leachate Levels Monitoring	1	LS	$ 5,000	$ 5,000		*From FY2022 HDR contract*
LFG Monitoring	1	LS	$ 2,500	$ 2,500		*From FY2022 HDR contract*
Supplies	1	LS	$ 15,000	$ 15,000	$ 15,000	*CRLCSWA FY2022 Budget, prorated to LF*
Fuel	31,200	gallons	$ 3.50	$ 109,200	$ 109,200	*Assume 3 gallons per hour operating*
Consulting/Eng Services	1	LS	$ 100,000	$ 100,000	$ 100,000	*Other-LF only*
LF Insurance	0.1%	Capital $	$ 36,022,000	$ 36,000	$ 36,000	*Percentage of LF total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL LF DIRECT OPERATIONS					**$ 1,583,600**	

LF Cash Reserves	Quantity	Unit	Unit Price	Annual Costs	Total	
Equipment Replacement					$ 601,500	*Rounded*
Compactor	1	EA	$ 200,000	$ 200,000		*Capital cost divided by 5-yr life*
Track Dozer (D8 or similar)	1	EA	$ 160,000	$ 160,000		*Capital cost divided by 5-yr life*
Track Dozer (D6 or similar)	0	EA	$ 110,000	$ -		*Capital cost divided by 5-yr life*
Excavator	1	EA	$ 142,857	$ 142,900		*Capital cost divided by 7-yr life*
Dump Trucks	1	EA	$ 28,571	$ 28,600		*Capital cost divided by 7-yr life*
Tanker Truck-Leachate Recirc	1	EA	$ 35,714	$ 35,700		*Capital cost divided by 7-yr life*
Water Truck	1	EA	$ 28,571	$ 28,600		*Capital cost divided by 7-yr life*
Pick-up Truck	1	EA	$ 5,714	$ 5,700		*Capital cost divided by 7-yr life*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included w/ MWP-RDF O&M*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 operations*
SUBTOTAL LF CASH RESERVES					**$ 601,500**	

Other Revenues	Quantity	Unit	Unit Price	Annual Costs	Total	
New LF Gas-to-Energy	1	LS	$ 436,000	$ 436,000	$ 436,000	*None first 10 yrs; amortize over 50 yr life*
SUBTOTAL OTHER REVENUES					**$ 436,000**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
COMPOST FACILITY SIZING

Compost Feedstock	***Initial Development, Year 2038***	***Long Term, Year 2088***	
Incoming Organics (tons)	38,118	55,601	*From SW Volumes Memo 6-10-2021*
% as Food Waste	10%	10%	*Food target percent for windrow ops*
Processing Days per Year	296	296	
Tons per Day	129	188	
Yard Waste Density (lb/cy)	650	650	
Yard Waste C:N Ratio	25	25	
Yard Waste Moisture Content	40%	40%	
Food Waste Density (lb/cy)	1,000	1,000	
Food Waste C:N Ratio	45	45	
Food Waste Moisture Content	60%	60%	
Target C:N Ratio	30 to 45	30 to 45	
Target Moisture Content	60%	60%	
Net Bulk Density at Arrival (lb/cy)	685	685	
Target Bulk Density (lb/cy)	850	850	
Net C:N Ratio	27	27	
Net Moisture Content	42%	42%	
Water to Add Initially (gal/yr)	**1,647,375**	**2,402,939**	
Annual Infeed Volume Processed (cy)	**111,295**	**162,340**	
Finished Compost Volume (cy)	61,212	89,287	
Density of Finished Compost (lb/cy)	800	800	
Finished Compost (tons)	**24,485**	**35,715**	
Composting Parameters			
Composting Period (days)	120	120	*6 months from incoming to screening*
Curing Period (days)	40	40	*Recommended*
Storage Period, Pre-Screening (days)	30	30	
Storage Period, Post-Screening (days)	30	30	*Total 60 days compost storage*
Initial Windrow Shrinkage Factor	10%	10%	
Compost Shrinkage Factor	30%	30%	
Curing Shrinkage Factor	5%	5%	
Unloading/Receiving Area			
Yard Waste Daily Pile Volume (cy)	357	520	
2x YW for Peak Day (cy)	713	1040	*Daily yard waste*
YW Pile Height (ft)	10	10	
YW Pile Area (sf)	*1,926*	*2,809*	
Wood & Leaves Pile Volumes (cy)	10,556	15,397	*Assume 10% of annual raw material*
Wood/Leaves Pile Height (ft)	10	10	*For raw material mixing ratios*
Wood/Leaves Pile Area (sf)	*28,501*	*41,573*	*Storage piles for wood chips & leaves*
Food Waste Pile Volume (cy)	26	38	
2x FW for Peak Day (cy)	52	75	*Daily food waste*
FW Pile Height (ft)	5	5	

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

FW Pile Area (sf)	*278*	*406*	
Hours per Day YW/FW Receipt	9	9	
Vehicles Peaking Factor	1.5	1.5	
Vehicles Payload (avg tons/vehicle)	2	2	*Assumption*
Unloading Time for Loads (minutes)	10	10	*Assumption*
No. Vehicles per Hour (vph)	11	16	
Total Number Unloading Bays	2	3	
Area per Unloading Bay (sf)	720	720	
Unloading Bay Space (sf)	*1,440*	*2,160*	
Maneuvering Space (sf)	*3,600*	*5,400*	
Total Unloading/Receiving Space (sf)	**35,745**	**52,347**	
Compost Pad			
Average Volume on Compost Pad (cy)	32,931	48,035	
Compost Windrow Length (ft)	200	200	
Compost Windrow Height (ft)	6	6	*To confirm w/ CRLCSWA*
Compost Windrow Width (ft)	14	14	*To confirm w/ CRLCSWA*
Volume per Row (cy)	373	373	
Number of Rows	89	129	
Spacing Between Windrows (ft)	8	8	
Total Compost Pad Area (sf)	**391,600**	**567,600**	
Compost Curing Pad			
Average Volume on Curing Pad (cy)	7,318	10,674	
Curing Windrow Length (ft)	100	100	
Curing Windrow Height (ft)	7	7	*To confirm w/ CRLCSWA*
Curing Windrow Width (ft)	16	16	*To confirm w/ CRLCSWA*
Volume per Row (cy)	249	249	
Number of Rows	30	43	
Spacing Between Windrows (ft)	6	6	
Total Curing Pad Area (sf)	**66,000**	**94,600**	
Storage Pad1 - PreScreening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	
Total Storage Pad1 Area (sf)	**12,937**	**18,871**	
Finished Compost Screening Area			
Loading Traffic Area Width (ft)	50	50	
Loading Traffic Area Length (ft)	100	100	
Loading Traffic Area (sf)	*5,000*	*5,000*	
Mixing Bin/Screen w/ Stockpile Width (ft)	75	75	
Mixing Bin/Screen w/ Stockpile Length (ft)	100	100	
Mixing Bin/Screen w/ Stockpile Area (sf)	*7,500*	*7,500*	
Total Screening Area (sf)	**12,500**	**12,500**	
Storage Pad2 - Post-Screening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

Total Storage Pad2 Area (sf)	**12,937**	**18,871**	
Traffic Lanes for Operations			
Traffic Lane Width (ft)	20	20	
Cummulative Processing Area (sf)	531,719	764,789	
Square Root (ft)	729	875	
Traffic Lane Length =	2,917	3,498	
Total Operations Traffic Lanes Area (sf)	**58,335**	**69,962**	
Retention/Leachate Pond			
Area Contributing to Pond (sf)	590,054	834,751	*Total of Areas above*
100-Yr 24 hr Stor Event Rainfall Intensity I	0.310	0.310	PF Map: Contiguous US (noaa.gov)
Area A (acres)	13.5	19.2	
Run-off Factor C	0.60	0.60	
Flow Rate Q (cfs)	2.5	3.6	*using Rational Formula Q=CIA*
Time to Retain (hours)	24	24	
Volume of Water to Retain (cf)	217,394	307,547	
Depth of Pond (ft)	6	6	
Side Slopes of Pond #:1	4	4	
Pond Area at 1/2 Depth (sf)	36,232	51,258	*Volume divided by Depth*
Length & Width at 1/2 Depth (ft)	190	226	
Total Pond Area (sf)	**45,945**	**62,701**	*at grade*
SUMMARY OF COMPOST AREAS			
Unloading/Receiving Area	35,745	52,347	
Compost Pad	391,600	567,600	
Compost Curing Pad	66,000	94,600	
Storage Pad1 - Pre-Screening	12,937	18,871	
Finished Compost Screening Area	12,500	12,500	
Storage Pad2 - Post-Screening	12,937	18,871	
Traffic Lanes for Operations	58,335	69,962	
Retention/Leachate Pond	45,945	62,701	
TOTAL REQUIRED AREA (sf)	**635,999**	**897,452**	
TOTAL REQUIRED AREA (acres)	**14.60**	**20.60**	
Site - Composting & Buffer (acres)	**23**	**30**	*Assume 100' buffer*

Project:	CRLCSWA Infrastructure Options				
Date:	11/9/2021				
Facility:	New Aerobic Organics Compost Site - Windrows - No Design				
Costs:	2021$	Facility Size:	21	Acres	
Location:	Linn County, Iowa	Required Land:	30	Acres	
Worksheet:	**Composting Capital Costs**	**TOTAL COMPOST CAP$**			**$9,052,700**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
CAPITAL COST ESTIMATE SUMMARY (1)(2)

Compost Site Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations	1	LS	$ 50,000	$ 50,000	*Assumption*
Site Work					
Mobilization/Demob	1	LS	$ 50,000	$ 50,000	
Clear & Grub	11	Acres	$ 2,000	$ 22,000	*Assume no demolition; half compost area*
Grading/Excavation	67,800	CY	$ 3	$ 203,400	*Assume 2' across compost area*
Structural Fill	20,300	CY	$ 10	$ 203,000	*Assume 30% of excavation quantities*
Roadways	9,100	SY	$ 45	$ 409,500	*4" asphalt over 6" granular base*
Site Utilities					
Stormwater Pond	-	LS	$ 200,000	$ -	*See Compost Leachate Lagoon*
Site Drainage/Erosion Control	1	EA	$ 25,000	$ 25,000	
Electrical - Service to Site	-	LS	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Water Supply & Fire Protection	1	LS	$ 100,000	$ 100,000	*Extend water supply to compost facility*
Sanitary Sewer	-	EA	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Natural Gas System	-	LS	$ -	$ -	*NA*
Surveying	1	EA	$ 10,000	$ 10,000	*For composting area only*
Landscaping, Signage	1	EA	$ 20,000	$ 20,000	*For composting area only*
Fencing	4,600	LF	$ 35	$ 161,000	*Around composting area*
Pads & Leachate Collection					
Composting & Curing Pads	73,600	SY	$ 45	$ 3,312,000	*Asphalt Pad - Full Buildout*
Screening/Storage Areas	5,600	SY	$ 25	$ 140,000	*Compacted Gravel Pad - Full Buildout*
Compost Leachate Lagoon, Lined	1	LS	$ 500,000	$ 500,000	*Approximate 2 acres*
Market Variability Factor	15%	Capital $	$ 5,205,900	$ 781,000	*Sitework, horizontal construction*
SUBTOTAL COMPOST SITE CAPITAL				**$ 5,986,900**	

Engineering (3)	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 5,986,900	$ 1,197,400
Engineering & Design	4%	Capital $	$ 5,986,900	$ 239,500
Permitting (Local & IDNR)	2%	Capital $	$ 5,986,900	$ 119,700
Construction Observation/CQA	6%	Capital $	$ 5,986,900	$ 359,200
SUBTOTAL COMPOST SOFT COSTS				**$ 1,915,800**

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Windrow Turner	1	EA	$ 750,000	$ 750,000	*Replacement*
Loader (large)	1	EA	$ 400,000	$ 400,000	*Replacement*
Water Truck	0	EA	$ 200,000	$ -	*Existing*
Screen Compost Finish	0	EA	$ 300,000	$ -	*Existing*
Grinder/Shredder	0	EA	$ 600,000	$ -	*Existing*
Conveyors	0	EA	$ 75,000	$ -	*NA - included w/ screener or grinder*
SUBTOTAL				**$ 1,150,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing co Does not include financing costs.

Assumed cell projects to be c Assumed cell projects to be competitively bid under one general contract.

Assumed construction to be d Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	New Aerobic Organics Compost Site - Windrows - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**COMPOST REV$**	**$1,091,100**
Worksheet:	**Composting O&M Costs**	**TOTAL COMPOST O&M$**	**$1,171,200**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
OPERATIONS COST ESTIMATE SUMMARY [1]

Compost Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 511,800	*FY2021 fully-burdened salary, escalated*
Scalehouse	0.0	FTE	$ 82,000	$ -		*Included in LF, TS, MWP, AD or WTE*
Windrow Turner Operator	1.5	FTE	$ 103,800	$ 155,700		
Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
Misc. Equip Operator	2.0	FTE	$ 100,200	$ 200,400		*Water truck, grinder, screen, turner, loader*
Utilities					$ 27,400	
Electricity	0	kWh	$ 0.15	$ -		*NA*
Water	1	LS	$ 25,000	$ 25,000		*130 gal/ton for composting, dust control*
Leachate	0	gallons	$ 0.15	$ -		*NA - Compost leachate NPDES Discharge*
Heating Fuel	0	LS	$ 2,500	$ -		*NA*
Phones	12	months	$ 200	$ 2,400		*Estimate based on # labor*
Maintenance and Repairs					$ 153,500	
Roadways, Pads Repair & Misc Maintenance	0.3%	Capital $	$ 5,986,900	$ 18,000		*Percentage of Compost capital*
Windrow Turner	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Loader	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Truck/Screen Equipment	2,368	hours	$ 15	$ 35,500		*80% of personnel hours*
Grinder	208	hours	$ 25	$ 5,200		*Estimate 4 hours per week*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	21,936	gallons	$ 3.50	$ 76,800	$ 76,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Insurance	0.1%	Capital $	$ 5,986,900	$ 6,000	$ 6,000	*Percentage of compost total capital*
Compost Lab Testing	1	LS	$ 5,000	$ 5,000	$ 5,000	*Portion from CRLCSWA FY2022 Budget*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL COMPOST DIRECT OPERATIONS					**$ 785,500**	

Compost Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 385,700	*Rounded*
Windrow Turner	1	EA	$ 150,000	$ 150,000		*Capital cost divided by 5-yr life*
Loader	1	EA	$ 57,143	$ 57,100		*Capital cost divided by 7-yr life*
Water Truck	1	EA	$ 28,600	$ 28,600		*Shared w/ TS for roads dust control*
Screen Compost Finish	1	EA	$ 30,000	$ 30,000		*Capital cost divided by 10-yr life*
Grinder/Shredder	1	EA	$ 120,000	$ 120,000		*Capital cost divided by 5-yr life*
Conveyors	0	EA	$ 7,500	$ -		*Included w/ screen or grinder*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 composting*
SUBTOTAL LF CASH RESERVES					**$ 385,700**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Compost Sales	7,345	Ton	$ 24	$ 176,300	$ 176,300	*Assume 30% compost sales to businesses*
Tip Fees	38,118	Ton	$ 24	$ 914,800	$ 914,800	*Current CRLCSWA unit price*
Non-Cash Adjustments	0	LS	$ 25,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
SUBTOTAL OTHER REVENUES					**$ 1,091,100**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options		
Date:	11/23/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$	Land:	10 Acres
Location:	Linn County, Iowa		
Worksheet:	**Scalehouse & Scales Capital Costs**	**TOTAL CAP$**	**$2,189,600**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
SCALEHOUSE CAPITAL COST ESTIMATE SUMMARY (1)(2)

Scalehouse Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scalehouse	600	SF	$ 250	$ 150,000	*Approx. current size*
Entrance & Queuing Roads	13,300	SY	$ 60	$ 798,000	*Concrete 4" over 6" granular base, 3000LF*
Road, Scale Approach, Parking	1,200	SY	$ 60	$ 72,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 15,000	$ 15,000	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,035,000	$ 310,500	*Vertical construction*
SUBTOTAL				**$ 1,345,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,345,500	$ 269,100	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,345,500	$ 161,500	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,345,500	$ 13,500	*Percentage of total capital*
SUBTOTAL				**$ 444,100**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scales	3	EA	$ 125,000	$ 375,000	*New*
Software	1	EA	$ 25,000	$ 25,000	*Software used for LF, Compost, RRC, etc.*
SUBTOTAL				**$ 400,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Admin/Educational Center Capital Cost**	**TOTAL CAP$**		**$2,878,100**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
ADMIN CAPITAL COST ESTIMATE SUMMARY (1)(2)

Administration & Educational Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Two-Story Building	5,500	SF	$ 250	$ 1,375,000	*Building footprint SF; same size as current*
Access Road & Parking	2,300	SY	$ 45	$ 103,500	*Asphalt 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 137,500	$ 137,500	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,616,000	$ 484,800	*Vertical construction*
SUBTOTAL				**$ 2,100,800**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 2,100,800	$ 420,200	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 2,100,800	$ 336,100	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 2,100,800	$ 21,000	*Percentage of total capital*
SUBTOTAL				**$ 777,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**
None at Admin Center				
SUBTOTAL				**$ -**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/9/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	4 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Resource Recovery Center Capital Cost**	**TOTAL CAP$**		**$9,933,900**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
RRC CAPITAL COST ESTIMATE SUMMARY (1)(2)

RRC Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
HHM Canopy - Covered Drive	2,000	SF	$ 25	$ 50,000	*CRLCSWA current size*
HHM Facility	8,000	SF	$ 300	$ 2,400,000	*CRLCSWA current size*
RRC Bldg	6,700	SF	$ 250	$ 1,675,000	*Size for just recyclables transfer*
RRC Office/Breakroom/Restrooms	3,600	SF	$ 200	$ 720,000	*CRLCSWA current size*
Access Road, Parking & Maneuvering	5,600	SY	$ 60	$ 336,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 239,750	$ 239,800	*5% of buildings cost*
Market Variability Factor	30%	Capital $	$ 5,420,800	$ 1,626,200	*Vertical construction*
SUBTOTAL				**$ 7,047,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 7,047,000	$ 1,409,400	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 7,047,000	$ 986,600	*Percentage of total capital*
Permitting (Local & IDNR)	2%	Capital $	$ 7,047,000	$ 140,900	*Percentage of total capital*
SUBTOTAL				**$ 2,536,900**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Baler	0	EA	$ 1,000,000	$ -	*Assumes RRC recyclabes transfer only*
Forklift	1	EA	$ 50,000	$ 50,000	*For HHM Facility*
Skid Loader	0	EA	$ 50,000	$ -	*Existing*
Mid-Size Loader	1	EA	$ 300,000	$ 300,000	*Share w/ Citizen Drop-Off and Bunkers*
Roll-off Containers	0	EA	$ 8,000	$ -	*Existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from Citizen Drop-Off*
Trailers	0	EA	$ 30,000	$ -	*Assume provided by end market*
Trucks	0	EA	$ 115,000	$ -	*Assume provided by end market*
SUBTOTAL				**$ 350,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

(3) Sizing for RRC Building

RRC Transfer Sizing	**Year 1**	**Year 50**	
Incoming Recyclables, TPY	4,045	5,943	*Single stream recyclables/drop box handled by CRLCSWA*
Incoming Recyclables, TPD	16	23	*5 days/week*
Incoming Recyclables, TPH	2	3	*8 hours/day*
Number of Unloading Bays	2	2	*Avg 3 tons/veh, 2x peak factor, 15 min unload + 1 extra*
Recyclables - Floor Storage (CY)	247	363	*126 lbs/CY, 1 day worth*
Recyclables - Trailer Payload	7	7	*tons/trailer* *126 lbs/CY*
Area Needed (SF):			
Tipping Floor	3,700	4,400	*Recyclables piled avg 4' high + unloading area*
Transfer Loadout Area Area	1,200	1,200	*60' x 1 trailer load-out lane*
Flex Area	1,000	1,100	*20% extra*
RRC Transfer Building (SF)	**5,900**	**6,700**	

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Maintenance Shop Capital Cost**	**TOTAL CAP$**		**$4,694,100**

SCENARIO 3
CRLCSWA SOLID WASTE CAMPUS FACILITIES
MAINT SHOP CAPITAL COST ESTIMATE SUMMARY (1)(2)

Maintenance Facility Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Maintenance Facility	17,200	SF	$ 150	$ 2,580,000	*CRLCSWA current sizes, LF+Site #3 compost*
Access Road & Maneuvering Area	1,200	SY	$ 45	$ 54,000	*Asphalt 4" over 6" granular base*
Market Variability Factor	30%	Capital $	$ 2,634,000	$ 790,200	*Vertical construction*
SUBTOTAL				**$ 3,424,200**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 3,424,200	$ 684,800	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 3,424,200	$ 410,900	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 3,424,200	$ 34,200	*Percentage of total capital*
SUBTOTAL				**$ 1,129,900**	

Maintenance Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
5-ton Overhead Crane w/ Hoist	1	EA	$ 40,000	$ 40,000	*Crane vendors $35K w/ $5k installed*
Maint/Repair Equipment	1	EA	$ 100,000	$ 100,000	*Estimate*
SUBTOTAL				**$ 140,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/10/2021			
Facility:	SCENARIO 3: Mixed Waste Processing-RDF Concept - No Design			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Citizen Drop-Off Center Capital Cost**	**TOTAL CAP$**		**$238,100**

SCENARIO 3
CRLCSWA MWP-RDF W/ NEW LANDFILL OPTION
DROP-OFF CAPITAL COST ESTIMATE SUMMARY [(1)(2)]

Citizen Drop-Off Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Materials Bunkers Area	1,700	SY	$ 60	$ 102,000	*Concrete for tires, white goods, scrap metal*
Concrete Bunker Walls	80	CY	$ 600	$ 48,000	*3 bunkers 60'x 35' each*
Bulk Excavation & Structural Fill	0	CY	$ 13	$ -	*Suitable on-site soils*
Waste Unloading Area	0	SY	$ 60	$ -	*Citizens drop-off at MWP-RDF facility*
Roll-Off Area	0	SY	$ 60	$ -	*Citizens drop-off at MWP-RDF facility*
Concrete Z-Wall	0	CY	$ 600	$ -	*Citizens drop-off at MWP-RDF facility*
Market Variability Factor	15%	Capital $	$ 150,000	$ 22,500	*Sitework, horizontal construction*
SUBTOTAL				**$ 172,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 172,500	$ 34,500	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 172,500	$ 27,600	*Percentage of total capital*
Permitting (Local)	2%	Capital $	$ 172,500	$ 3,500	*Percentage of total capital*
SUBTOTAL				**$ 65,600**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Roll-off Containers	0	EA	$ 8,000	$ -	*1 glass; existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from MWP-RDF*
Skid Loader	0	EA	$ 50,000	$ -	*Share from RRC*
Mid-Size Loader	0	EA	$ 300,000	$ -	*Share from RRC*
SUBTOTAL				**$ -**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.
(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	10/28/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,811,500**

SCENARIO 1
CRLCSWA SOLID WASTE CAMPUS FACILITIES OPTION
OPERATIONS COST ESTIMATE SUMMARY (1)

Scalehouse Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 246,000	
Scalehouse Personnel	3	FTE	$ 82,000	$ 246,000		
Utilities					$ 4,300	
Electricity	6,000	kWh	$ 0.15	$ 900		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 1,000	$ 1,000		*Estimate - small building*
Heating Fuel	1	LS	$ 1,000	$ 1,000		*Estimate 1-2 Therms/SF/year*
Phones	12	months	$ 120	$ 1,400		*Estimate*
Maintenance and Repairs					$ 9,000	
Building	1%	Capital $	$ 150,000	$ 1,500		*Percentage of building capital*
Scales	2%	Capital $	$ 375,000	$ 7,500		*Percentage of scales capital*
Mobile Equipment	0	hours	$ 15	$ -		*None*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 525,000	$ 1,600	$ 1,600	*Percentage of building & scales total capital*
Cash Reserves Bldg/Equip Replacement					$ 31,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Scales	3	EA	$ 8,333	$ 25,000		*Capital divided by 15-yr life*
Scalehouse Building	1	EA	$ 6,000	$ 6,000		*Capital divided by 25-yr life*
SUBTOTAL SCALEHOUSE & SCALES					**$ 293,900**	

Administration & Educational Center Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Agency Labor:					$ 1,583,500	*Estimate 40% from CRLCSWA FY2022 Budget*
Executive Director	1	FTE				
Site Engineer	1	FTE				
Director of Education	1	FTE				
Hazardous Materials Manager	1	FTE				
Operations Foreman	1	FTE				
Admin Personnel	2	FTE				
Utilities					$ 47,500	
Electricity	110,000	kWh	$ 0.15	$ 16,500		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 5,000	$ 5,000		*Estimate - office building*
Natural Gas/Heating Fuel	1	LS	$ 8,000	$ 8,000		*Estimate 1 Therms/SF/year*
Phones	12	months	$ 1,500	$ 18,000		*Estimate*
Maintenance and Repairs					$ 34,500	
Building & Grounds	0.5%	Capital $	$ 2,100,800	$ 10,500		*Percentage of capital*
Mobile Equipment	936	hours	$ 5	$ 4,700		*Assume pick-up trucks maintenance*
Office Equipment	1	LS	$ 19,300	$ 19,300		*CRLCSWA FY2022 Budget*
Agency Purchased Services	1	LS	$ 511,700	$ 511,700	$ 511,700	*CRLCSWA FY2022 Budget*
Agency Supplies & Materials	1	LS	$ 20,900	$ 20,900	$ 20,900	*CRLCSWA FY2022 Budget*
Agency Other Costs	1	LS	$ 46,000	$ 46,000	$ 46,000	*CRLCSWA FY2022 Budget*
Other Operating Costs - Services					$ 222,500	
ECICOG	1	LS	$ 10,000	$ 10,000		*CRLCSWA FY2022 Budget*
Public Education	1	LS	$ 37,500	$ 37,500		*CRLCSWA FY2022 Budget*
Media Advertising	1	LS	$ 125,000	$ 125,000		*CRLCSWA FY2022 Budget*
Comprehensive Planning	1	LS	$ 50,000	$ 50,000		*Annual estimate over period*
Fuel	2,808	gallons	$ 3.50	$ 9,800	$ 9,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 2,100,800	$ 6,300	$ 6,300	*Percentage of capital*
Cash Reserves Bldg/Equip Replacement					$ 55,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Admin Building	1	EA	$ 55,000	$ 55,000		*Capital divided by 25 years*
SUBTOTAL ADMINISTRATION & EDUCATIONAL CENTER					**$ 2,537,700**	

Resource Recovery Center/HHW Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	

Project:	CRLCSWA Infrastructure Options		
Date:	10/28/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,811,500**

	Quantity	Unit	Unit Price	Annual Costs	Total	
Labor					$ 486,300	
Hazardous Materials Manager						*Included w/ Agency Labor in Admin/Ed Center*
RRC Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
HHW Facility Receiving	1.5	FTE	$ 82,000	$ 123,000		
HHW Facility Chemists	2.0	FTE	$ 103,800	$ 207,600		
Utilities					$ 59,600	
Electricity	274,500	kWh	$ 0.15	$ 41,200		*15 kWh/SF, mixed use*
Water & Sewer	1	LS	$ 3,000	$ 3,000		*Estimate*
Natural Gas/Heating Fuel	1	LS	$ 13,000	$ 13,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 200	$ 2,400		*Estimate*
Maintenance and Repairs					$ 43,000	
Building & Grounds	0.5%	Capital $	$ 7,047,000	$ 35,200		*Percentage of capital*
Mobile Equipment	520	hours	$ 15	$ 7,800		*Loader, assume 2 hrs per day*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	1,560	gallons	$ 3.50	$ 5,500	$ 5,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 7,047,000	$ 21,100	$ 21,100	*Percentage of building total capital*
Cash Reserves Bldg/Equip Replacement					$ 243,300	
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Loader	1	EA	$ 42,900	$ 42,900		*Capital cost divided by 7-yr life*
Roll-offs	2	EA	$ 800	$ 1,600		*Capital cost divided by 10-yr life*
RRC/HHW Buildings	1	EA	$ 193,800	$ 193,800		*Capital cost divided by 25-yr life*
Disposal/Management Services					$ 543,600	
HHW Disposal	1	LS	$ 90,000	$ 90,000		*CRLCSWA FY2022 Budget*
Electronics Disposal	1	LS	$ 67,700	$ 67,700		*CRLCSWA FY2022 Budget*
Batteries/Flourescents/Medical Waste	1	LS	$ 13,200	$ 13,200		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 24,900	$ 24,900		*CRLCSWA FY2022 Budget*
Tires	1	LS	$ 48,300	$ 48,300		*CRLCSWA FY2022 Budget*
Recycling Services	1	LS	$ 299,500	$ 299,500		*CRLCSWA FY2022 Budget*
SUBTOTAL RESOURCE RECOVERY CENTER					**$ 1,407,400**	

Maintenance Facility Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 311,400	
Mechanic/Maintenance	3	FTE	$ 103,800	$ 311,400		*Servicing all facilities' mobile equipment*
Utilities					$ 34,400	
Electricity	120,400	kWh	$ 0.15	$ 18,100		*Assume 7 kWh/SF repair shop*
Water & Sewer	1	LS	$ 2,500	$ 2,500		*Estimate*
Heating Fuel	1	LS	$ 12,000	$ 12,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 150	$ 1,800		*Estimate*
Maintenance and Repairs					$ 24,100	
Building & Grounds	0.5%	Capital $	$ 3,424,200	$ 17,100		*Percentage of capital*
Crane/Equipment	5%	Capital $	$ 140,000	$ 7,000		*Percentage of equipment capital*
Mobile Equipment	0	hours	$ 15	$ -		*Included w/ LF, TS, MWP, AD or WTE*
Supplies	1	LS	$ 78,600	$ 78,600	$ 78,600	*FY2022 Budget, Tools & Equipment, Shop*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 3,424,200	$ 10,300	$ 10,300	*Percentage of total capital*
Cash Reserves Bldg/Equip Replacement					$ 107,200	
Overhead Crane	1	EA	$ 4,000	$ 4,000		*Capital over 10-year life*
Maintenance Building	1	EA	$ 103,200	$ 103,200		*Capital over 25-year life*
SUBTOTAL MAINTENANCE FACILITY					**$ 566,000**	

Citizen Drop-Off Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:	Included with Labor for LF, TS, MWP, AD or WTE					*Shared Labor*
Utilities					$ -	
Electricity	0	kWh	$ 0.15	$ -		*Outdoors*
Water & Sewer	0	LS	$ -	$ -		*NA*
Heating Fuel	0	LS	$ -	$ -		*NA*
Phones	0	months	$ -	$ -		*NA*
Maintenance and Repairs					$ 2,400	
Paving/Pad Repairs	1%	Capital $	$ 102,000	$ 1,000		*Percentage of pad capital*
Mobile Equipment	96	hours	$ 15	$ 1,400		*Assume 8 hours/month*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*

Project:	CRLCSWA Infrastructure Options		
Date:	10/28/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,811,500**

Fuel	288	gallons	$ 3.50	$ 1,000	$ 1,000	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 102,000	$ 300	$ 300	*Percentage of construction capital*
Cash Reserves Equipment Replacement						
Roll-off Containers	1	EA	$ 800	$ 800	$ 800	*Capital over 10-year life*
Roll-off Truck	0	EA	$ 11,000	$ -	$ -	*Capital over 10-year life*
SUBTOTAL CITIZEN DROP-OFF					**$ 6,500**	

Miscellaneous Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
RRC/HHW Materials					$ 647,900	
Scrap Metal	1	LS	$ 18,000	$ 18,000		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 74,700	$ 74,700		*CRLCSWA FY2022 Budget*
Waste Tires	1	LS	$ 53,900	$ 53,900		*CRLCSWA FY2022 Budget*
Electronic Waste	1	LS	$ 114,300	$ 114,300		*CRLCSWA FY2022 Budget*
HHW	1	LS	$ 57,200	$ 57,200		*CRLCSWA FY2022 Budget*
Commingled Recycling	1	LS	$ 271,400	$ 271,400		*CRLCSWA FY2022 Budget*
Recycling Services Revenue Share	1	LS	$ 58,400	$ 58,400		*CRLCSWA FY2022 Budget*
Other Misc. Revenue	0	LS	$ 29,400	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
SUBTOTAL MISC REVENUES					**$ 647,900**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Table 4 - CRLCSWA Material Handling Projections (In Tons)

Material	FY2020	FY2030	FY2040	FY2050	Year 1 FY2038	Year 50 FY2087
	Fiscal Year					
Population	228,600	254,900	276,800	298,900		
Materials Landfilled						
MSW	160,086	178,430	193,760	209,230	190,592	278,007
Disaster Debris	0	2,549	2,768	2,989	2,723	3,972
Special Waste	16,612	20,392	22,144	23,912	21,782	31,772
C&D	25,960	17,843	19,376	20,923	19,059	27,801
Shingles	9,091	2,549	2,768	2,989	2,723	3,972
Subtotal Materials Landfilled	**211,749**	**221,763**	**240,816**	**260,043**	**236,879**	**345,523**
Materials Recycled						
Organics	29,710	35,686	38,752	41,846	38,118	55,601
Single Stream/Drop Box/City	11,872	12,745	13,840	14,945	13,614	19,858
Scrap Metal/White Goods	876	1,098	1,193	1,288	1,173	1,711
Subtotal Materials Recycled	**42,458**	**49,529**	**53,785**	**58,079**	**52,905**	**77,170**
Total Materials	254,207	271,292	294,601	318,122	289,784	422,693
Annual MSW Percent Increase		0.65%	0.83%	0.77%		0.77%

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2088	FY2090
		Fiscal Year (Tons)							
PAPER									
Compostable Paper	9.30%	14,888	16,594	17,735	18,020	19,458		26,054	
High Grade Office Paper	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Magazines/Catalogs	1.10%	1,761	1,963	2,098	2,131	2,302		3,082	
Mixed Recyclable Paper	4.20%	6,724	7,494	8,009	8,138	8,788		11,766	
Newsprint	1.00%	1,601	1,784	1,907	1,938	2,092		2,802	
Non-Recyclable Paper	4.60%	7,364	8,208	8,772	8,913	9,625		12,887	
OCC and Kraft Paper	3.40%	5,443	6,067	6,484	6,588	7,114		9,525	
Aseptic/Gable Top Containers	0.10%	160	178	191	194	209		280	
Subtotal Paper	**24.5%**	**39,221**	**43,715**	**46,720**	**47,471**	**51,261**		**68,637**	
PLASTIC									
#1 PET IA Deposit Beverage Container	0.50%	800	892	953	969	1,046		1,401	
#1 PET Beverage Containter	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
#2 HDPE Containers Natural	0.50%	800	892	953	969	1,046		1,401	
#2 HDPE Containers Colored	0.60%	961	1,071	1,144	1,163	1,255		1,681	
Retail Shopping Bags	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Plastic Film	8.70%	13,927	15,523	16,590	16,857	18,203		24,373	
Other #1 PET Containers	0.30%	480	535	572	581	628		840	
Plastic Containers #3-#7	2.40%	3,842	4,282	4,577	4,650	5,022		6,724	
Other Plastic Containers	0.30%	480	535	572	581	628		840	
Expanded Polystyrene	0.90%	1,441	1,606	1,716	1,744	1,883		2,521	
Other Plastic Products	2.90%	4,642	5,174	5,530	5,619	6,068		8,124	
Subtotal Plastic	**19.1%**	**30,576**	**34,080**	**36,423**	**37,008**	**39,963**		**53,509**	
METAL									
Aluminum Beverage Containers	0.10%	160	178	191	194	209		280	
Aluminum IA Deposit Beverage Containers	0.31%	496	553	591	601	649		868	
Ferrous Food & Beverage Containers	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Aluminum Containers	0.31%	496	553	591	601	649		868	
Other Ferrous Scrap Metals	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
Other Non-Ferrous Scrap Metals	0.70%	1,121	1,249	1,335	1,356	1,465		1,961	
Subtotal Metal	**3.4%**	**5,475**	**6,102**	**6,522**	**6,627**	**7,156**		**9,581**	
GLASS									
Blue Glass	0.02%	32	36	38	39	42		56	
Brown Glass	0.03%	48	54	57	58	63		84	
Clear Glass	0.89%	1,425	1,588	1,697	1,724	1,862		2,493	
Glass IA Deposit Containers	0.58%	928	1,035	1,106	1,124	1,214		1,625	
Green Glass	0.02%	32	36	38	39	42		56	
Other Mixed Cullet	0.58%	928	1,035	1,106	1,124	1,214		1,625	
Subtotal Glass	**2.1%**	**3,394**	**3,783**	**4,043**	**4,108**	**4,436**		**5,939**	
ORGANICS									
Yard Waste	1.00%	1,601	1,784	1,907	1,938	2,092		2,802	
Food Waste - Loose	15.32%	24,525	27,335	29,214	29,684	32,054		42,919	
Food Waste - Packaged	6.82%	10,918	12,169	13,005	13,214	14,269		19,106	
Textiles and Leather	2.92%	4,675	5,210	5,568	5,658	6,110		8,180	
Diapers	2.92%	4,675	5,210	5,568	5,658	6,110		8,180	
Rubber	2.42%	3,874	4,318	4,615	4,689	5,063		6,780	
Subtotal Organics	**31.4%**	**50,267**	**56,027**	**59,878**	**60,841**	**65,698**		**87,967**	
DURABLE									
Cell Phones & Chargers	0.05%	80	89	95	97	105		140	
Central Processing Units / Peripherals	0.28%	448	500	534	543	586		784	
Computer Monitors / TVs	0.20%	320	357	381	388	418		560	
Electrical and Household Appliances	0.90%	1,441	1,606	1,716	1,744	1,883		2,521	
Subtotal Durable	**1.4%**	**2,289**	**2,552**	**2,727**	**2,771**	**2,992**		**4,006**	
CONSTRUCTION & DEMOLITION									
Wood - Untreated	0.30%	480	535	572	581	628		840	

Table - CRLCSWA Waste Composition

	2017 Sort	Fiscal Year (Tons)							
Material	**Data (%)**	**FY2020**	**FY2030**	**FY2038**	**FY2040**	**FY2050**	**FY2080**	**FY2088**	**FY2090**
Wood - Treated	5.50%	8,805	9,814	10,488	10,657	11,508		15,408	
Asphalt Pavement, Brick, Rock, & Concrete	0.04%	64	71	76	78	84		112	
Asphalt Roofing	0.03%	48	54	57	58	63		84	
Drywall/Gypsum Board	0.04%	64	71	76	78	84		112	
Carpet & Carpet Padding	1.30%	2,081	2,320	2,479	2,519	2,720		3,642	
Subtotal C&D	**7.2%**	**11,542**	**12,865**	**13,749**	**13,970**	**15,085**		**20,199**	
HOUSEHOLD HAZARDOUS MATERIALS (HHM)									
Chemicals	0.50%	800	892	953	969	1,046		1,401	
Lead-Acid Batteries	0.05%	80	89	95	97	105		140	
Mercury Containing Products	0.04%	64	71	76	78	84		112	
Lithium Batteries	0.10%	160	178	191	194	209		280	
Other Batteries	0.05%	80	89	95	97	105		140	
Sharps	0.04%	64	71	76	78	84		112	
Prescription Medications	0.04%	64	71	76	78	84		112	
Subtotal HHM	**0.8%**	**1,313**	**1,463**	**1,564**	**1,589**	**1,716**		**2,297**	
OTHER									
Other Organics	4.40%	7,044	7,851	8,391	8,525	9,206		12,327	
Other Inorganics	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
Other C&D	1.10%	1,761	1,963	2,098	2,131	2,302		3,082	
Other Durables	1.30%	2,081	2,320	2,479	2,519	2,720		3,642	
Other HHM	0.10%	160	178	191	194	209		280	
Fines	1.60%	2,561	2,855	3,051	3,100	3,348		4,482	
Other	0.30%	480	535	572	581	628		840	
Subtotal Other	**10.0%**	**16,009**	**17,843**	**19,069**	**19,376**	**20,923**		**28,015**	
TOTALS - MSW	**100.0%**	**160,086**	**178,430**	**190,694**	**193,760**	**209,230**	**263,453**	**280,150**	**284,488**
						0.77%			
		160,086	178,430	190,694	193,760	209,230	Check	280,150	

Project:	CRLCSWA Infrastructure Options
Date:	12/27/2021
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**OTHER SROI INPUTS**

SCENARIO 4
CRLCSWA AD w/ NEW LANDFILL OPTION
OTHER SROI INPUTS (2021$)

Timing of Capital Costs

SCENARIO 4 CAMPUS	2022	2023	2024	2025	2026	2027
Land Acquisition/Legal/Env	0%	0%	5%	10%	10%	10%
Anaerobic Digesters	0%	0%	0%	0%	0%	0%
New Landfill	0%	0%	0%	0%	0%	0%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 4 CAMPUS	2028	2029	2030	2031	2032	2033
Land Acquisition/Legal/Env	15%	50%	0%	0%	0%	0%
Anaerobic Digesters	0%	0%	0%	0%	0%	1%
New Landfill	0%	0%	0%	1%	1%	1%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 4CAMPUS	2034	2035	2036	2037	2038	2039
Anaerobic Digesters	2%	6%	45%	45%	1%	0%
New Landfill	2%	6%	8%	10%	2%	0%
Compost Facility	5%	10%	40%	30%	15%	0%
Scalehouse	0%	5%	45%	50%	0%	0%
Admin/Educational Center	0%	5%	30%	55%	10%	0%
RRC/HHW	5%	10%	30%	50%	5%	0%
Maintenance Shop	0%	5%	30%	55%	10%	0%
Citizen Drop-Off	0%	5%	60%	30%	5%	0%

Travel Distances

Digestate to on-site Solid Waste Campus, Compost Facility.

Rejects to on-site Solid Waste Campus, Landfill.

Project:	CRLCSWA Infrastructure Options
Date:	11/30/2021
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**SUMMARY**

SCENARIO 4
CRLCSWA AD w/ NEW LANDFILL OPTION
SUMMARY (2021$)

Facility	Minimum Land Required (Acres)	Land Purchase (Acres)	Liner / Pad Areas (Acres)	Building(s) Size (SF)	Year 1, TPY	Year 50, TPY
AD Facility	15	---	---	112,000	26,245	38,282
New Landfill	204	---	90	---	211,946	309,155
Compost Facility	31	---	22	---	41,858	61,056
Scalehouse	10	---	---	600	---	---
Admin/Educational Center	2	---	---	5,500	---	---
RRC/HHW	4	---	---	18,300	4,045	5,943
Maintenance Shop	2	---	---	17,200	---	---
Citizen Drop-Off	4	---	2.0	---	1,173	1,711
TOTAL	**272**	**320**	**---**	**153,600**	**---**	**---**

Diversion Tonnages		
Composted Organics-YW, FW	38,118	55,601
Composted Organics-Digestate	3,740	5,455
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
AD - Organics, Less Digestate	21,192	30,912
Diversion Subtotal	**68,269**	**99,623**
Landfill Tonnages	**211,946**	**309,155**
% Diversion/Reduction from LF	**24%**	**24%**

Facility	Full Build-Out: Total Facilities Capital $	Year 1 O&M$: O&M $	Year 1 O&M$: O&M - Haul$	Year 1 O&M$: Closure/ Post-Closure Fund$	Year 1 Revenues $: Other Revenues$	Year 1 Revenues $: Energy/ Materials Revenues$
AD Facility	$39,797,500	$2,109,000	---	---	$335,700	$197,100
New Landfill	$86,756,600	$2,605,800	---	$578,480	$0	$436,000
Compost Facility	$9,384,800	$1,174,100	---	---	$0	$1,100,700
Scalehouse	$2,189,600	$293,900	---	---	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0
RRC/HHW	$9,933,900	$1,407,400	---	---	$0	$647,900
Maintenance Shop	$4,694,100	$566,000	---	---	$0	$0
Citizen Drop-Off	$1,505,300	$34,700	---	---	$0	$0
	$157,139,900	**$10,728,600**	**$0**	**$578,480**	**$335,700**	**$2,381,700**

SCENARIO 4 CAMPUS	Quantity	Unit	Unit Price	Total	
Land Acquisition - Purchase	320	Acres	$25,000	$8,000,000	*3 Qtr Sections*
Land Acquisition - Legal/Support	25%	LS	$8,000,000	$2,000,000	*% Land Purchase*
Social Justice/Env Impact/Legal	1	RS	$7,000,000	$7,000,000	*Risk Factor*
SUBTOTAL				**$17,000,000**	
Facilities Capital				$115,879,900	
Contingency, Permitting, Eng/Construction Observation/CQA				$36,594,000	
Equipment/Mobile Equipment				$4,666,000	
SUBTOTAL				**$157,139,900**	
Estimated Financing Costs - Landfill				$14,084,000	*8 cells, 7 yrs ea, 4%*
Estimated Financing Costs - All Other Facilities				$31,961,000	*20 yrs, 4% APR*
SUBTOTAL				**$46,045,000**	
TOTAL CAPITAL$				**$220,184,900**	

SCENARIO 4 TIPPING FEE ESTIMATE (2021$)

	Capital$[1]	Annual O&M$[2]	Annual Haul$[2]	Annual Closure/PC$[2]	Total - Gross
Total Costs - Facilities	$157,139,900	$10,728,600	$0	$578,480	
Total Costs - Financing	$46,045,000	---	---	---	
Total Costs-Land/Legal/Env Impac	$17,000,000	---	---	---	
Processed & Landfilled Tons	14,400,160	236,879	236,879	236,879	
$/Ton	**$15.29**	**$45.29**	**$0.00**	**$2.44**	**$60.58**

	Annual Other Revenues[3]	Annual Mat'l/ Energy Revenues[4]	Total - Revenues Before Fees
Revenues	$335,700	$2,381,700	
Landfilled Tons	236,879	236,879	
	$1.42	**$10.05**	**$11.47**

ESTIMATED NET TIP FEE	**$49.11**
Rounded ESTIMATED NET TIP FEE	**$50.00**

Notes:

1. Capital costs include full build out of facilities for 50-year period divided by projected processed & landfilles tons Year 2038-2087.
   Financing costs assume constant annual 4% interest rate on Facilities Capital plus Contingency, Permitting, Engineering & Construction Observation/CQA.
   Land acquisition costs including social justice, environmental impacts and legal.
2. Annual O&M costs include replacement reserves for equipment and rehab/rebuild of buildings over 50-year period. Divided by Year 2038 processed & landfille
3. Other Revenues obtained from CRLCSWA FY2022 budget including grants, investments, non-cash adjustments, other misc. revenues.
   Divided by Year 2038 processed & landfilled tons.
4. Annual Material/Energy Revenues includes recycled materials revenues through RRC (from FY2022 budget), composting tip fees at $24/ton, compost sales

Project:	CRLCSWA Infrastructure Options
Date:	11/30/2021
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**AD Sizing**

SCENARIO 4
CRLCSWA AD w/ NEW LANDFILL OPTION
SIZING ANAEROBIC DIGESTION FACILITY

Waste Flow (Tons)	Year 1 FY2038	Year 25 FY2063	Year 50 FY2087		Assumptions/Comments
MSW	190,592	234,299	278,007		
Organics Stream	52,489	64,526	76,563	28%	*of MSW composition (yard waste, food waste, other organics)*
Waste to AD Facility					
AD Capture Rate - Assumed[1]	26,245	32,263	38,282	50%	*of Organics Stream*
Pre-Processing Rejects	1,312	1,613	1,914	5%	*of Select Organic Loads*
AD Processed Waste, TPY	24,932	30,650	36,367		*wet tons*
AD Processed Waste, TPD	69	84	100	365	*days/year*
AD Pounds Per Day	138,000	168,000	200,000		
Gallons Per Day[2]	16,547	20,144	23,981	8.34	*pounds per gallon, recirculate dilution water*
Select Loads Receipt, TPD	89	109	129	296	*days/year*
Digester Calculations					
Wet Tons Received, TPY	24,932	30,650	36,367		
Total Solids, TPY	7,480	9,195	10,910	30%	*solids content of wet tons (cake) received*
Volatile Solids (VS), lbs per day	34,837	42,826	50,815		*at 85% of total solids*
Gallons Per Year Treated	7,174,764	8,820,109	10,465,454	25%	
Gallons Per Day	19,657	24,165	28,672		
Feed Rate	14.78	14.78	14.78		*VS /gallons per day converted to pounds*
Effluent/Digestate					
Effluent to Dewatering, Gals/Day	16,547	20,144	23,981		*Can use liquids for fertilizer*
Digestate	3,740	4,597	5,455	15%	*of Processed Waste (assumes 30% solids post digestion)*
Diversion - Composting, TPY	3,740	4,597	5,455		

Notes:

1 Capture rate assumes high recovery percentage of the organics stream in MSW.

2 Assumes wet AD system for preliminary analysis. Total costs are simliar between wet AD and dry AD systems.

Waste to Landfill			
Direct to Landfill:			
Remaining MSW Loads	164,348	202,036	239,725
Disaster Debris	2,723	3,347	3,972
Special Waste	21,782	26,777	31,772
C&D	19,059	23,430	27,801
Shingles	2,723	3,347	3,972
From AD Facility:			
Pre-Processing Rejects	1,312	1,613	1,914
Process Residue/Fines	0	0	0
Landfilled Waste	211,946	260,551	309,155
% of Scenario 1 Landfilled	89.5%	89.5%	89.5%

AD Building Sizing	Year 1 FY2038	Year 25 FY2063	Year 50 FY2087		
Sizing Assumptions					
Unloading Bays	2	2	2		*Avg 3 tons/veh, peak factor 2.0, 12 min unload*
Minimum Width (ft)	40	40	40		*20 ft per bay, accounting for structure*
Waste Storage on Tip Floor (CY)	411	505	599	350	*lbs/CY and 1 day waste*
Effluent Storage, # Tanks	2	3	4		*20K gallon tanks, 3 days storage*
Estimated Square Feet - Receiving & Preprocessing Building					
Tipping Floor	3,800	4,300	4,700		*Waste piled avg 6' high + unloading area*
Pre-Processing System Area	10,000	10,000	10,000		*Assume 200' L x 50' W*
Rejects/Fines Loadout Area	1,200	1,200	1,200		*60' x loadout bays; 1 roll-offs, trucks, trailers*
Office/Breakroom/Restrooms	300	310	320	2.0%	*of area from tip floor thru loadout*
Spare Parts/Shop Room	300	310	320	2.0%	*of area from tip floor thru loadout*
Building SF	15,600	16,120	16,540		
Estimated Square Feet - Anaerobic Digestion System					
Digesters	10,000	15,000	20,000		*Assumes 100'x100' Year 1, prorated*
Biogas to Power System	2,400	2,400	2,400		*Energy production*
Digestate/Effluent Management	1,250	1,875	2,500		*approximate 25' diameter per tank*
Digester System SF	13,650	19,275	24,900		
Estimate AD Land Requirements (Acres)					
Building	0.4	0.4	0.4		

Project:	CRLCSWA Infrastructure Options
Date:	11/30/2021
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**AD Sizing**

AD System	0.3	0.4	0.6	
Surrounding Area	13.0	13.4	13.9	300 *ft buffer area*
Entrance Area	0.0	0.0	0.0	*included w/ scalehouse*
Land (Acres)	13.6	14.3	14.8	

Tonnage Projections-Total Processed or Landfilled

Year	CRLCSWA Projections		Annual % Increase
2020	-	tons	0.46%
2030	221,763	tons	0.83%
2040	240,816	tons	0.77%
2050	260,043	tons	

YR	Calculate Annual Tonnage Processed/Landfilled	Tons per Year	TPD
1	2038	236,879	800
2	2039	238,823	807
3	2040	240,816	814
4	2041	242,673	820
5	2042	244,544	826
6	2043	246,430	833
7	2044	248,330	839
8	2045	250,245	845
9	2046	252,175	852
#	2047	254,119	859
#	2048	256,079	865
#	2049	258,053	872
#	2050	260,043	879
#	2051	262,048	885
#	2052	264,069	892
#	2053	266,105	899
#	2054	268,157	906
#	2055	270,225	913
#	2056	272,308	920
#	2057	274,408	927
#	2058	276,524	934
#	2059	278,656	941
#	2060	280,805	949
#	2061	282,970	956
#	2062	285,152	963
#	2063	287,351	971
#	2064	289,567	978
#	2065	291,800	986
#	2066	294,050	993
#	2067	296,317	1001
#	2068	298,602	1009
#	2069	300,905	1017
#	2070	303,225	1024
#	2071	305,563	1032
#	2072	307,919	1040
#	2073	310,294	1048
#	2074	312,686	1056
#	2075	315,097	1065
#	2076	317,527	1073
#	2077	319,975	1081
#	2078	322,443	1089
#	2079	324,929	1098
#	2080	327,435	1106
#	2081	329,960	1115
#	2082	332,504	1123
#	2083	335,068	1132
#	2084	337,651	1141
#	2085	340,255	1150
#	2086	342,879	1158
#	2087	345,523	1167
	2088		

TOTAL ESTIMATED FOR POTENTIAL PROCESSED/LF **14,400,160** **tons**

Project:	CRLCSWA Infrastructure Options			
Date:	11/30/2021 Revised: 12/14/2021			
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design			
Costs:	2021$	Process Size:	84 TPD	
Location:	Linn County, Iowa	Required Land:	15 Acres	
Worksheet:	**AD Capital Cost**	**TOTAL AD CAP$**		**$39,797,500**

SCENARIO 4
CRLCSWA AD w/ NEW LANDFILL OPTION
AD CAPITAL COST ESTIMATE SUMMARY (1)(2)

AD Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
AD Building	16,000	SF	$ 200	$ 3,200,000	*Includes building, foundations, floors, HVAC*
Pre-Processing Equipment	1	EA	$ 1,500,000	$ 1,500,000	*To remove contamination from select loads*
AD Digesters	1	EA	$ 7,500,000	$ 7,500,000	*To handle up to 30K TPY*
Effluent Management Equipment	1	EA	$ 1,500,000	$ 1,500,000	*Pumping system, tanks*
Biogas Upgrade to Power	1	EA	$ -	$ -	*Included in Digester Costs*
Equipment & AD Install & Start-up	20%	LS	$ 10,500,000	$ 2,100,000	*Vendor cost*
Site Investigations	1	LS	$ 200,000	$ 200,000	*Geotech*
Site Work					
Mobilization/Demob	1	LS	$ 300,000	$ 300,000	
Clear & Grub	8	Acres	$ 2,000	$ 15,000	*Assume no demolition; half of area*
Bulk Excavation/Grading	2,400	CY	$ 3	$ 7,200	*Adequate quantity & quality of soils on-site*
Structural Fill	2,400	CY	$ 10	$ 24,000	*Assume 100% of bulk excavation quantities*
Roadways	-	SY	$ 45	$ -	*4" asphalt over 6" granular base*
Stormwater Pond	1	LS	$ 200,000	$ 200,000	
Site Drainage/Erosion Control	1	EA	$ 50,000	$ 50,000	
Site Utilities					
Electrical - New Service to Site	1	LS	$ 2,000,000	$ 2,000,000	*From 1 mile away; extra for AD*
Water Supply & Fire Protection	1	LS	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Sanitary Sewer	1	EA	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Natural Gas System	1	LS	$ 1,500,000	$ 1,500,000	*Estimate, From 1 mile away*
Surveying	1	EA	$ 25,000	$ 25,000	
Screening, Landscaping, Signage	1	EA	$ 60,000	$ 60,000	*Allowance*
Fencing	3,200	LF	$ 35	$ 112,000	*Site Perimeter*
Market Variability Factor	30%	Capital $	$ 23,413,200	$ 7,024,000	*Vertical construction*
SUBTOTAL AD CONSTRUCTION				**$ 30,437,200**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	LS	$ 17,837,200	$ 3,567,400	*Without Land & Process Equipment*
Contingency - Process/AD Equip	10%	LS	$ 12,600,000	$ 1,260,000	*Process Equipment only*
Eng., Design, Constr. Admin & CQA	12%	LS	$ 30,437,200	$ 3,652,500	*Percentage of total capital*
Permitting (Local & IDNR)	1%	LS	$ 30,437,200	$ 304,400	*Percentage of total capital*
SUBTOTAL AD COSTS				**$ 8,784,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Loader (large)	1	EA	$ 400,000	$ 400,000	
Skid Loader	1	EA	$ 50,000	$ 50,000	
Roll-Off Truck	1	EA	$ 110,000	$ 110,000	
Roll-Off Containers	2	EA	$ 8,000	$ 16,000	*Rejects*
Forklift	0	EA	$ 50,000	$ -	*None*
Yard Tractor	0	EA	$ 100,000	$ -	*None*
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*
SUBTOTAL				**$ 576,000**	

ASSUMPTIONS:

1. No sales tax is included. Assumed facility is tax exempt.
2. Costs rounded to nearest thousand.
3. Does not include financing costs.
4. Assumed project to be competitively bid under one general contract.
5. Assumed construction to be during normal working hours.
6. The construction costs are used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Project:	CRLCSWA Infrastructure Options		
Date:	11/30/2021		
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design	**ENERGY REV$**	**$197,100**
Costs:	2021$ Process Size 84 TPD	**MAT'L REV$**	**$0**
Location:	Linn County, Iowa	**OTHER REVENUES$**	**$335,700**
Worksheet:	**AD O&M Costs**	**ANNUAL AD O&M$**	**$2,109,000**

SCENARIO 4
CRLCSWA AD w/ NEW LANDFILL OPTION
AD OPERATIONS COST ESTIMATE SUMMARY [1]

AD Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 634,800	*FY2021 fully-burdened salary, escalated*
Scalehouse Personnel	0	FTE	$ 82,000	$ -		*Included w/ Scalehouse operations*
AD Manager	1	FTE	$ 124,800	$ 124,800		*Estimated rate*
Loader Operator	1.5	FTE	$ 103,800	$ 155,700		*Estimate*
Spotters/Laborers	0	FTE	$ 52,000	$ -		*Assume none at AD receiving facility*
Sorters	0	FTE	$ 41,600	$ -		*No manual sorting*
Process Operators	1.5	FTE	$ 100,200	$ 150,300		*Estimate*
Roll-Off/Misc. Equip	1	FTE	$ 100,200	$ 100,200		*Rejects to LF; Digestate to Composting*
Maintenance/Mechanic	1	FTE	$ 103,800	$ 103,800		*Maintain building & process equipment*
Utilities					$ 96,900	
Electricity	260,000	kWh	$ 0.15	$ 39,000		*10 kWh/SF estimate + AD System*
Water & Sewer	1	LS	$ 50,000	$ 50,000		*Estimate - water for slurry*
Natural Gas/Heating Fuel	1	LS	$ 5,000	$ 5,000		*Avg 0.3 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 240	$ 2,900		*Estimate based on FTE*
Maintenance and Repairs					$ 212,000	
Building	1%	Capital $	$ 3,200,000	$ 32,000		*Percentage of building capital*
Process Equipment	1%	Capital $	$ 7,500,000	$ 75,000		*Percentage of process equipment capital*
Mobile Equipment	7,000	hours	$ 15	$ 105,000		*Avg mobile equip operating hrs*
Supplies	1	LS	$ 25,000	$ 25,000	$ 25,000	*Estimate*
Fuel	21,000	gallons	$ 3.50	$ 73,500	$ 73,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	1	LS	$ 150,000	$ 150,000	$ 150,000	*Estimate-AD plus SW campus facilities*
AD Facility Insurance	0.1%	Capital $	$ 30,437,200	$ 30,400	$ 30,400	*Percentage of AD total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL AD DIRECT OPERATIONS					**$ 1,222,600**	

AD Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Mobile Equipment Replacement					$ 80,400	
Loaders	1	EA	$ 57,143	$ 57,100		*Capital cost divided by 7-yr life*
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Roll-Off Truck	1	EA	$ 11,000	$ 11,000		*Capital cost divided by 10-yr life*
Roll-Off Containers	2	EA	$ 800	$ 1,600		*Capital cost divided by 10-yr life*
Forklift	0	EA	$ 5,000	$ -		*Capital cost divided by 10-yr life*
Yard Tractor	0	EA	$ 10,000	$ -		*Capital cost divided by 10-yr life*
Pick-up Truck	1	EA	$ 5,714	$ 5,700		*Capital cost divided by 7-yr life*
AD Plant	1	EA	$ 640,000	$ 640,000	$ 640,000	*Capital cost divided by 15-yr life*
Building Replacement	1	EA	$ 128,000	$ 128,000	$ 128,000	*Bldg capital cost divided by 25-yr life*
Operating Cash Reserve	1	LS	$ 38,000	$ 38,000	$ 38,000	*CRLCSWA FY2021 Budget, rounded*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 operations*
SUBTOTAL CASH RESERVES					**$ 886,400**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Grants/Investments/ Other	1	LS	$ 281,300	$ 281,300	$ 281,300	*CRLCSWA FY2022 Budget*
Non-Cash Adjustments	1	LS	$ 25,000	$ 25,000	$ 25,000	*CRLCSWA FY2022 Budget*
Other Misc. Revenue	1	LS	$ 29,400	$ 29,400	$ 29,400	*CRLCSWA FY2022 Budget*
AD Energy Revenue	6,570,000	kWh	$ 0.03	$ 197,100	$ 197,100	*Assuming 750 KW power output*
AD Digestate to Composting	3,740	Tons	$ -	$ -	$ -	*Add'l Compost$ w/ Composting Facility*
Carbon Credits?						
SUBTOTAL OTHER REVENUES					**$ 532,800**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   No Shifts = 1 8 hours per shift
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options
Date:	11/15/2021
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MSW Landfill Sizing**

SCENARIO 4
CRLCSWA AD W/ NEW LANDFILL OPTION
SIZING LANDFILL

Landfill Sizing Components	Calculations		Comments/Notes	
Size	90	acres		
Width Est	1960	feet	Check of dimensions =	90.0 acres
Length Est	2000	feet		
Depth (top liner system)	30	feet	Liner Sideslopes 3:1	
Ground Surface Area:	3,920,400	SF		
Bottom Area:	3,239,600	SF		
VOLUME-below ground surface	**3,980,000**	**CY**		
Height (top of waste)	145	feet	Cap Sideslopes 4:1	
Top Area:	672,000	SF	Check top width/length=	820 feet
Ground Surface Area:	3,920,400	SF		
VOLUME-above ground surface	**12,330,000**	**CY**		
TOTAL WASTE VOLUME CAPACITY	**16,310,000**	**CY**		
Yr 2038-Yr 2088, Estimated Disposal	12,884,470	Tons	from calculation below	
Estimate Density, AUF	1,600	lbs/CY		
Minimum Required Volume:	**16,106,000**	**CY**		99% of total
Landfill Life:	**50**	**years**		
Conceptual Roadways:				
Entrance Roadways	0	LF	Main entrance w/ Scalehouse	
Perimeter Roadways	7920	LF		
Minimum Site Area:	500' Buffer		1000' Buffer	
Site - Landfill, Buffer & Borrow	204	acres		364 acres

Tonnage Projections-Total Disposed

Year	CRLCSWA Projections		Scenario 3 Landfilled Waste		Annual Increase
2030	221,763	tons	198,422	tons	0.83%
2040	240,816	tons	215,469	tons	0.77%
2050	260,043	tons	232,673	tons	0.77%

YR	Calculate Annual Tonnage Potential Disposal in New LF	Tons per Year	TPD
1	2038	211,917	716
2	2039	213,686	722
3	2040	215,469	728
4	2041	217,131	734
5	2042	218,805	739
6	2043	220,492	745
7	2044	222,192	751
8	2045	223,906	756
9	2046	225,632	762
10	2047	227,372	768

Project:	CRLCSWA Infrastructure Options
Date:	11/15/2021
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MSW Landfill Sizing**

11	2048	229,125	774
12	2049	230,892	780
13	2050	232,673	786
14	2051	234,467	792
15	2052	236,275	798
16	2053	238,097	804
17	2054	239,933	811
18	2055	241,783	817
19	2056	243,647	823
20	2057	245,526	829
21	2058	247,419	836
22	2059	249,327	842
23	2060	251,249	849
24	2061	253,187	855
25	2062	255,139	862
26	2063	257,106	869
27	2064	259,089	875
28	2065	261,087	882
29	2066	263,100	889
30	2067	265,129	896
31	2068	267,173	903
32	2069	269,233	910
33	2070	271,309	917
34	2071	273,401	924
35	2072	275,510	931
36	2073	277,634	938
37	2074	279,775	945
38	2075	281,932	952
39	2076	284,106	960
40	2077	286,297	967
41	2078	288,505	975
42	2079	290,729	982
43	2080	292,971	990
44	2081	295,230	997
45	2082	297,507	1005
46	2083	299,801	1013
47	2084	302,112	1021
48	2085	304,442	1029
49	2086	306,790	1036
50	2087	309,155	1044
	2088		

TOTAL ESTIMATED TONS FOR POTENTIAL DISPOSAL **12,884,465 tons**

Project:	CRLCSWA Infrastructure Options				
Date:	11/15/2021				
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design				
Costs:	2021$	LF Size:	90	Acres	
Location:	Linn County, Iowa	Required Land:	204	Acres	
Worksheet:	**MSW Landfill Capital Cost**	**TOTAL LF CAP$**			**$86,756,600**

SCENARIO 4
CRLCSWA AD W/ NEW LANDFILL OPTION
CAPITAL COST ESTIMATE SUMMARY (1)(2)

Landfill Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations					
Hydrogeologic Characterization	1	LS	$ 200,000	$ 200,000	*Initial site investigations*
Supplemental Site Investigations	8	EA	$ 20,000	$ 160,000	*prior to each cell development*
Groundwater Monitoring Wells	7	EA	$ 8,000	$ 56,000	
Gas Migration Monitoring Probes	8	EA	$ 3,000	$ 24,000	
Site Work					
Mobilization/Demob	8	EA	$ 100,000	$ 800,000	*Number of cells construction*
Clear & Grub	45	Acres	$ 2,000	$ 90,000	*Assume no demolition; half of LF area*
Bulk Excavation	3,980,000	CY	$ 3	$ 11,940,000	*Adequate quantity & quality of soils on-site*
Structural Fill	1,194,000	CY	$ 10	$ 11,940,000	*Assume 30% of bulk excavation quantities*
Roadways	26,000	SY	$ 45	$ 1,170,000	*4" asphalt over 6" granular base*
Site Utilities					
Stormwater Pond	2	LS	$ 250,000	$ 500,000	*Estimate*
Site Drainage/Erosion Control	8	EA	$ 50,000	$ 400,000	*Number of cells construction*
Electrical Service	1	LS	$ 100,000	$ 100,000	*Extend electrical to landfill*
Water Supply & Fire Protection	1	LS	$ 100,000	$ 100,000	*Extend water supply to landfill*
Sanitary Sewer	-	EA	$ -	$ -	*Included w/ MWP-RDF Facility*
Natural Gas System	-	LS	$ -	$ -	*NA for Landfill*
Surveying	8	EA	$ 25,000	$ 200,000	
Screening, Landscaping, Signage	8	EA	$ 60,000	$ 480,000	*Allowance*
Fencing	11,900	LF	$ 35	$ 416,500	*LF site perimeter*
Liner & Leachate Collection System					
Composite Liner System	90	Acres	$ 250,000	$ 22,500,000	*Recompacted Clay, geomembrane, 12" granular, geotextile & protective cover*
Leachate Collection Pipes, Sumps, Pumps & Controls, Lift Station, Forcemain	8%	Liner $	$ 22,500,000	$ 1,800,000	
Leachate Lagoon	1	LS	$ 2,925,000	$ 2,925,000	*Estimate 9 acres lined + 30% for excavation*
Active Gas Collection System	90	Acres	$ -	$ -	*See Closure Costs - to begin within 2 or 5 years of first placement of waste*
Market Variability Factor	15%	Capital $	$ 55,801,500	$ 8,370,200	*Sitework, horizontal construction*
SUBTOTAL LANDFILL CAPITAL				**$ 64,171,700**	

Engineering (3)	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 64,171,700	$ 12,834,300
Engineering & Design	4%	Capital $	$ 64,171,700	$ 2,566,900
Permitting	2%	Capital $	$ 64,171,700	$ 1,283,400
Construction Observation/CQA	6%	Capital $	$ 64,171,700	$ 3,850,300
SUBTOTAL LANDFILL SOFT COSTS				**$ 20,534,900**

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Landfill Compactor	1	EA	$ 1,000,000	$ 1,000,000	*Replacement*
Track Dozer (D8 or similar)	1	EA	$ 800,000	$ 800,000	*Replacement*
Track Dozer (D6 or similar)	0	EA	$ 550,000	$ -	*Existing*
Excavator	0	EA	$ 1,000,000	$ -	*Existing*
Dump Trucks	0	EA	$ 200,000	$ -	*Existing*
Tanker Truck - Leachate Recirculation	1	EA	$ 250,000	$ 250,000	*New 4000-gallon tanker/water truck*
Water Truck	0	EA	$ 200,000	$ -	*Existing*
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*

SUBTOTAL **$ 2,050,000**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed cell projects to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options		
Date:	11/15/2021		
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa		
Worksheet:	**MSW LF Closure & Post-Closure Costs**	**ANNUAL FUND PAY-IN**	**$578,480**

SCENARIO 4
CRLCSWA AD W/ NEW LANDFILL OPTION
CLOSURE & POST-CLOSURE COSTS ESTIMATE SUMMARY [1]

LF Closure Costs	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Direct Capital Costs					$ 14,380,000	
MSW Landfill Capping System [2]	90	Acres	$ 120,000	$10,800,000		*Financial assurance (FA) $/acre w/ market variability*
Active LFG Collection System [3]	90	Acres	$ 27,000	$ 2,430,000		*FA $/acre w/ market variability*
LFG Blower Skid/Flare [4]	1	LS	$ 1,150,000	$ 1,150,000		*FA w/ market variability factor*
Contingency	10%	Capital $	$ 14,380,000	$ 1,438,000	$ 1,438,000	*10% contingency matches FA*
Legal & Administrative	1	LS	$ 25,000	$ 25,000	$ 25,000	
Design/Engineering	8%	Capital $	$ 14,380,000	$ 1,150,400	$ 1,150,400	
Construction Observation / CQA	10%	Capital $	$ 14,380,000	$ 1,438,000	$ 1,438,000	
SUBTOTAL LF CLOSURE COSTS					**$ 18,431,400**	
ANNUAL CLOSURE FUND PAYMENT[7]					$368,600	

LF Post-Closure Costs	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Direct Post-Closure Operations					$ 9,540,000	
Annual Post-Closure [5]	30	Years	$ 223,000	$ 6,690,000		*FA $ increased for acres*
Active LFG System O&M [6]	30	Years	$ 95,000	$ 2,850,000		*FA $ increased for acres*
Contingency	10%	PC Ops$	$ 9,540,000	$ 954,000	$ 954,000	*10% contingency matches FA*
SUBTOTAL LF POST-CLOSURE COSTS					**$ 10,494,000**	
ANNUAL POST-CLOSURE FUND PAYMENT[7]					$ 209,880	

ASSUMPTIONS:

(1) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.
Assumed projects to be comptetively bid.
Assumed construction to be during normal working hours.
(2) Estimate for composite capping system, terracing, letdown structures, vegetation, and supporting construction activities.
(3) Assumes installation of an active landfill gas collection system with extraction wells, piping, condensate management, system appurtenances, and general conditions.
(4) Assumes installation of landfill gas blower skid/flare and supporting site work, utilities, and general conditions.
(5) Estimate of post-closure care for cap and vegetation, leachate management, groundwater monitoring, LFG migration monitoring, stormwater and security.
(6) Estimate for LFG operations; repairs/maintenance of LFG collection wells, piping, blower, flare; and reporting requirements.
(7) Annual payment assumes site life of 50 years.

Project:	CRLCSWA Infrastructure Options		
Date:	11/15/2021		
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**LFG REVENUES$**	**$436,000**
Worksheet:	**MSW Landfill O&M Costs**	**ANNUAL LF O&M$**	**$2,605,800**

SCENARIO 4
CRLCSWA AD W/ NEW LANDFILL OPTION
LF OPERATIONS COST ESTIMATE SUMMARY (1)

LF Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor					$ 675,000	*FY2021 fully-burdened salary, escalated*
Scalehouse Personnel	0	FTE	$ 82,000	$ -		*Included in Scalehouse operations*
LF Compactor Operator	2	FTE	$ 103,800	$ 207,600		
LF Equip Operators	2	FTE	$ 103,800	$ 207,600		
LF Leachate Recir/Misc.	1	FTE	$ 103,800	$ 103,800		
LF Spotters/Laborers	3	FTE	$ 52,000	$ 156,000		*Estimated rate*
LF Utilities					$ 23,400	
Electricity	40,000	kWh	$ 0.15	$ 6,000		*Assume for leachate & LFG management*
Water	1	LS	$ 15,000	$ 15,000		*Estimate - dust control, etc.*
Leachate	0	gallons	$ 0.15	$ -		*Assume full management on site*
Heating Fuel	0	LS	$ -	$ -		*None at LF area - See SW Campus Bldgs*
Phones	12	months	$ 200	$ 2,400		*Estimate, Use by # primary staff*
Maintenance and Repairs					$ 759,300	
Active LFG System O&M	1	LS	$ 48,000	$ 48,000		*None first 10 yrs; amortize over 50 yr life*
LFG-to-Energy O&M	1	LS	$ 228,000	$ 228,000		*None first 10 yrs; amortize over 50 yr life*
Roads, Land & LF Maint.	0.2%	Capital $	$ 64,171,700	$ 128,300		*Percentage of LF capital*
Mobile Equipment	14,200	hours	$ 25	$ 355,000		*Avg equip operating hours, total*
LF Environmental Compliance					$ 79,800	
Groundwater Monitoring	1	LS	$ 56,000	$ 56,000		*From FY2022 HDR contract*
Groundwater Lab Analysis	1	LS	$ 16,300	$ 16,300		*CRLCSWA FY2022 Budget*
Leachate Levels Monitoring	1	LS	$ 5,000	$ 5,000		*From FY2022 HDR contract*
LFG Monitoring	1	LS	$ 2,500	$ 2,500		*From FY2022 HDR contract*
Supplies	1	LS	$ 15,000	$ 15,000	$ 15,000	*CRLCSWA FY2022 Budget, prorated to LF*
Fuel	42,600	gallons	$ 3.50	$ 149,100	$ 149,100	*Assume 3 gallons per hour operating*
Consulting/Eng Services	1	LS	$ 100,000	$ 100,000	$ 100,000	*Other-LF only*
LF Insurance	0.1%	Capital $	$ 64,171,700	$ 64,200	$ 64,200	*Percentage of LF total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL LF DIRECT OPERATIONS					**$ 1,865,800**	

LF Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 740,000	*Rounded*
Compactor	1	EA	$ 200,000	$ 200,000		*Capital cost divided by 5-yr life*
Track Dozer (D8 or similar)	1	EA	$ 160,000	$ 160,000		*Capital cost divided by 5-yr life*
Track Dozer (D6 or similar)	1	EA	$ 110,000	$ 110,000		*Capital cost divided by 5-yr life*
Excavator	1	EA	$ 142,857	$ 142,900		*Capital cost divided by 7-yr life*
Dump Trucks	2	EA	$ 28,571	$ 57,100		*Capital cost divided by 7-yr life*
Tanker Truck-Leachate Recirc	1	EA	$ 35,714	$ 35,700		*Capital cost divided by 7-yr life*
Water Truck	1	EA	$ 28,571	$ 28,600		*Capital cost divided by 7-yr life*
Pick-up Truck	1	EA	$ 5,714	$ 5,700		*Capital cost divided by 7-yr life*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included w/ MWP-RDF O&M*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 operations*
SUBTOTAL LF CASH RESERVES					**$ 740,000**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
New LF Gas-to-Energy	1	LS	$ 436,000	$ 436,000	$ 436,000	*None first 10 yrs; amortize over 50 yr life*
SUBTOTAL OTHER REVENUES					**$ 436,000**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options
Date:	11/30/2021
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

SCENARIO 4
CRLCSWA AD w/ LANDFILL OPTION
AEROBIC COMPOSTING FACILITY SIZING

Compost Feedstock	***Initial Development, Year 2038***	***Long Term, Year 2088***	
Incoming Organics (tons)	38,118	55,601	*From SW Volumes Memo 6-10-2021*
Incoming Digestate (tons)	3,740	5,455	*From AD system*
% as Food Waste	10%	10%	*Food target percent for windrow ops*
Processing Days per Year	296	296	
Tons per Day	129	188	
Yard Waste Density (lb/cy)	650	650	
Yard Waste C:N Ratio	25	25	
Yard Waste Moisture Content	40%	40%	
Digestate Density (lb/cy)	1,000	1,000	*Assumption*
Digestate C:N Ratio	45	45	*Assumption*
Digestate Moisture Content	60%	60%	*Assumption*
Food Waste Density (lb/cy)	1,000	1,000	
Food Waste C:N Ratio	45	45	
Food Waste Moisture Content	60%	60%	
Target C:N Ratio	30 to 45	30 to 45	
Target Moisture Content	60%	60%	
Net Bulk Density at Arrival (lb/cy)	713	713	
Target Bulk Density (lb/cy)	850	850	
Net C:N Ratio	29	29	
Net Moisture Content	44%	44%	
Water to Add Initially (gal/yr)	**1,500,189**	**2,188,248**	
Annual Infeed Volume Processed (cy)	**117,391**	**171,232**	
Finished Compost Volume (cy)	64,565	94,178	
Density of Finished Compost (lb/cy)	800	800	
Finished Compost (tons)	**25,826**	**37,671**	

Composting Parameters			
Composting Period (days)	120	120	*6 months from incoming to screening*
Curing Period (days)	40	40	*Recommended*
Storage Period, Pre-Screening (days)	30	30	
Storage Period, Post-Screening (days)	30	30	*Total 60 days compost storage*
Initial Windrow Shrinkage Factor	10%	10%	
Compost Shrinkage Factor	30%	30%	
Curing Shrinkage Factor	5%	5%	

Unloading/Receiving Area			
Yard Waste Daily Pile Volume (cy)	357	520	
2x YW for Peak Day (cy)	713	1040	*Daily yard waste*
YW Pile Height (ft)	10	10	
YW Pile Area (sf)	*1,926*	*2,809*	
Wood & Leaves Pile Volumes (cy)	10,556	15,397	*Assume 10% of annual raw material*
Wood/Leaves Pile Height (ft)	10	10	*For raw material mixing ratios*

Project:	CRLCSWA Infrastructure Options
Date:	11/30/2021
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

Wood/Leaves Pile Area (sf)	*28,501*	*41,573*	*Storage piles for wood chips & leaves*
Digestate Pile Volumes (cy)	76	111	*3-days Digestate*
Digestate Pile Height (ft)	5	5	*For raw material mixing ratios*
Digestate Pile Area (sf)	*409*	*597*	
Food Waste Pile Volume (cy)	26	38	
2x FW for Peak Day (cy)	52	75	*Daily food waste*
FW Pile Height (ft)	5	5	
FW Pile Area (sf)	*278*	*406*	
Hours per Day YW/FW Receipt	9	9	
Vehicles Peaking Factor	1.5	1.5	
Vehicles Payload (avg tons/vehicle)	2	2	*Assumption*
Unloading Time for Loads (minutes)	10	10	*Assumption*
No. Vehicles per Hour (vph)	11	16	
Total Number Unloading Bays	2	3	
Area per Unloading Bay (sf)	720	720	
Unloading Bay Space (sf)	*1,440*	*2,160*	
Maneuvering Space (sf)	*3,600*	*5,400*	
Total Unloading/Receiving Space (sf)	**36,154**	**52,945**	

Compost Pad

Average Volume on Compost Pad (cy)	34,735	50,666	
Compost Windrow Length (ft)	200	200	
Compost Windrow Height (ft)	6	6	*To confirm w/ CRLCSWA*
Compost Windrow Width (ft)	14	14	*To confirm w/ CRLCSWA*
Volume per Row (cy)	373	373	
Number of Rows	94	136	
Spacing Between Windrows (ft)	8	8	
Total Compost Pad Area (sf)	**413,600**	**598,400**	

Compost Curing Pad

Average Volume on Curing Pad (cy)	7,719	11,259	
Curing Windrow Length (ft)	100	100	
Curing Windrow Height (ft)	7	7	*To confirm w/ CRLCSWA*
Curing Windrow Width (ft)	16	16	*To confirm w/ CRLCSWA*
Volume per Row (cy)	249	249	
Number of Rows	32	46	
Spacing Between Windrows (ft)	6	6	
Total Curing Pad Area (sf)	**70,400**	**101,200**	

Storage Pad1 - PreScreening

Average Volume on Storage Pad (cy)	5,307	7,741
Storage Windrow/Pile Height (ft)	15	15
Total Storage Pad1 Area (sf)	**13,646**	**19,904**

Finished Compost Screening Area

Loading Traffic Area Width (ft)	50	50
Loading Traffic Area Length (ft)	100	100
Loading Traffic Area (sf)	*5,000*	*5,000*
Mixing Bin/Screen w/ Stockpile Width (ft)	75	75

Project:	CRLCSWA Infrastructure Options		
Date:	11/30/2021		
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa		
Worksheet:	**Aerobic Organics Composting - Sizing**		

Mixing Bin/Screen w/ Stockpile Length (ft)	100	100	
Mixing Bin/Screen w/ Stockpile Area (sf)	*7,500*	*7,500*	
Total Screening Area (sf)	**12,500**	**12,500**	
Storage Pad2 - Post-Screening			
Average Volume on Storage Pad (cy)	5,307	7,741	
Storage Windrow/Pile Height (ft)	15	15	
Total Storage Pad2 Area (sf)	**13,646**	**19,904**	
Traffic Lanes for Operations			
Traffic Lane Width (ft)	20	20	
Cummulative Processing Area (sf)	559,946	804,853	
Square Root (ft)	748	897	
Traffic Lane Length =	2,993	3,589	
Total Operations Traffic Lanes Area (sf)	**59,864**	**71,771**	
Retention/Leachate Pond			
Area Contributing to Pond (sf)	619,809	876,624	*Total of Areas above*
100-Yr 24 hr Stor Event Rainfall Intensity I	0.310	0.310	PF Map: Contiguous US (noaa.gov)
Area A (acres)	14.2	20.1	
Run-off Factor C	0.60	0.60	
Flow Rate Q (cfs)	2.6	3.7	*using Rational Formula Q=CIA*
Time to Retain (hours)	24	24	
Volume of Water to Retain (cf)	228,356	322,974	
Depth of Pond (ft)	6	6	
Side Slopes of Pond #:1	4	4	
Pond Area at 1/2 Depth (sf)	38,059	53,829	*Volume divided by Depth*
Length & Width at 1/2 Depth (ft)	195	232	
Total Pond Area (sf)	**48,000**	**65,542**	*at grade*
SUMMARY OF COMPOST AREAS			
Unloading/Receiving Area	36,154	52,945	
Compost Pad	413,600	598,400	
Compost Curing Pad	70,400	101,200	
Storage Pad1 - Pre-Screening	13,646	19,904	
Finished Compost Screening Area	12,500	12,500	
Storage Pad2 - Post-Screening	13,646	19,904	
Traffic Lanes for Operations	59,864	71,771	
Retention/Leachate Pond	48,000	65,542	
TOTAL REQUIRED AREA (sf)	**667,809**	**942,166**	
TOTAL REQUIRED AREA (acres)	**15.33**	**21.63**	
Site - Composting & Buffer (acres)	**24**	**31**	*Assume 100' buffer*

Project:	CRLCSWA Infrastructure Options			
Date:	11/9/2021			
Facility:	New Aerobic Organics Compost Site - Windrows - No Design			
Costs:	2021$	Facility Size:	22 Acres	
Location:	Linn County, Iowa	Required Land:	31 Acres	
Worksheet:	**Composting Capital Costs**	**TOTAL COMPOST CAP$**		**$9,384,800**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
CAPITAL COST ESTIMATE SUMMARY [1][2]

Compost Site Capital	**Quantity**	**Unit**		**Unit Price**		**Total**	
Site Investigations	1	LS	$	50,000	$	50,000	*Assumption*
Site Work							
Mobilization/Demob	1	LS	$	50,000	$	50,000	
Clear & Grub	11	Acres	$	2,000	$	22,000	*Assume no demolition; half compost area*
Grading/Excavation	71,000	CY	$	3	$	213,000	*Assume 2' across compost area*
Structural Fill	21,300	CY	$	10	$	213,000	*Assume 30% of excavation quantities*
Roadways	9,300	SY	$	45	$	418,500	*4" asphalt over 6" granular base*
Site Utilities							
Stormwater Pond	-	LS	$	200,000	$	-	*See Compost Leachate Lagoon*
Site Drainage/Erosion Control	1	EA	$	25,000	$	25,000	
Electrical - Service to Site	-	LS	$	-	$	-	*Included w/ LF, TS, AD, MWP or WTE*
Water Supply & Fire Protection	1	LS	$	100,000	$	100,000	*Extend water supply to compost facility*
Sanitary Sewer	-	EA	$	-	$	-	*Included w/ LF, TS, AD, MWP or WTE*
Natural Gas System	-	LS	$	-	$	-	*NA*
Surveying	1	EA	$	10,000	$	10,000	*For composting area only*
Landscaping, Signage	1	EA	$	20,000	$	20,000	*For composting area only*
Fencing	4,600	LF	$	35	$	161,000	*Around composting area*
Pads & Leachate Collection							
Composting & Curing Pads	77,700	SY	$	45	$	3,497,000	*Asphalt Pad - Full Buildout*
Screening/Storage Areas	5,800	SY	$	25	$	145,000	*Compacted Gravel Pad - Full Buildout*
Compost Leachate Lagoon, Lined	1	LS	$	500,000	$	500,000	*Approximate 2 acres*
Market Variability Factor	15%	Capital $	$	5,424,500	$	814,000	*Sitework, horizontal construction*
SUBTOTAL COMPOST SITE CAPITAL					**$**	**6,238,500**	

***Engineering* [3]**	**Quantity**	**Unit**		**Unit Price**		**Total**
Contingency	20%	Capital $	$	6,238,500	$	1,247,700
Engineering & Design	4%	Capital $	$	6,238,500	$	249,500
Permitting (Local & IDNR)	2%	Capital $	$	6,238,500	$	124,800
Construction Observation/CQA	6%	Capital $	$	6,238,500	$	374,300
SUBTOTAL COMPOST SOFT COSTS					**$**	**1,996,300**

Equipment Capital	**Quantity**	**Unit**		**Unit Price**		**Total**	
Windrow Turner	1	EA	$	750,000	$	750,000	*Replacement*
Loader (large)	1	EA	$	400,000	$	400,000	*Replacement*
Water Truck	0	EA	$	200,000	$	-	*Existing*
Screen Compost Finish	0	EA	$	300,000	$	-	*Existing*
Grinder/Shredder	0	EA	$	600,000	$	-	*Existing*
Conveyors	0	EA	$	75,000	$	-	*NA - included w/ screener or grinder*
SUBTOTAL					**$**	**1,150,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing co Does not include financing costs.

Assumed cell projects to be c Assumed cell projects to be competitively bid under one general contract.

Assumed construction to be d Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	New Aerobic Organics Compost Site - Windrows - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**COMPOST REV$**	**$1,100,700**
Worksheet:	**Composting O&M Costs**	**TOTAL COMPOST O&M$**	**$1,174,100**

SCENARIO 4
CRLCSWA AEROBIC ORGANICS COMPOSTING
OPERATIONS COST ESTIMATE SUMMARY (1)

Compost Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 511,800	*FY2021 fully-burdened salary, escalated*
Scalehouse	0.0	FTE	$ 82,000	$ -		*Included in LF, TS, MWP, AD or WTE*
Windrow Turner Operator	1.5	FTE	$ 103,800	$ 155,700		
Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
Misc. Equip Operator	2.0	FTE	$ 100,200	$ 200,400		*Water truck, grinder, screen, turner, loader*
Utilities					$ 29,400	
Electricity	0	kWh	$ 0.15	$ -		*NA*
Water	1	LS	$ 27,000	$ 27,000		*130 gal/ton for composting, dust control*
Leachate	0	gallons	$ 0.15	$ -		*NA - Compost leachate NPDES Discharge*
Heating Fuel	0	LS	$ 2,500	$ -		*NA*
Phones	12	months	$ 200	$ 2,400		*Estimate based on # labor*
Maintenance and Repairs					$ 154,200	
Roadways, Pads Repair & Misc Maintenance	0.3%	Capital $	$ 6,238,500	$ 18,700		*Percentage of Compost capital*
Windrow Turner	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Loader	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Truck/Screen Equipment	2,368	hours	$ 15	$ 35,500		*80% of personnel hours*
Grinder	208	hours	$ 25	$ 5,200		*Estimate 4 hours per week*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	21,936	gallons	$ 3.50	$ 76,800	$ 76,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Insurance	0.1%	Capital $	$ 6,238,500	$ 6,200	$ 6,200	*Percentage of compost total capital*
Compost Lab Testing	1	LS	$ 5,000	$ 5,000	$ 5,000	*Portion from CRLCSWA FY2022 Budget*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL COMPOST DIRECT OPERATIONS					**$ 788,400**	

Compost Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 385,700	*Rounded*
Windrow Turner	1	EA	$ 150,000	$ 150,000		*Capital cost divided by 5-yr life*
Loader	1	EA	$ 57,143	$ 57,100		*Capital cost divided by 7-yr life*
Water Truck	1	EA	$ 28,600	$ 28,600		*Shared w/ TS for roads dust control*
Screen Compost Finish	1	EA	$ 30,000	$ 30,000		*Capital cost divided by 10-yr life*
Grinder/Shredder	1	EA	$ 120,000	$ 120,000		*Capital cost divided by 5-yr life*
Conveyors	0	EA	$ 7,500	$ -		*Included w/ screen or grinder*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 composting*
SUBTOTAL LF CASH RESERVES					**$ 385,700**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Compost Sales	7,748	Ton	$ 24	$ 185,900	$ 185,900	*Assume 30% compost sales to businesses*
Tip Fees	38,118	Ton	$ 24	$ 914,800	$ 914,800	*Current CRLCSWA unit price*
Digestate	3,740	Ton	$ -	$ -	$ -	
Non-Cash Adjustments	0	LS	$ 25,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
SUBTOTAL OTHER REVENUES					**$ 1,100,700**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options		
Date:	11/23/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$	Land:	10 Acres
Location:	Linn County, Iowa		
Worksheet:	**Scalehouse & Scales Capital Costs**	**TOTAL CAP$**	**$2,189,600**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
SCALEHOUSE CAPITAL COST ESTIMATE SUMMARY (1)(2)

Scalehouse Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scalehouse	600	SF	$ 250	$ 150,000	*Approx. current size*
Entrance & Queuing Roads	13,300	SY	$ 60	$ 798,000	*Concrete 4" over 6" granular base, 3000LF*
Road, Scale Approach, Parking	1,200	SY	$ 60	$ 72,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 15,000	$ 15,000	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,035,000	$ 310,500	*Vertical construction*
SUBTOTAL				**$ 1,345,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,345,500	$ 269,100	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,345,500	$ 161,500	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,345,500	$ 13,500	*Percentage of total capital*
SUBTOTAL				**$ 444,100**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scales	3	EA	$ 125,000	$ 375,000	*New*
Software	1	EA	$ 25,000	$ 25,000	*Software used for LF, Compost, RRC, etc.*
SUBTOTAL				**$ 400,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	2	Acres
Location:	Linn County, Iowa			
Worksheet:	**Admin/Educational Center Capital Cost**	**TOTAL CAP$**		**$2,878,100**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
ADMIN CAPITAL COST ESTIMATE SUMMARY (1)(2)

Administration & Educational Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Two-Story Building	5,500	SF	$ 250	$ 1,375,000	*Building footprint SF; same size as current*
Access Road & Parking	2,300	SY	$ 45	$ 103,500	*Asphalt 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 137,500	$ 137,500	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,616,000	$ 484,800	*Vertical construction*
SUBTOTAL				**$ 2,100,800**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 2,100,800	$ 420,200	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 2,100,800	$ 336,100	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 2,100,800	$ 21,000	*Percentage of total capital*
SUBTOTAL				**$ 777,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**
None at Admin Center				
SUBTOTAL				**$ -**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$	Land:	4 Acres
Location:	Linn County, Iowa		
Worksheet:	**Resource Recovery Center Capital Cost**	**TOTAL CAP$**	**$9,933,900**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
RRC CAPITAL COST ESTIMATE SUMMARY [(1)(2)]

RRC Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
HHM Canopy - Covered Drive	2,000	SF	$ 25	$ 50,000	*CRLCSWA current size*
HHM Facility	8,000	SF	$ 300	$ 2,400,000	*CRLCSWA current size*
RRC Bldg	6,700	SF	$ 250	$ 1,675,000	*Size for just recyclables transfer*
RRC Office/Breakroom/Restrooms	3,600	SF	$ 200	$ 720,000	*CRLCSWA current size*
Access Road, Parking & Maneuvering	5,600	SY	$ 60	$ 336,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 239,750	$ 239,800	*5% of buildings cost*
Market Variability Factor	30%	Capital $	$ 5,420,800	$ 1,626,200	*Vertical construction*
SUBTOTAL				**$ 7,047,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 7,047,000	$ 1,409,400	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 7,047,000	$ 986,600	*Percentage of total capital*
Permitting (Local & IDNR)	2%	Capital $	$ 7,047,000	$ 140,900	*Percentage of total capital*
SUBTOTAL				**$ 2,536,900**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Baler	0	EA	$ 1,000,000	$ -	*Assumes RRC recyclabes transfer only*
Forklift	1	EA	$ 50,000	$ 50,000	*For HHM Facility*
Skid Loader	0	EA	$ 50,000	$ -	*Existing*
Mid-Size Loader	1	EA	$ 300,000	$ 300,000	*Share w/ Citizen Drop-Off and Bunkers*
Roll-off Containers	0	EA	$ 8,000	$ -	*Existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from Citizen Drop-Off*
Trailers	0	EA	$ 30,000	$ -	*Assume provided by end market*
Trucks	0	EA	$ 115,000	$ -	*Assume provided by end market*
SUBTOTAL				**$ 350,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

(3) Sizing for RRC Building

RRC Transfer Sizing	**Year 1**	**Year 50**	
Incoming Recyclables, TPY	4,045	5,943	*Single stream recyclables/drop box handled by CRLCSWA*
Incoming Recyclables, TPD	16	23	*5 days/week*
Incoming Recyclables, TPH	2	3	*8 hours/day*
Number of Unloading Bays	2	2	*Avg 3 tons/veh, 2x peak factor, 15 min unload + 1 extra*
Recyclables - Floor Storage (CY)	247	363	*126 lbs/CY, 1 day worth*
Recyclables - Trailer Payload	7	7	*tons/trailer* *126 lbs/CY*
Area Needed (SF):			
Tipping Floor	3,700	4,400	*Recyclables piled avg 4' high + unloading area*
Transfer Loadout Area Area	1,200	1,200	*60' x 1 trailer load-out lane*
Flex Area	1,000	1,100	*20% extra*
RRC Transfer Building (SF)	**5,900**	**6,700**	

Project:	CRLCSWA Infrastructure Options
Date:	11/30/2021
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design
Costs:	2021$ Land: 2 Acres
Location:	Linn County, Iowa
Worksheet:	**Maintenance Shop Capital Cost** **TOTAL CAP$** **$4,694,100**

SCENARIO 4
CRLCSWA SOLID WASTE CAMPUS FACILITIES
MAINT SHOP CAPITAL COST ESTIMATE SUMMARY (1)(2)

Maintenance Facility Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Maintenance Facility	17,200	SF	$ 150	$ 2,580,000	*CRLCSWA current sizes, LF+Site #3 compost*
Access Road & Maneuvering Area	1,200	SY	$ 45	$ 54,000	*Asphalt 4" over 6" granular base*
Market Variability Factor	30%	Capital $	$ 2,634,000	$ 790,200	*Vertical construction*
SUBTOTAL				**$ 3,424,200**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 3,424,200	$ 684,800	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 3,424,200	$ 410,900	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 3,424,200	$ 34,200	*Percentage of total capital*
SUBTOTAL				**$ 1,129,900**	

Maintenance Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
5-ton Overhead Crane w/ Hoist	1	EA	$ 40,000	$ 40,000	*Crane vendors $35K w/ $5k installed*
Maint/Repair Equipment	1	EA	$ 100,000	$ 100,000	*Estimate*
SUBTOTAL				**$ 140,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/30/2021		
Facility:	SCENARIO 4: Anaerobic Digestion Concept - No Design		
Costs:	2021$	Land:	4 Acres
Location:	Linn County, Iowa		
Worksheet:	**Citizen Drop-Off Center Capital Cost**	**TOTAL CAP$**	**$1,505,300**

SCENARIO 4
CRLCSWA AD W/ NEW LANDFILL OPTION
DROP-OFF CAPITAL COST ESTIMATE SUMMARY (1)(2)

Citizen Drop-Off Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Materials Bunkers Area	1,700	SY	$ 60	$ 102,000	*Concrete for tires, white goods, scrap metal*
Concrete Bunker Walls	80	CY	$ 600	$ 48,000	*3 bunkers 60'x 35' each*
Bulk Excavation & Structural Fill	25,200	CY	$ 13	$ 327,600	*Suitable on-site soils; unloading area 4'*
Waste Unloading Area	6,300	SY	$ 60	$ 378,000	*Current access/maneuvering, Concrete*
Roll-Off Area	1,200	SY	$ 60	$ 72,000	*7 roll-off bays, Concrete*
Concrete Z-Wall	70	CY	$ 600	$ 42,000	*7 roll-off bays*
Market Variability Factor	15%	Capital $	$ 969,600	$ 145,400	*Sitework, horizontal construction*
SUBTOTAL				**$ 1,115,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,115,000	$ 223,000	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 1,115,000	$ 156,100	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,115,000	$ 11,200	*Percentage of total capital*
SUBTOTAL				**$ 390,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Roll-off Containers	0	EA	$ 8,000	$ -	*1 glass; existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from AD Facility*
Skid Loader	0	EA	$ 50,000	$ -	*Share from RRC*
Mid-Size Loader	0	EA	$ 300,000	$ -	*Share from RRC*
SUBTOTAL				**$ -**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/30/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,839,700**

SCENARIO 4
CRLCSWA SOLID WASTE CAMPUS FACILITIES OPTION
OPERATIONS COST ESTIMATE SUMMARY (1)

Scalehouse Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 246,000	
Scalehouse Personnel	3	FTE	$ 82,000	$ 246,000		
Utilities					$ 4,300	
Electricity	6,000	kWh	$ 0.15	$ 900		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 1,000	$ 1,000		*Estimate - small building*
Heating Fuel	1	LS	$ 1,000	$ 1,000		*Estimate 1-2 Therms/SF/year*
Phones	12	months	$ 120	$ 1,400		*Estimate*
Maintenance and Repairs					$ 9,000	
Building	1%	Capital $	$ 150,000	$ 1,500		*Percentage of building capital*
Scales	2%	Capital $	$ 375,000	$ 7,500		*Percentage of scales capital*
Mobile Equipment	0	hours	$ 15	$ -		*None*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 525,000	$ 1,600	$ 1,600	*Percentage of building & scales total capital*
Cash Reserves Bldg/Equip Replacement					$ 31,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Scales	3	EA	$ 8,333	$ 25,000		*Capital divided by 15-yr life*
Scalehouse Building	1	EA	$ 6,000	$ 6,000		*Capital divided by 25-yr life*
SUBTOTAL SCALEHOUSE & SCALES					**$ 293,900**	

Administration & Educational Center Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Agency Labor:					$ 1,583,500	*Estimate 40% from CRLCSWA FY2022 Budget*
Executive Director	1	FTE				
Site Engineer	1	FTE				
Director of Education	1	FTE				
Hazardous Materials Manager	1	FTE				
Operations Foreman	1	FTE				
Admin Personnel	2	FTE				
Utilities					$ 47,500	
Electricity	110,000	kWh	$ 0.15	$ 16,500		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 5,000	$ 5,000		*Estimate - office building*
Natural Gas/Heating Fuel	1	LS	$ 8,000	$ 8,000		*Estimate 1 Therms/SF/year*
Phones	12	months	$ 1,500	$ 18,000		*Estimate*
Maintenance and Repairs					$ 34,500	
Building & Grounds	0.5%	Capital $	$ 2,100,800	$ 10,500		*Percentage of capital*
Mobile Equipment	936	hours	$ 5	$ 4,700		*Assume pick-up trucks maintenance*
Office Equipment	1	LS	$ 19,300	$ 19,300		*CRLCSWA FY2022 Budget*
Agency Purchased Services	1	LS	$ 511,700	$ 511,700	$ 511,700	*CRLCSWA FY2022 Budget*
Agency Supplies & Materials	1	LS	$ 20,900	$ 20,900	$ 20,900	*CRLCSWA FY2022 Budget*
Agency Other Costs	1	LS	$ 46,000	$ 46,000	$ 46,000	*CRLCSWA FY2022 Budget*
Other Operating Costs - Services					$ 222,500	
ECICOG	1	LS	$ 10,000	$ 10,000		*CRLCSWA FY2022 Budget*
Public Education	1	LS	$ 37,500	$ 37,500		*CRLCSWA FY2022 Budget*
Media Advertising	1	LS	$ 125,000	$ 125,000		*CRLCSWA FY2022 Budget*
Comprehensive Planning	1	LS	$ 50,000	$ 50,000		*Annual estimate over period*
Fuel	2,808	gallons	$ 3.50	$ 9,800	$ 9,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 2,100,800	$ 6,300	$ 6,300	*Percentage of capital*
Cash Reserves Bldg/Equip Replacement					$ 55,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Admin Building	1	EA	$ 55,000	$ 55,000		*Capital divided by 25 years*
SUBTOTAL ADMINISTRATION & EDUCATIONAL CENTER					**$ 2,537,700**	

Project:	CRLCSWA Infrastructure Options		
Date:	11/30/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,839,700**

Resource Recovery Center/HHW Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor					$ 486,300	
Hazardous Materials Manager						*Included w/ Agency Labor in Admin/Ed Center*
RRC Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
HHW Facility Receiving	1.5	FTE	$ 82,000	$ 123,000		
HHW Facility Chemists	2.0	FTE	$ 103,800	$ 207,600		
Utilities					$ 59,600	
Electricity	274,500	kWh	$ 0.15	$ 41,200		*15 kWh/SF, mixed use*
Water & Sewer	1	LS	$ 3,000	$ 3,000		*Estimate*
Natural Gas/Heating Fuel	1	LS	$ 13,000	$ 13,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 200	$ 2,400		*Estimate*
Maintenance and Repairs					$ 43,000	
Building & Grounds	0.5%	Capital $	$ 7,047,000	$ 35,200		*Percentage of capital*
Mobile Equipment	520	hours	$ 15	$ 7,800		*Loader, assume 2 hrs per day*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	1,560	gallons	$ 3.50	$ 5,500	$ 5,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 7,047,000	$ 21,100	$ 21,100	*Percentage of building total capital*
Cash Reserves Bldg/Equip Replacement					$ 243,300	
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Loader	1	EA	$ 42,900	$ 42,900		*Capital cost divided by 7-yr life*
Roll-offs	2	EA	$ 800	$ 1,600		*Capital cost divided by 10-yr life*
RRC/HHW Buildings	1	EA	$ 193,800	$ 193,800		*Capital cost divided by 25-yr life*
Disposal/Management Services					$ 543,600	
HHW Disposal	1	LS	$ 90,000	$ 90,000		*CRLCSWA FY2022 Budget*
Electronics Disposal	1	LS	$ 67,700	$ 67,700		*CRLCSWA FY2022 Budget*
Batteries/Flourescents/Medical Waste	1	LS	$ 13,200	$ 13,200		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 24,900	$ 24,900		*CRLCSWA FY2022 Budget*
Tires	1	LS	$ 48,300	$ 48,300		*CRLCSWA FY2022 Budget*
Recycling Services	1	LS	$ 299,500	$ 299,500		*CRLCSWA FY2022 Budget*
SUBTOTAL RESOURCE RECOVERY CENTER					**$ 1,407,400**	

Maintenance Facility Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 311,400	
Mechanic/Maintenance	3	FTE	$ 103,800	$ 311,400		*Servicing all facilities' mobile equipment*
Utilities					$ 34,400	
Electricity	120,400	kWh	$ 0.15	$ 18,100		*Assume 7 kWh/SF repair shop*
Water & Sewer	1	LS	$ 2,500	$ 2,500		*Estimate*
Heating Fuel	1	LS	$ 12,000	$ 12,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 150	$ 1,800		*Estimate*
Maintenance and Repairs					$ 24,100	
Building & Grounds	0.5%	Capital $	$ 3,424,200	$ 17,100		*Percentage of capital*
Crane/Equipment	5%	Capital $	$ 140,000	$ 7,000		*Percentage of equipment capital*
Mobile Equipment	0	hours	$ 15	$ -		*Included w/ LF, TS, MWP, AD or WTE*
Supplies	1	LS	$ 78,600	$ 78,600	$ 78,600	*FY2022 Budget, Tools & Equipment, Shop*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 3,424,200	$ 10,300	$ 10,300	*Percentage of total capital*
Cash Reserves Bldg/Equip Replacement					$ 107,200	
Overhead Crane	1	EA	$ 4,000	$ 4,000		*Capital over 10-year life*
Maintenance Building	1	EA	$ 103,200	$ 103,200		*Capital over 25-year life*
SUBTOTAL MAINTENANCE FACILITY					**$ 566,000**	

Citizen Drop-Off Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:	Included with Labor for LF, TS, MWP, AD or WTE					*Shared Labor*
Utilities					$ -	
Electricity	0	kWh	$ 0.15	$ -		*Outdoors*
Water & Sewer	0	LS	$ -	$ -		*NA*

Project:	CRLCSWA Infrastructure Options
Date:	11/30/2021
Facility:	Solid Waste Campus Support Facilities
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Support Facilities O&M Costs**

MATERIAL REV$	**$647,900**
ANNUAL O&M$	**$4,839,700**

Heating Fuel	0	LS	$ -	$ -		*NA*
Phones	0	months	$ -	$ -		*NA*
Maintenance and Repairs					$ 19,800	
Paving/Pad Repairs	1%	Capital $	$ 450,000	$ 4,500		*Percentage of pad capital*
Mobile Equipment	1,020	hours	$ 15	$ 15,300		*Assume 8 hours/month*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	3,060	gallons	$ 3.50	$ 10,700	$ 10,700	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 450,000	$ 1,400	$ 1,400	*Percentage of construction capital*
Cash Reserves Equipment Replacement						
Roll-off Containers	1	EA	$ 800	$ 800	$ 800	*Capital over 10-year life*
Roll-off Truck	0	EA	$ 11,000	$ -	$ -	*Capital over 10-year life*
SUBTOTAL CITIZEN DROP-OFF					**$ 34,700**	

Miscellaneous Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
RRC/HHW Materials					$ 647,900	
Scrap Metal	1	LS	$ 18,000	$ 18,000		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 74,700	$ 74,700		*CRLCSWA FY2022 Budget*
Waste Tires	1	LS	$ 53,900	$ 53,900		*CRLCSWA FY2022 Budget*
Electronic Waste	1	LS	$ 114,300	$ 114,300		*CRLCSWA FY2022 Budget*
HHW	1	LS	$ 57,200	$ 57,200		*CRLCSWA FY2022 Budget*
Commingled Recycling	1	LS	$ 271,400	$ 271,400		*CRLCSWA FY2022 Budget*
Recycling Services Revenue Share	1	LS	$ 58,400	$ 58,400		*CRLCSWA FY2022 Budget*
Other Misc. Revenue	0	LS	$ 29,400	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
SUBTOTAL MISC REVENUES					**$ 647,900**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Table 4 - CRLCSWA Material Handling Projections (In Tons)

Material	FY2020	FY2030	FY2040	FY2050	FY2038	FY2087
	Fiscal Year					
Population	228,600	254,900	276,800	298,900		
Materials Landfilled						
MSW	160,086	178,430	193,760	209,230	190,592	278,007
Disaster Debris	0	2,549	2,768	2,989	2,723	3,972
Special Waste	16,612	20,392	22,144	23,912	21,782	31,772
C&D	25,960	17,843	19,376	20,923	19,059	27,801
Shingles	9,091	2,549	2,768	2,989	2,723	3,972
Subtotal Materials Landfilled	**211,749**	**221,763**	**240,816**	**260,043**	**236,879**	**345,523**
Materials Recycled						
Organics	29,710	35,686	38,752	41,846	38,118	55,601
Single Stream/Drop Box/City	11,872	12,745	13,840	14,945	13,614	19,858
Scrap Metal/White Goods	876	1,098	1,193	1,288	1,173	1,711
Subtotal Materials Recycled	**42,458**	**49,529**	**53,785**	**58,079**	**52,905**	**77,170**
Total Materials	254,207	271,292	294,601	318,122	289,784	422,693
Annual MSW Percent Increase		0.65%	0.83%	0.77%		0.77%

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	Fiscal Year (Tons) FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2087	FY2090
PAPER									
Compostable Paper	9.30%	14,888	16,594	17,735	18,020	19,458		26,054	
High Grade Office Paper	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Magazines/Catalogs	1.10%	1,761	1,963	2,098	2,131	2,302		3,082	
Mixed Recyclable Paper	4.20%	6,724	7,494	8,009	8,138	8,788		11,766	
Newsprint	1.00%	1,601	1,784	1,907	1,938	2,092		2,802	
Non-Recyclable Paper	4.60%	7,364	8,208	8,772	8,913	9,625		12,887	
OCC and Kraft Paper	3.40%	5,443	6,067	6,484	6,588	7,114		9,525	
Aseptic/Gable Top Containers	0.10%	160	178	191	194	209		280	
Subtotal Paper	**24.5%**	**39,221**	**43,715**	**46,720**	**47,471**	**51,261**		**68,637**	
PLASTIC									
#1 PET IA Deposit Beverage Container	0.50%	800	892	953	969	1,046		1,401	
#1 PET Beverage Containter	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
#2 HDPE Containers Natural	0.50%	800	892	953	969	1,046		1,401	
#2 HDPE Containers Colored	0.60%	961	1,071	1,144	1,163	1,255		1,681	
Retail Shopping Bags	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Plastic Film	8.70%	13,927	15,523	16,590	16,857	18,203		24,373	
Other #1 PET Containers	0.30%	480	535	572	581	628		840	
Plastic Containers #3-#7	2.40%	3,842	4,282	4,577	4,650	5,022		6,724	
Other Plastic Containers	0.30%	480	535	572	581	628		840	
Expanded Polystyrene	0.90%	1,441	1,606	1,716	1,744	1,883		2,521	
Other Plastic Products	2.90%	4,642	5,174	5,530	5,619	6,068		8,124	
Subtotal Plastic	**19.1%**	**30,576**	**34,080**	**36,423**	**37,008**	**39,963**		**53,509**	
METAL									
Aluminum Beverage Containers	0.10%	160	178	191	194	209		280	
Aluminum IA Deposit Beverage Containers	0.31%	496	553	591	601	649		868	
Ferrous Food & Beverage Containers	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Aluminum Containers	0.31%	496	553	591	601	649		868	
Other Ferrous Scrap Metals	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
Other Non-Ferrous Scrap Metals	0.70%	1,121	1,249	1,335	1,356	1,465		1,961	
Subtotal Metal	**3.4%**	**5,475**	**6,102**	**6,522**	**6,627**	**7,156**		**9,581**	
GLASS									
Blue Glass	0.02%	32	36	38	39	42		56	
Brown Glass	0.03%	48	54	57	58	63		84	
Clear Glass	0.89%	1,425	1,588	1,697	1,724	1,862		2,493	
Glass IA Deposit Containers	0.58%	928	1,035	1,106	1,124	1,214		1,625	
Green Glass	0.02%	32	36	38	39	42		56	
Other Mixed Cullet	0.58%	928	1,035	1,106	1,124	1,214		1,625	
Subtotal Glass	**2.1%**	**3,394**	**3,783**	**4,043**	**4,108**	**4,436**		**5,939**	
ORGANICS									
Yard Waste	1.00%	1,601	1,784	1,907	1,938	2,092		2,802	
Food Waste - Loose	15.32%	24,525	27,335	29,214	29,684	32,054		42,919	
Food Waste - Packaged	6.82%	10,918	12,169	13,005	13,214	14,269		19,106	
Textiles and Leather	2.92%	4,675	5,210	5,568	5,658	6,110		8,180	
Diapers	2.92%	4,675	5,210	5,568	5,658	6,110		8,180	
Rubber	2.42%	3,874	4,318	4,615	4,689	5,063		6,780	
Subtotal Organics	**31.4%**	**50,267**	**56,027**	**59,878**	**60,841**	**65,698**		**87,967**	
DURABLE									
Cell Phones & Chargers	0.05%	80	89	95	97	105		140	
Central Processing Units / Peripherals	0.28%	448	500	534	543	586		784	
Computer Monitors / TVs	0.20%	320	357	381	388	418		560	
Electrical and Household Appliances	0.90%	1,441	1,606	1,716	1,744	1,883		2,521	
Subtotal Durable	**1.4%**	**2,289**	**2,552**	**2,727**	**2,771**	**2,992**		**4,006**	
CONSTRUCTION & DEMOLITION									
Wood - Untreated	0.30%	480	535	572	581	628		840	

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	Fiscal Year (Tons) FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2087	FY2090
Wood - Treated	5.50%	8,805	9,814	10,488	10,657	11,508		15,408	
Asphalt Pavement, Brick, Rock, & Concrete	0.04%	64	71	76	78	84		112	
Asphalt Roofing	0.03%	48	54	57	58	63		84	
Drywall/Gypsum Board	0.04%	64	71	76	78	84		112	
Carpet & Carpet Padding	1.30%	2,081	2,320	2,479	2,519	2,720		3,642	
Subtotal C&D	**7.2%**	**11,542**	**12,865**	**13,749**	**13,970**	**15,085**		**20,199**	
HOUSEHOLD HAZARDOUS MATERIALS (HHM)									
Chemicals	0.50%	800	892	953	969	1,046		1,401	
Lead-Acid Batteries	0.05%	80	89	95	97	105		140	
Mercury Containing Products	0.04%	64	71	76	78	84		112	
Lithium Batteries	0.10%	160	178	191	194	209		280	
Other Batteries	0.05%	80	89	95	97	105		140	
Sharps	0.04%	64	71	76	78	84		112	
Prescription Medications	0.04%	64	71	76	78	84		112	
Subtotal HHM	**0.8%**	**1,313**	**1,463**	**1,564**	**1,589**	**1,716**		**2,297**	
OTHER									
Other Organics	4.40%	7,044	7,851	8,391	8,525	9,206		12,327	
Other Inorganics	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
Other C&D	1.10%	1,761	1,963	2,098	2,131	2,302		3,082	
Other Durables	1.30%	2,081	2,320	2,479	2,519	2,720		3,642	
Other HHM	0.10%	160	178	191	194	209		280	
Fines	1.60%	2,561	2,855	3,051	3,100	3,348		4,482	
Other	0.30%	480	535	572	581	628		840	
Subtotal Other	**10.0%**	**16,009**	**17,843**	**19,069**	**19,376**	**20,923**		**28,015**	
TOTALS - MSW	**100.0%**	**160,086**	**178,430**	**190,694**	**193,760**	**209,230**	**263,453**	**280,150**	**284,488**
						0.77%			
		160,086	178,430	190,694	193,760	209,230	Check	280,150	

Project:	CRLCSWA Infrastructure Options
Date:	12/27/2021
Facility:	SCENARIO 5: WTE Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**OTHER SROI INPUTS**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
OTHER SROI INPUTS (2021$)

Timing of Capital Costs

SCENARIO 5 CAMPUS	2022	2023	2024	2025	2026	2027
Land Acquisition/Legal/Env	0%	0%	5%	10%	10%	10%
WTE Facility	0%	0%	0%	0%	0%	0%
New Landfill	0%	0%	0%	0%	0%	0%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 3 CAMPUS	2028	2029	2030	2031	2032	2033
Land Acquisition/Legal/Env	15%	50%	0%	0%	0%	0%
WTE Facility	0%	0%	1%	3%	5%	10%
New Landfill	0%	0%	0%	1%	1%	1%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 3 CAMPUS	2034	2035	2036	2037	2038	2039
WTE Facility	15%	20%	25%	20%	1%	0%
New Landfill	2%	6%	8%	10%	2%	0%
Compost Facility	5%	10%	40%	30%	15%	0%
Scalehouse	0%	5%	45%	50%	0%	0%
Admin/Educational Center	0%	5%	30%	55%	10%	0%
RRC/HHW	5%	10%	30%	50%	5%	0%
Maintenance Shop	0%	5%	30%	55%	10%	0%
Citizen Drop-Off	0%	5%	60%	30%	5%	0%

Travel Distances

WTE ash to on-site Solid Waste Campus, Landfill.

Ash Dump Truck =	10	tons per load
One-way Distance =	0.5	miles
Average Speed =	15	mph
Ash Generation, Year 2038 =	45,266	tons ash
Calculated # Loads in Year 2038 =	4527	loads

Recovered Materials to Markets Assumptions:

1. Ferrous & Non-Ferrous Metals to local scrap dealers in Cedar Rapids, Iowa.

Project:	CRLCSWA Infrastructure Options
Date:	11/23/2021 Revised: 12/15/2021
Facility:	SCENARIO 5: WTE Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**SUMMARY**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
SUMMARY (2021$)

Facility	Minimum Land Required (Acres)	Land Purchase (Acres)	Liner / Pad Areas (Acres)	Building Size (SF)	Year 1, TPY	Year 50, TPY
WTE Facility	18	---	---	77,100	190,592	278,007
New Landfill	141	---	50	---	101,068	147,443
Compost Facility	30	---	21	---	38,118	55,601
Scalehouse	10	---	---	600	---	---
Admin/Educational Center	2	---	---	5,500	---	---
RRC/HHW	4	---	---	18,300	4,045	5,943
Maintenance Shop	2	---	---	13,100	---	---
Citizen Drop-Off	2	---	0.4		1,173	1,711
TOTAL	**209**	**320**	---	**114,600**	---	---

Diversion Tonnages		
Organics	38,118	55,601
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
WTE - Ferrous Metals	3,621	5,282
WTE - NonFerrous Metals	453	660
Diversion Subtotal	**47,410**	**69,198**
WTE Volume Reduction	**131,723**	**192,137**
Landfill Tonnages	**101,068**	**147,443**
% Diversion/Reduction from LF	**64%**	**64%**

Facility	Full Build-Out	Year 1 O&M$			Year 1 Revenues $	
	Total Facilities Capital $	O&M $	O&M - Haul$	Closure/ Post-Closure Fund$	Other Revenues$	Energy/ Materials Revenues$
WTE Facility	$525,352,000	$20,343,000	---	---	$335,700	$4,064,900
New Landfill	$48,317,300	$1,297,700	---	$264,300	$0	$0
Compost Facility	$9,052,700	$1,171,200	---	---	$0	$1,091,100
Scalehouse	$2,189,600	$293,900	---	---	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0
RRC/HHW	$9,933,900	$1,407,400	---	---	$0	$647,900
Maintenance Shop	$3,630,800	$527,300	---	---	$0	$0
Citizen Drop-Off	$238,100	$6,500	---	---	$0	$0
	$601,592,500	**$27,584,700**	**$0**	**$264,300**	**$335,700**	**$5,803,900**

SCENARIO 3 CAMPUS	Quantity	Unit	Unit Price	Total	
Land Acquisition - Purchase	320	Acres	$25,000	$8,000,000	*3 Qtr Sections*
Land Acquisition - Legal/Support	25%	LS	$8,000,000	$2,000,000	*% Land Purchase*
Social Justice/Env Impact/Legal	2	RS	$7,000,000	$14,000,000	*Risk Factor*
SUBTOTAL				**$24,000,000**	
Facilities Capital				$464,775,300	
Contingency, Permitting, Eng/Construction Observation/CQA				$132,785,200	
Equipment/Mobile Equipment				$4,032,000	
SUBTOTAL				**$601,592,500**	
Estimated Financing Costs - Landfill				$11,067,000	*5 cells, 10 yrs ea, 4%*

Estimated Financing Costs - All Other Facilities	$259,420,000	*20 yrs, 4% APR*
SUBTOTAL	**$270,487,000**	
TOTAL CAPITAL$	**$896,079,500**	

SCENARIO 5 TIPPING FEE ESTIMATE (2021$)

	Capital$[1]	Annual O&M$[2]	Annual Haul$[2]	Annual Closure/PC$[2]	Total - Gross
Total Costs - Facilities	$601,592,500	$27,584,700	$0	$264,300	
Total Costs - Financing	$270,487,000	---	---	---	
Total Costs-Land/Legal/Env Impac	$24,000,000	---	---	---	
Processed & Landfilled Tons	14,400,161	236,879	236,879	236,879	
$/Ton	**$62.23**	**$116.45**	**$0.00**	**$1.12**	**$178.68**

	Annual Other Revenues[3]	Annual Mat'l/ Energy Revenues[4]	Total - Revenues Before Fees
Revenues	$335,700	$5,803,900	
Landfilled Tons	236,879	236,879	
	$1.42	**$24.50**	**$25.92**

ESTIMATED NET TIP FEE	**$152.76**
Rounded ESTIMATED NET TIP FEE	**$153.00**

Notes:

1. Capital costs include full build out of facilities for 50-year period divided by projected processed & landfilles tons Year 2038-2087.
   Financing costs assume constant annual 4% interest rate on Facilities Capital plus Contingency, Permitting, Engineering & Construction Observation/CQA.
   Land acquisition costs including social justice, environmental impacts and legal.
2. Annual O&M costs include replacement reserves for equipment and rehab/rebuild of buildings over 50-year period. Divided by Year 2038 processed & landfi
3. Other Revenues obtained from CRLCSWA FY2022 budget including grants, investments, non-cash adjustments, other misc. revenues.
   Divided by Year 2038 processed & landfilled tons.
4. Annual Material/Energy Revenues includes recycled materials revenues through RRC (from FY2022 budget), composting tip fees at $24/ton, compost sales at $24/ton, WTE energy & recovered metals revenues. Divided by Year 2038 processed & landfilled tons.

Project:	CRLCSWA Infrastructure Options
Date:	11/23/2021
Facility:	SCENARIO 5: WTE Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**WTE Sizing**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
SIZING WTE FACILITY

Waste Flow (Tons)	**Year 1 FY2038**	**Year 25 FY2063**	**Year 50 FY2087**		
Waste thru WTE Facility					
MSW	190,592	234,300	278,007		
Disaster Debris	0	0	0	0%	*Estimate to WTE*
C&D	0	0	0	0%	*Estimate to WTE*
Shingles	0	0	0	0%	*Estimate to WTE*
Incoming Waste, TPY	190,592	234,300	278,007		
Incoming Waste, TPD	644	792	939	296	*days/year*
Incoming Waste, TPH	72	88	104	9	*hours/day*
Initial Rejects	9,530	11,715	13,900	5%	*of Total Waste Incoming*
Processed Waste, TPY	181,063	222,585	264,106		
Processed Waste, TPD	**550**	**680**	**800**	329	*days/year, 90% WTE availability*
Processed Waste, TPH	23	28	33	24	*hours/day*
Ferrous Metals Recovery	3,621	4,452	5,282	2.0%	*of Processed Waste*
Non-Ferrous Metals Recovery	453	556	660	0.25%	*of Processed Waste*
Diversion - Recyclables, TPY	4,074	5,008	5,942		*Recovered from the ash*
WTE Ash Residue	45,266	55,646	66,027	25%	*of Processed Waste, Remaining after metals*
Waste to Landfill					
Direct to Landfill:					
Disaster Debris	2,723	3,347	3,972		
C&D Waste	19,059	23,430	27,801		
Special Waste	21,782	26,777	31,772		
Shingles	2,723	3,347	3,972		
From WTE Facility:					
Initial Rejects	9,530	11,715	13,900		
Ash Residue	45,266	55,646	66,027		
Landfilled Waste	101,082	124,262	147,443		
% of Scenario 1 Landfilled	42.7%	42.7%	42.7%		

Bldg Sizing	**Year 1 FY2038**	**Year 25 FY2063**	**Year 50 FY2087**		
Sizing Assumptions					
Unloading Bays	9	11	13		*Avg 3 tons/veh, peak factor 2.0, 12 min unload*
Minimum Width (ft)	180	220	260		*20 ft per unloading bay*
Interior Maneuvering (ft)	100	100	100		*maneuvering & unloading*
Waste Storage in Pit (CY)	12,878	15,831	18,784	500	*lbs/CY and 5 day waste*
WTE Combustion/APC Units	1.6	1.9	2.3		*at 350 TPD units*
WTE Constrution Size (TPD)	700	700	700		
Estimated Square Feet					
Tipping Floor	18,000	22,000	26,000		*Maneuvering + unloading area*
Waste Storage Pit	8,700	10,700	12,700		*40 ft deep*
WTE Combustion/APC Units	30,000	30,000	30,000	2	*units at 15,000 SF per unit*
Turbine Generator Room	12,000	12,000	12,000		*Estimate 200' x 60'*
WTE SF	**68,700**	**74,700**	**80,700**		
Ash Management Building	2,400	2,400	2,400		*Estimate 60' x 40'*
Estimate MWP-RDF Land Requirements (Acres)					
Buildings	1.6	1.8	1.9		
Surrounding Area	15.4	15.7	16.0	300	*ft buffer area*
Entrance Area	0.0	0.0	0.0		*Included w/ scalehouse*
Land (Acres)	17.1	17.5	17.9		

Energy Production	**Year 1 FY2038**	**Year 25 FY2063**	**Year 50 FY2087**		
Net kWh Generation	108,637,688	133,550,765	158,463,841	600	*kWh/ton net*
Parasitic Load (kW)	1608	1976	2345	70	*kWh/ton net*

Tonnage Projections-Total Processed or Landfilled

Project:	CRLCSWA Infrastructure Options
Date:	11/23/2021
Facility:	SCENARIO 5: WTE Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**WTE Sizing**

Year	CRLCSWA Projections		Annual % Increase
2020	-	tons	0.46%
2030	221,763	tons	0.83%
2040	240,816	tons	0.77%
2050	260,043	tons	

YR	Calculate Annual Tonnage Processed/Landfilled	Tons per Year	TPD
1	2038	236,879	800
2	2039	238,823	807
3	2040	240,816	814
4	2041	242,673	820
5	2042	244,544	826
6	2043	246,430	833
7	2044	248,330	839
8	2045	250,245	845
9	2046	252,175	852
#	2047	254,119	859
#	2048	256,079	865
#	2049	258,053	872
#	2050	260,043	879
#	2051	262,048	885
#	2052	264,069	892
#	2053	266,105	899
#	2054	268,157	906
#	2055	270,225	913
#	2056	272,308	920
#	2057	274,408	927
#	2058	276,524	934
#	2059	278,656	941
#	2060	280,805	949
#	2061	282,970	956
#	2062	285,152	963
#	2063	287,351	971
#	2064	289,567	978
#	2065	291,800	986
#	2066	294,050	993
#	2067	296,317	1001
#	2068	298,602	1009
#	2069	300,905	1017
#	2070	303,225	1024
#	2071	305,563	1032
#	2072	307,919	1040
#	2073	310,294	1048
#	2074	312,686	1056
#	2075	315,097	1065
#	2076	317,527	1073
#	2077	319,975	1081
#	2078	322,443	1089
#	2079	324,929	1098
#	2080	327,435	1106
#	2081	329,960	1115
#	2082	332,504	1123
#	2083	335,068	1132
#	2084	337,651	1141
#	2085	340,255	1150
#	2086	342,879	1158
#	2087	345,523	1167
	2088		
	TOTAL ESTIMATED FOR POTENTIAL PROCESSED/LF	**14,400,161**	**tons**

Project:	CRLCSWA Infrastructure Options				
Date:	11/10/2021	Revised: 12/15/2021			
Facility:	SCENARIO 5: WTE Concept - No Design				
Costs:	2021$	WTE Size:	700	TPD	
Location:	Linn County, Iowa	Required Land:	18	Acres	
Worksheet:	**WTE Capital Cost**		**TOTAL CAP$**		**$525,352,000**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
WTE CAPITAL COST ESTIMATE SUMMARY (1)(2)

MWP-RDF Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
WTE Facility	700	TPD	$ 450,000	$ 315,000,000	*Includes sitework, utilities, equipment*
Market Variability Factor	30%	Capital $	$ 315,000,000	$ 94,500,000	*Vertical construction*
SUBTOTAL WTE CONSTRUCTION				**$ 409,500,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	LS	$ 409,500,000	$ 81,900,000	
Eng., Design, Constr. Mgmt, Commissioning	0%	LS	$ 409,500,000	$ -	*Vendor's Cost, Included in WTE facility*
Permitting (Local & IDNR)	3%	LS	$ 409,500,000	$ 12,285,000	*Owner's Costs*
Procurement, Review & Construction Monitoring	5%	LS	$ 409,500,000	$ 20,475,000	*Owner's Costs*
SUBTOTAL WTE SOFT COSTS				**$ 114,660,000**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Loader	2	EA	$ 400,000	$ 800,000	
Skid Loader	1	EA	$ 50,000	$ 50,000	
Roll-Off Truck	1	EA	$ 110,000	$ 110,000	
Roll-Off Containers	4	EA	$ 8,000	$ 32,000	*Rejects & Metals Recovery*
Dump Truck	1	EA	$ 200,000	$ 200,000	*Ash haul to on-site landfill*
Forklift	0	EA	$ 50,000	$ -	
Yard Tractor	0	EA	$ 100,000	$ -	
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*
SUBTOTAL				**$ 1,192,000**	

ASSUMPTIONS:

1. No sales tax is included. Assumed facility is tax exempt.
2. Costs rounded to nearest thousand.
3. Does not include financing costs.
4. Assumed project to be competitively bid under one general contract.
5. Assumed construction to be during normal working hours.
6. The construction costs are used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021 Revised: 12/15/2021			
Facility:	SCENARIO 5: WTE Concept - No Design		**ENERGY REV$**	**$3,259,100**
Costs:	2021$ WTE Size:	700 TPD	**MAT'L REV$**	**$805,800**
Location:	Linn County, Iowa		**OTHER REVENUES$**	**$335,700**
Worksheet:	**WTE O&M Costs**		**ANNUAL WTE O&M$**	**$20,343,000**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
WTE OPERATIONS COST ESTIMATE SUMMARY (1)

WTE Direct Operations	Quantity	Unit	Unit Price	Annual Costs	Total	
Labor:					$ 3,390,800	*FY2021 fully-burdened salary, escalated*
Scalehouse	0	FTE	$ 82,000	$ -		*Included w/ Scalehouse operations*
Loader Operator	2	FTE	$ 103,800	$ 207,600		*Tipping Floor, 6 days/wk*
Crane Operator	4	FTE	$ 103,800	$ 415,200		*1 per shift x 3 shifts/day x 7 days/wk*
Power Block Personnel	17	FTE	$ 114,400	$ 1,944,800		*4 per shift x 3 shifts/day x 7 days/wk*
Ash Management	2	FTE	$ 100,200	$ 200,400		*1 per shift x 2 shifts/day x 5 days/wk*
Maintenance/Mechanics	6	FTE	$ 103,800	$ 622,800		*2 per shift x 2 shifts/day x 7 days/wk*
Transfer Drivers - See Haul Costs						*Included in haul costs per ton*
Utilities					$ 119,500	
Electricity	183,000	kWh	$ 0.15	$ 27,500		*13% parasitic load during downtimes*
Water & Sewer	1	LS	$ 30,000	$ 30,000		*Estimate*
Natural Gas	1	LS	$ 50,000	$ 50,000		*Estimate - start ups*
Phones	12	months	$ 1,000	$ 12,000		*Estimate based on FTE*
Maintenance and Repairs					$ 3,253,500	
Building	1%	Capital $	$ 63,000,000	$ 630,000		*Bldg capital 20% of construction capital*
Power Block Equipment	1%	Capital $	$ 252,000,000	$ 2,520,000		*Equip capital 80% of construction capital*
Mobile Equipment	6,900	hours	$ 15	$ 103,500		*Avg equip operating hours (loaders, ash dump truck); not include transfer*
Consumables	1	LS	$ 100,000	$ 100,000	$ 100,000	*Estimate*
Supplies	0	LS	$ -	$ -	$ -	*Included w/ Power Block Equipment Estimate*
Fuel	20,700	gallons	$ 3.50	$ 72,500	$ 72,500	*Assume 3 gallons per hour operating*
Professional Services & Eng	1	LS	$ 200,000	$ 200,000	$ 200,000	*Estimate*
WTE Insurance	0.1%	Capital $	$ 409,500,000	$ 409,500	$ 409,500	*Percentage of WTE total capital*
Administration - Agency Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL WTE DIRECT OPERATIONS					**$ 7,545,800**	

WTE Cash Reserves	Quantity	Unit	Unit Price	Annual Costs	Total	
Mobile Equipment Replacement					$ 159,200	
Loaders	2	EA	$ 57,143	$ 114,300		*Capital cost divided by 7-yr life*
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Roll-Off Truck	1	EA	$ 11,000	$ 11,000		*Capital cost divided by 10-yr life*
Roll-Off Containers	4	EA	$ 800	$ 3,200		*Capital cost divided by 10-yr life*
Dump Truck	1	EA	$ 20,000	$ 20,000		*Capital cost divided by 10-yr life*
Forklift	0	EA	$ 5,000	$ -		*Capital cost divided by 10-yr life*
Yard Tractor	0	EA	$ 10,000	$ -		*Capital cost divided by 10-yr life*
Pickup Truck	1	EA	$ 5,714	$ 5,700		
WTE Rehab/Replacement	1	EA	$ 12,600,000	$ 12,600,000	$ 12,600,000	*Capital cost divided by 25-yr life*
Operating Cash Reserve	1	LS	$ 38,000	$ 38,000	$ 38,000	*CRLCSWA FY2021 Budget, rounded*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*Estimate from Agency, NA if compost w/ MWP*
SUBTOTAL CASH RESERVES					**$ 12,797,200**	

Other Revenues	Quantity	Unit	Unit Price	Annual Costs	Total	
Grants/Investments/ Other	1	LS	$ 281,300	$ 281,300	$ 281,300	*CRLCSWA FY2022 Budget*
Non-Cash Adjustments	1	LS	$ 25,000	$ 25,000	$ 25,000	*CRLCSWA FY2022 Budget*
Other Misc. Revenue	1	LS	$ 29,400	$ 29,400	$ 29,400	*CRLCSWA FY2022 Budget*
Ferrous Revenues	3,621	Tons	$ 140	$ 506,976	$ 507,000	*Source: Price of Scrap Metals.com Iowa*
Non-Ferrous Revenues	453	Tons	$ 660	$ 298,754	$ 298,800	*Source: Price of Scrap Metals.com Iowa*
Energy Revenues	108,637,688	kWh	$ 0.03	$ 3,259,131	$ 3,259,100	*Approx. wholesale price*
SUBTOTAL OTHER REVENUES					**$ 4,400,600**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 365 days.
   No Shifts = 3 8 hours per shift
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options
Date:	11/11/2021
Facility:	SCENARIO 5: WTE Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MSW Landfill Sizing**

SCENARIO 5
CRLCSWA WTE W/ NEW LANDFILL OPTION
SIZING LANDFILL

Landfill Sizing Components	Calculations		Comments/Notes	
Size	50	acres		
Width Est	1455	feet	Check of dimensions =	50.1 acres
Length Est	1500	feet		
Depth (top liner system)	30	feet	Liner Sideslopes 3:1	
Top Area:	2,178,000	SF		
Bottom Area:	1,683,000	SF		
VOLUME-below ground surface	**2,150,000**	**CY**		
Height (top of waste)	125	feet	Cap Sideslopes 4:1	
Top Area:	227,500	SF	Check top width/length=	477 feet
Bottom Area:	2,178,000	SF		
VOLUME-above ground surface	**5,570,000**	**CY**		
TOTAL WASTE VOLUME CAPACITY	**7,720,000**	**CY**		
Yr 2038-Yr 2088, Estimated Disposal	6,144,900	Tons	from calculation below	
Estimate Density, AUF	1,600	lbs/CY		
Minimum Required Volume:	**7,681,000**	**CY**		99% of total available
Landfill Life:	**50**	**years**		
Conceptual Roadways:				
Entrance Roadways	0	LF	Main entrance w/ Scenario Facility	
Perimeter Roadways	5910	LF		
Minimum Site Area:	500' Buffer		1000' Buffer	
Site - Landfill, Buffer & Borrow	141	acres	278	acres

Tonnage Projections-Total Disposed

Year	CRLCSWA Projections		Scenario 5 LF Waste		Annual % Increase
2030	221,763	tons	94,632	tons	0.83%
2040	240,816	tons	102,762	tons	0.77%
2050	260,043	tons	110,967	tons	

YR	Calculate Annual Tonnage Potential Disposal in New LF	TPY	TPD
1	2038	101,068	341
2	2039	101,911	344
3	2040	102,762	347
4	2041	103,554	350
5	2042	104,353	353
6	2043	105,158	355
7	2044	105,968	358
8	2045	106,786	361

Project:	CRLCSWA Infrastructure Options
Date:	11/11/2021
Facility:	SCENARIO 5: WTE Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MSW Landfill Sizing**

9	2046	107,609	364
10	2047	108,439	366
11	2048	109,275	369
12	2049	110,118	372
13	2050	110,967	375
14	2051	111,822	378
15	2052	112,685	381
16	2053	113,553	384
17	2054	114,429	387
18	2055	115,311	390
19	2056	116,201	393
20	2057	117,097	396
21	2058	118,000	399
22	2059	118,909	402
23	2060	119,826	405
24	2061	120,750	408
25	2062	121,681	411
26	2063	122,620	414
27	2064	123,565	417
28	2065	124,518	421
29	2066	125,478	424
30	2067	126,446	427
31	2068	127,421	430
32	2069	128,403	434
33	2070	129,393	437
34	2071	130,391	441
35	2072	131,397	444
36	2073	132,410	447
37	2074	133,431	451
38	2075	134,460	454
39	2076	135,496	458
40	2077	136,541	461
41	2078	137,594	465
42	2079	138,655	468
43	2080	139,724	472
44	2081	140,802	476
45	2082	141,887	479
46	2083	142,981	483
47	2084	144,084	487
48	2085	145,195	491
49	2086	146,315	494
50	2087	147,443	498
	2088		
TOTAL ESTIMATED TONS FOR POTENTIAL DISPOSAL		**6,144,882**	**tons**

Project:	CRLCSWA Infrastructure Options			
Date:	11/11/2021 Revised: 12/15/2021			
Facility:	SCENARIO 5: WTE Concept - No Design			
Costs:	2021$	LF Size:	50 Acres	
Location:	Linn County, Iowa	Required Land:	141 Acres	
Worksheet:	**MSW Landfill Capital Cost**	**TOTAL LF CAP$**		**$48,317,300**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
CAPITAL COST ESTIMATE SUMMARY (1)(2)

Landfill Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations					
Hydrogeologic Characterization	1	LS	$ 200,000	$ 200,000	*Initial site investigations*
Supplemental Site Investigations	5	EA	$ 20,000	$ 100,000	*prior to each cell development*
Groundwater Monitoring Wells	7	EA	$ 8,000	$ 56,000	
Gas Migration Monitoring Probes	-	EA	$ 3,000	$ -	*None - Ash, rejects, special waste, etc.*
Site Work					
Mobilization/Demob	5	EA	$ 100,000	$ 500,000	*Number of cells construction*
Clear & Grub	25	Acres	$ 2,000	$ 50,000	*Assume no demolition; half of LF area*
Bulk Excavation	2,150,000	CY	$ 3	$ 6,450,000	*Adequate quantity & quality of soils on-site*
Structural Fill	645,000	CY	$ 10	$ 6,450,000	*Assume 30% of bulk excavation quantities*
Roadways	20,000	SY	$ 45	$ 900,000	*4" asphalt over 6" granular base*
Site Utilities					
Stormwater Pond	1	LS	$ 250,000	$ 250,000	*Estimate*
Site Drainage/Erosion Control	5	EA	$ 50,000	$ 250,000	*Number of cells construction*
Electrical - New service to Site	1	LS	$ 100,000	$ 100,000	*Extend electrical to landfill*
Water Supply & Fire Protection	1	LS	$ 100,000	$ 100,000	*Extend water supply to landfill*
Sanitary Sewer	-	EA		$ -	*Included w/ WTE Facility*
Natural Gas System	-	LS	$ -	$ -	*NA for Landfill*
Surveying	5	EA	$ 25,000	$ 125,000	
Screening, Landscaping, Signage	5	EA	$ 60,000	$ 300,000	*Allowance*
Fencing	9,900	LF	$ 35	$ 346,500	*LF site perimeter*
Liner & Leachate Collection System					
Composite Liner System	50	Acres	$ 250,000	$ 12,500,000	*Recompacted Clay, geomembrane, 12" granular, geotextile & protective cover*
Leachate Collection Pipes, Sumps, Pumps & Controls, Lift Station, Forcemain	8%	Liner $	$ 12,500,000	$ 1,000,000	
Leachate Lagoon	1	LS	$ 1,625,000	$ 1,625,000	*Estimate 5 acres lined + 30% for excavation*
Active Gas Collection System	50	Acres	$ -	$ -	*None - See Closure Costs*
Market Variability Factor	15%	Capital $	$ 31,302,500	$ 4,695,400	*Sitework, horizontal construction*
SUBTOTAL LANDFILL CAPITAL				**$ 35,997,900**	

Engineering (4)	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 35,997,900	$ 7,199,600
Engineering & Design	4%	Capital $	$ 35,997,900	$ 1,439,900
Permitting	2%	Capital $	$ 35,997,900	$ 720,000
Construction Observation/CQA	6%	Capital $	$ 35,997,900	$ 2,159,900
SUBTOTAL LANDFILL SOFT COSTS				**$ 11,519,400**

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Landfill Compactor	0	EA	$ 1,000,000	$ -	*None*
Track Dozer (D8 or similar)	1	EA	$ 800,000	$ 800,000	*New*
Track Dozer (D6 or similar)	0	EA	$ 550,000		*Existing*
Excavator	0	EA	$ 1,000,000	$ -	*Existing*
Dump Trucks	0	EA	$ 200,000	$ -	*Existing*
Tanker Truck - Leachate Recirculation	0	EA	$ 250,000	$ -	*None*
Water Truck	0	EA	$ 300,000		*Existing*
Pick-up Truck	0	EA	$ 40,000		*Existing*

Project:	CRLCSWA Infrastructure Options				
Date:	11/11/2021 Revised: 12/15/2021				
Facility:	SCENARIO 5: WTE Concept - No Design				
Costs:	2021$	LF Size:	50	Acres	
Location:	Linn County, Iowa	Required Land:	141	Acres	
Worksheet:	**MSW Landfill Capital Cost**	**TOTAL LF CAP$**			**$48,317,300**

SUBTOTAL	**$**	**800,000**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed cell projects to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options
Date:	11/11/2021
Facility:	SCENARIO 5: WTE Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MSW LF Closure & Post-Closure Costs** **ANNUAL FUND PAY-IN** **$264,300**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
CLOSURE & POST-CLOSURE COSTS ESTIMATE SUMMARY [1]

LF Closure Costs	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Direct Capital Costs					$ 6,000,000	
MSW Landfill Capping System [2]	50	Acres	$ 120,000	$ 6,000,000		*Financial assurance (FA) $/acre w/ market variability*
Active LFG Collection System [3]	0	Acres	$ 27,000	$ -		*None- $/acre w/ market variability*
LFG Blower Skid/Flare [4]	0	LS	$1,150,000	$ -		*None - Unit $ w/ market variability factor*
Contingency	10%	Capital $	$ 6,000,000	$ 600,000	$ 600,000	*10% contingency matches FA*
Legal & Administrative	1	LS	$ 25,000	$ 25,000	$ 25,000	
Design/Engineering	8%	Capital $	$ 6,000,000	$ 480,000	$ 480,000	
Construction Observation / CQA	10%	Capital $	$ 6,000,000	$ 600,000	$ 600,000	
SUBTOTAL LF CLOSURE COSTS					**$ 7,705,000**	
ANNUAL CLOSURE FUND PAYMENT[7]					$154,100	

LF Post-Closure Costs	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Direct Post-Closure Operations					$ 5,010,000	
Annual Post-Closure [5]	30	Years	$ 167,000	$ 5,010,000		*FA $*
Active LFG System O&M [6]	0	Years	$ 80,000	$ -		*None - FA $ unit prices*
Contingency	10%	PC Ops$	$ 5,010,000	$ 501,000	$ 501,000	*10% contingency matches FA*
SUBTOTAL LF POST-CLOSURE COSTS					**$ 5,511,000**	
ANNUAL POST-CLOSURE FUND PAYMENT[7]					$ 110,200	

ASSUMPTIONS:

(1) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Assumed projects to be comptetively bid.

Assumed construction to be during normal working hours.

(2) Estimate for composite capping system, terracing, letdown structures, vegetation, and supporting construction activities.

(3) Assumes installation of an active landfill gas collection system with extraction wells, piping, condensate management, system appurtenances, and general conditions.

(4) Assumes installation of landfill gas blower skid/flare and supporting site work, utilities, and general conditions.

(5) Estimate of post-closure care for cap and vegetation, leachate management, groundwater monitoring, LFG migration monitoring, stormwater and security.

(6) Estimate for LFG operations; repairs/maintenance of LFG collection wells, piping, blower, flare; and reporting requirements.

(7) Annual payment assumes site life of 50 years.

Project:	CRLCSWA Infrastructure Options		
Date:	11/11/2021		
Facility:	SCENARIO 5: WTE Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**LFG REVENUES$**	**$0**
Worksheet:	**MSW Landfill O&M Costs**	**ANNUAL LF O&M$**	**$1,297,700**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
OPERATIONS COST ESTIMATE SUMMARY (1)

LF Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor					$ 415,400	*FY2021 fully-burdened salary, escalated*
Scalehouse	0	FTE	$ 82,000	$ -		*Included w/ scalehouse operations*
LF Compactor Operator	0	FTE	$ 103,800	$ -		*WTE ash landfill w/ C&D, special waste, etc.*
LF Equip Operator	3	FTE	$ 103,800	$ 311,400		*Dozers, excavator, dump truck*
LF Leachate Recirculation	0	FTE	$ 103,800	$ -		*None*
LF Spotters	2	FTE	$ 52,000	$ 104,000		*Estimated rate*
LF Utilities					$ 13,700	
Electricity	15,000	kWh	$ 0.15	$ 2,300		*Assume for leachate pumping*
Water	1	LS	$ 10,000	$ 10,000		*Estimate - dust control, etc.*
Leachate	0	gallons	$ 0.15	$ -		*Assume full management on site*
Heating Fuel	0	LS	$ -	$ -		*None at LF area - See SW Campus Bldgs*
Phones	12	months	$ 120	$ 1,400		*Estimate, Use by # primary staff*
Maintenance and Repairs					$ 204,500	
Active LFG System O&M	0	LS	$ 48,000	$ -		*None for ash and C&D landfill*
LFG-to-Energy O&M	0	LS	$ 228,000	$ -		*None for ash and C&D landfill*
Roads, Land & LF Maint	0.2%	Capital $	$ 35,997,900	$ 72,000		*Percentage of LF capital*
Mobile Equipment	5,300	hours	$ 25	$ 132,500		*Avg equip operating hours, total*
LF Environmental Compliance					$ 77,300	
Groundwater Monitoring	1	LS	$ 56,000	$ 56,000		*From FY2022 HDR contract*
Groundwater Lab Analysis	1	LS	$ 16,300	$ 16,300		*CRLCSWA FY2022 Budget*
Leachate Levels Monitoring	1	LS	$ 5,000	$ 5,000		*From FY2022 HDR contract*
LFG Monitoring	0	LS	$ 2,500	$ -		*From FY2022 HDR contract - None for ash*
Supplies	1	LS	$ 15,000	$ 15,000	$ 15,000	*CRLCSWA FY2022 Budget, prorated to LF*
Fuel	15,900	gallons	$ 3.50	$ 55,700	$ 55,700	*Assume 3 gallons per hour operating*
Professional Services & Eng.	1	LS	$ 100,000	$ 100,000	$ 100,000	*Estimate-inspection, permitting, legal*
LF Insurance	0.1%	Capital $	$ 35,997,900	$ 36,000	$ 36,000	*Percentage of LF total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL LF DIRECT OPERATIONS					**$ 917,600**	

LF Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 380,100	*Rounded*
Compactor	0	EA	$ 200,000	$ -		*Capital cost divided by 5-yr life*
Track Dozer (D8 or similar)	1	EA	$ 160,000	$ 160,000		*Capital cost divided by 5-yr life*
Track Dozer (D6 or similar)	0	EA	$ 110,000	$ -		*Capital cost divided by 5-yr life*
Excavator	1	EA	$ 142,857	$ 142,900		*Capital cost divided by 7-yr life*
Dump Trucks	1	EA	$ 28,571	$ 28,600		*Capital cost divided by 7-yr life*
Tanker Truck-Leachate Recirc	0	EA	$ 35,714	$ -		*Capital cost divided by 7-yr life*
Water Truck	1	EA	$ 42,857	$ 42,900		*Capital cost divided by 7-yr life*
Pick-up Truck	1	EA	$ 5,714	$ 5,700		*Capital cost divided by 7-yr life*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included w/ WTE O&M*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 operations*
SUBTOTAL LF CASH RESERVES					**$ 380,100**	

LF Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
New LF Gas-to-Energy	0	LS	$ 436,000	$ -	$ -	*None for ash and C&D landfill*
SUBTOTAL LF REVENUES					**$ -**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
COMPOST FACILITY SIZING

Compost Feedstock	***Initial Development, Year 2038***	***Long Term, Year 2088***	
Incoming Organics (tons)	38,118	55,601	*From SW Volumes Memo 6-10-2021*
% as Food Waste	10%	10%	*Food target percent for windrow ops*
Processing Days per Year	296	296	
Tons per Day	129	188	
Yard Waste Density (lb/cy)	650	650	
Yard Waste C:N Ratio	25	25	
Yard Waste Moisture Content	40%	40%	
Food Waste Density (lb/cy)	1,000	1,000	
Food Waste C:N Ratio	45	45	
Food Waste Moisture Content	60%	60%	
Target C:N Ratio	30 to 45	30 to 45	
Target Moisture Content	60%	60%	
Net Bulk Density at Arrival (lb/cy)	685	685	
Target Bulk Density (lb/cy)	850	850	
Net C:N Ratio	27	27	
Net Moisture Content	42%	42%	
Water to Add Initially (gal/yr)	**1,647,375**	**2,402,939**	
Annual Infeed Volume Processed (cy)	**111,295**	**162,340**	
Finished Compost Volume (cy)	61,212	89,287	
Density of Finished Compost (lb/cy)	800	800	
Finished Compost (tons)	**24,485**	**35,715**	
Composting Parameters			
Composting Period (days)	120	120	*6 months from incoming to screening*
Curing Period (days)	40	40	*Recommended*
Storage Period, Pre-Screening (days)	30	30	
Storage Period, Post-Screening (days)	30	30	*Total 60 days compost storage*
Initial Windrow Shrinkage Factor	10%	10%	
Compost Shrinkage Factor	30%	30%	
Curing Shrinkage Factor	5%	5%	
Unloading/Receiving Area			
Yard Waste Daily Pile Volume (cy)	357	520	
2x YW for Peak Day (cy)	713	1040	*Daily yard waste*
YW Pile Height (ft)	10	10	
YW Pile Area (sf)	*1,926*	*2,809*	
Wood & Leaves Pile Volumes (cy)	10,556	15,397	*Assume 10% of annual raw material*
Wood/Leaves Pile Height (ft)	10	10	*For raw material mixing ratios*
Wood/Leaves Pile Area (sf)	*28,501*	*41,573*	*Storage piles for wood chips & leaves*
Food Waste Pile Volume (cy)	26	38	
2x FW for Peak Day (cy)	52	75	*Daily food waste*
FW Pile Height (ft)	5	5	

Project:	CRLCSWA Infrastructure Options	
Date:	11/9/2021	
Facility:	New Aerobic Organics Compost Site - Windrows - No Design	
Costs:	2021$	
Location:	Linn County, Iowa	
Worksheet:	**Aerobic Organics Composting - Sizing**	

FW Pile Area (sf)	*278*	*406*	
Hours per Day YW/FW Receipt	9	9	
Vehicles Peaking Factor	1.5	1.5	
Vehicles Payload (avg tons/vehicle)	2	2	*Assumption*
Unloading Time for Loads (minutes)	10	10	*Assumption*
No. Vehicles per Hour (vph)	11	16	
Total Number Unloading Bays	2	3	
Area per Unloading Bay (sf)	720	720	
Unloading Bay Space (sf)	*1,440*	*2,160*	
Maneuvering Space (sf)	*3,600*	*5,400*	
Total Unloading/Receiving Space (sf)	**35,745**	**52,347**	
Compost Pad			
Average Volume on Compost Pad (cy)	32,931	48,035	
Compost Windrow Length (ft)	200	200	
Compost Windrow Height (ft)	6	6	*To confirm w/ CRLCSWA*
Compost Windrow Width (ft)	14	14	*To confirm w/ CRLCSWA*
Volume per Row (cy)	373	373	
Number of Rows	89	129	
Spacing Between Windrows (ft)	8	8	
Total Compost Pad Area (sf)	**391,600**	**567,600**	
Compost Curing Pad			
Average Volume on Curing Pad (cy)	7,318	10,674	
Curing Windrow Length (ft)	100	100	
Curing Windrow Height (ft)	7	7	*To confirm w/ CRLCSWA*
Curing Windrow Width (ft)	16	16	*To confirm w/ CRLCSWA*
Volume per Row (cy)	249	249	
Number of Rows	30	43	
Spacing Between Windrows (ft)	6	6	
Total Curing Pad Area (sf)	**66,000**	**94,600**	
Storage Pad1 - PreScreening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	
Total Storage Pad1 Area (sf)	**12,937**	**18,871**	
Finished Compost Screening Area			
Loading Traffic Area Width (ft)	50	50	
Loading Traffic Area Length (ft)	100	100	
Loading Traffic Area (sf)	*5,000*	*5,000*	
Mixing Bin/Screen w/ Stockpile Width (ft)	75	75	
Mixing Bin/Screen w/ Stockpile Length (ft)	100	100	
Mixing Bin/Screen w/ Stockpile Area (sf)	*7,500*	*7,500*	
Total Screening Area (sf)	**12,500**	**12,500**	
Storage Pad2 - Post-Screening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

Total Storage Pad2 Area (sf)	**12,937**	**18,871**	
Traffic Lanes for Operations			
Traffic Lane Width (ft)	20	20	
Cummulative Processing Area (sf)	531,719	764,789	
Square Root (ft)	729	875	
Traffic Lane Length =	2,917	3,498	
Total Operations Traffic Lanes Area (sf)	**58,335**	**69,962**	
Retention/Leachate Pond			
Area Contributing to Pond (sf)	590,054	834,751	*Total of Areas above*
100-Yr 24 hr Stor Event Rainfall Intensity I	0.310	0.310	PF Map: Contiguous US (noaa.gov)
Area A (acres)	13.5	19.2	
Run-off Factor C	0.60	0.60	
Flow Rate Q (cfs)	2.5	3.6	*using Rational Formula Q=CIA*
Time to Retain (hours)	24	24	
Volume of Water to Retain (cf)	217,394	307,547	
Depth of Pond (ft)	6	6	
Side Slopes of Pond #:1	4	4	
Pond Area at 1/2 Depth (sf)	36,232	51,258	*Volume divided by Depth*
Length & Width at 1/2 Depth (ft)	190	226	
Total Pond Area (sf)	**45,945**	**62,701**	*at grade*
SUMMARY OF COMPOST AREAS			
Unloading/Receiving Area	35,745	52,347	
Compost Pad	391,600	567,600	
Compost Curing Pad	66,000	94,600	
Storage Pad1 - Pre-Screening	12,937	18,871	
Finished Compost Screening Area	12,500	12,500	
Storage Pad2 - Post-Screening	12,937	18,871	
Traffic Lanes for Operations	58,335	69,962	
Retention/Leachate Pond	45,945	62,701	
TOTAL REQUIRED AREA (sf)	**635,999**	**897,452**	
TOTAL REQUIRED AREA (acres)	**14.60**	**20.60**	
Site - Composting & Buffer (acres)	**23**	**30**	*Assume 100' buffer*

Project:	CRLCSWA Infrastructure Options			
Date:	11/9/2021			
Facility:	New Aerobic Organics Compost Site - Windrows - No Design			
Costs:	2021$	Facility Size:	21 Acres	
Location:	Linn County, Iowa	Required Land:	30 Acres	
Worksheet:	**Composting Capital Costs**	**TOTAL COMPOST CAP$**		**$9,052,700**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
CAPITAL COST ESTIMATE SUMMARY [(1)(2)]

Compost Site Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations	1	LS	$ 50,000	$ 50,000	*Assumption*
Site Work					
Mobilization/Demob	1	LS	$ 50,000	$ 50,000	
Clear & Grub	11	Acres	$ 2,000	$ 22,000	*Assume no demolition; half compost area*
Grading/Excavation	67,800	CY	$ 3	$ 203,400	*Assume 2' across compost area*
Structural Fill	20,300	CY	$ 10	$ 203,000	*Assume 30% of excavation quantities*
Roadways	9,100	SY	$ 45	$ 409,500	*4" asphalt over 6" granular base*
Site Utilities					
Stormwater Pond	-	LS	$ 200,000	$ -	*See Compost Leachate Lagoon*
Site Drainage/Erosion Control	1	EA	$ 25,000	$ 25,000	
Electrical - Service to Site	-	LS	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Water Supply & Fire Protection	1	LS	$ 100,000	$ 100,000	*Extend water supply to compost facility*
Sanitary Sewer	-	EA	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Natural Gas System	-	LS	$ -	$ -	*NA*
Surveying	1	EA	$ 10,000	$ 10,000	*For composting area only*
Landscaping, Signage	1	EA	$ 20,000	$ 20,000	*For composting area only*
Fencing	4,600	LF	$ 35	$ 161,000	*Around composting area*
Pads & Leachate Collection					
Composting & Curing Pads	73,600	SY	$ 45	$ 3,312,000	*Asphalt Pad - Full Buildout*
Screening/Storage Areas	5,600	SY	$ 25	$ 140,000	*Compacted Gravel Pad - Full Buildout*
Compost Leachate Lagoon, Lined	1	LS	$ 500,000	$ 500,000	*Approximate 2 acres*
Market Variability Factor	15%	Capital $	$ 5,205,900	$ 781,000	*Sitework, horizontal construction*
SUBTOTAL COMPOST SITE CAPITAL				**$ 5,986,900**	

Engineering [(3)]	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 5,986,900	$ 1,197,400
Engineering & Design	4%	Capital $	$ 5,986,900	$ 239,500
Permitting (Local & IDNR)	2%	Capital $	$ 5,986,900	$ 119,700
Construction Observation/CQA	6%	Capital $	$ 5,986,900	$ 359,200
SUBTOTAL COMPOST SOFT COSTS				**$ 1,915,800**

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Windrow Turner	1	EA	$ 750,000	$ 750,000	*Replacement*
Loader (large)	1	EA	$ 400,000	$ 400,000	*Replacement*
Water Truck	0	EA	$ 200,000	$ -	*Existing*
Screen Compost Finish	0	EA	$ 300,000	$ -	*Existing*
Grinder/Shredder	0	EA	$ 600,000	$ -	*Existing*
Conveyors	0	EA	$ 75,000	$ -	*NA - included w/ screener or grinder*
SUBTOTAL				**$ 1,150,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.
(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing co: Does not include financing costs.
Assumed cell projects to be cc Assumed cell projects to be competitively bid under one general contract.
Assumed construction to be d Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	New Aerobic Organics Compost Site - Windrows - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**COMPOST REV$**	**$1,091,100**
Worksheet:	**Composting O&M Costs**	**TOTAL COMPOST O&M$**	**$1,171,200**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
OPERATIONS COST ESTIMATE SUMMARY (1)

Compost Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 511,800	*FY2021 fully-burdened salary, escalated*
Scalehouse	0.0	FTE	$ 82,000	$ -		*Included in LF, TS, MWP, AD or WTE*
Windrow Turner Operator	1.5	FTE	$ 103,800	$ 155,700		
Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
Misc. Equip Operator	2.0	FTE	$ 100,200	$ 200,400		*Water truck, grinder, screen, turner, loader*
Utilities					$ 27,400	
Electricity	0	kWh	$ 0.15	$ -		*NA*
Water	1	LS	$ 25,000	$ 25,000		*130 gal/ton for composting, dust control*
Leachate	0	gallons	$ 0.15	$ -		*NA - Compost leachate NPDES Discharge*
Heating Fuel	0	LS	$ 2,500	$ -		*NA*
Phones	12	months	$ 200	$ 2,400		*Estimate based on # labor*
Maintenance and Repairs					$ 153,500	
Roadways, Pads Repair & Misc Maintenance	0.3%	Capital $	$ 5,986,900	$ 18,000		*Percentage of Compost capital*
Windrow Turner	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Loader	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Truck/Screen Equipment	2,368	hours	$ 15	$ 35,500		*80% of personnel hours*
Grinder	208	hours	$ 25	$ 5,200		*Estimate 4 hours per week*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	21,936	gallons	$ 3.50	$ 76,800	$ 76,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Insurance	0.1%	Capital $	$ 5,986,900	$ 6,000	$ 6,000	*Percentage of compost total capital*
Compost Lab Testing	1	LS	$ 5,000	$ 5,000	$ 5,000	*Portion from CRLCSWA FY2022 Budget*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL COMPOST DIRECT OPERATIONS					**$ 785,500**	

Compost Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 385,700	*Rounded*
Windrow Turner	1	EA	$ 150,000	$ 150,000		*Capital cost divided by 5-yr life*
Loader	1	EA	$ 57,143	$ 57,100		*Capital cost divided by 7-yr life*
Water Truck	1	EA	$ 28,600	$ 28,600		*Shared w/ TS for roads dust control*
Screen Compost Finish	1	EA	$ 30,000	$ 30,000		*Capital cost divided by 10-yr life*
Grinder/Shredder	1	EA	$ 120,000	$ 120,000		*Capital cost divided by 5-yr life*
Conveyors	0	EA	$ 7,500	$ -		*Included w/ screen or grinder*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 composting*
SUBTOTAL LF CASH RESERVES					**$ 385,700**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Compost Sales	7,345	Ton	$ 24	$ 176,300	$ 176,300	*Assume 30% compost sales to businesses*
Tip Fees	38,118	Ton	$ 24	$ 914,800	$ 914,800	*Current CRLCSWA unit price*
Non-Cash Adjustments	0	LS	$ 25,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
SUBTOTAL OTHER REVENUES					**$ 1,091,100**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	10 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Scalehouse & Scales Capital Costs**	**TOTAL CAP$**		**$2,189,600**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
SCALEHOUSE CAPITAL COST ESTIMATE SUMMARY (1)(2)

Scalehouse Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scalehouse	600	SF	$ 250	$ 150,000	*Approx. current size*
Entrance & Queuing Roads	13,300	SY	$ 60	$ 798,000	*Concrete 4" over 6" granular base, 3000LF*
Road, Scale Approach, Parking	1,200	SY	$ 60	$ 72,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 15,000	$ 15,000	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,035,000	$ 310,500	*Vertical construction*
SUBTOTAL				**$ 1,345,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,345,500	$ 269,100	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,345,500	$ 161,500	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,345,500	$ 13,500	*Percentage of total capital*
SUBTOTAL				**$ 444,100**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scales	3	EA	$ 125,000	$ 375,000	*New*
Software	1	EA	$ 25,000	$ 25,000	*Software used for LF, Compost, RRC, etc.*
SUBTOTAL				**$ 400,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Admin/Educational Center Capital Cost**	**TOTAL CAP$**		**$2,878,100**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
ADMIN CAPITAL COST ESTIMATE SUMMARY (1)(2)

Administration & Educational Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Two-Story Building	5,500	SF	$ 250	$ 1,375,000	*Building footprint SF; same size as current*
Access Road & Parking	2,300	SY	$ 45	$ 103,500	*Asphalt 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 137,500	$ 137,500	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,616,000	$ 484,800	*Vertical construction*
SUBTOTAL				**$ 2,100,800**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 2,100,800	$ 420,200	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 2,100,800	$ 336,100	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 2,100,800	$ 21,000	*Percentage of total capital*
SUBTOTAL				**$ 777,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**
None at Admin Center				
SUBTOTAL				**$ -**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$	Land:	4 Acres
Location:	Linn County, Iowa		
Worksheet:	**Resource Recovery Center Capital Cost**	**TOTAL CAP$**	**$9,933,900**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
RRC CAPITAL COST ESTIMATE SUMMARY [(1)(2)]

RRC Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
HHM Canopy - Covered Drive	2,000	SF	$ 25	$ 50,000	*CRLCSWA current size*
HHM Facility	8,000	SF	$ 300	$ 2,400,000	*CRLCSWA current size*
RRC Bldg	6,700	SF	$ 250	$ 1,675,000	*Size for just recyclables transfer*
RRC Office/Breakroom/Restrooms	3,600	SF	$ 200	$ 720,000	*CRLCSWA current size*
Access Road, Parking & Maneuvering	5,600	SY	$ 60	$ 336,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 239,750	$ 239,800	*5% of buildings cost*
Market Variability Factor	30%	Capital $	$ 5,420,800	$ 1,626,200	*Vertical construction*
SUBTOTAL				**$ 7,047,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 7,047,000	$ 1,409,400	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 7,047,000	$ 986,600	*Percentage of total capital*
Permitting (Local & IDNR)	2%	Capital $	$ 7,047,000	$ 140,900	*Percentage of total capital*
SUBTOTAL				**$ 2,536,900**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Baler	0	EA	$ 1,000,000	$ -	*Assumes RRC recyclabes transfer only*
Forklift	1	EA	$ 50,000	$ 50,000	*For HHM Facility*
Skid Loader	0	EA	$ 50,000	$ -	*Existing*
Mid-Size Loader	1	EA	$ 300,000	$ 300,000	*Share w/ Citizen Drop-Off and Bunkers*
Roll-off Containers	0	EA	$ 8,000	$ -	*Existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from Citizen Drop-Off*
Trailers	0	EA	$ 30,000	$ -	*Assume provided by end market*
Trucks	0	EA	$ 115,000	$ -	*Assume provided by end market*
SUBTOTAL				**$ 350,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Sizing for RRC Building

RRC Transfer Sizing	**Year 1**	**Year 50**	
Incoming Recyclables, TPY	4,045	5,943	*Single stream recyclables/drop box handled by CRLCSWA*
Incoming Recyclables, TPD	16	23	*5 days/week*
Incoming Recyclables, TPH	2	3	*8 hours/day*
Number of Unloading Bays	2	2	*Avg 3 tons/veh, 2x peak factor, 15 min unload + 1 extra*
Recyclables - Floor Storage (CY)	247	363	*126 lbs/CY, 1 day worth*
Recyclables - Trailer Payload	7	7	*tons/trailer* *126 lbs/CY*
Area Needed (SF):			
Tipping Floor	3,700	4,400	*Recyclables piled avg 4' high + unloading area*
Transfer Loadout Area Area	1,200	1,200	*60' x 1 trailer load-out lane*
Flex Area	1,000	1,100	*20% extra*
RRC Transfer Building (SF)	**5,900**	**6,700**	

Project:	CRLCSWA Infrastructure Options			
Date:	11/11/2021			
Facility:	SCENARIO 5: WTE Concept - No Design			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Maintenance Shop Capital Cost**	**TOTAL CAP$**		**$3,630,800**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
MAINT SHOP CAPITAL COST ESTIMATE SUMMARY (1)(2)

Maintenance Facility Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Maintenance Facility	13,100	SF	$ 150	$ 1,965,000	*CRLCSWA current Site#3 compost + 1/2 LF*
Access Road & Maneuvering Area	1,200	SY	$ 45	$ 54,000	*Asphalt 4" over 6" granular base*
Market Variability Factor	30%	Capital $	$ 2,019,000	$ 605,700	*Vertical construction*
SUBTOTAL				**$ 2,624,700**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 2,624,700	$ 524,900	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 2,624,700	$ 315,000	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 2,624,700	$ 26,200	*Percentage of total capital*
SUBTOTAL				**$ 866,100**	

Maintenance Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
5-ton Overhead Crane w/ Hoist	1	EA	$ 40,000	$ 40,000	*Crane vendors $35K w/ $5k installed*
Maint/Repair Equipment	1	EA	$ 100,000	$ 100,000	*Estimate*
SUBTOTAL				**$ 140,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/11/2021		
Facility:	SCENARIO 5: WTE Concept - No Design		
Costs:	2021$	Land:	2 Acres
Location:	Linn County, Iowa		
Worksheet:	**Citizen Drop-Off Center Capital Cost**	**TOTAL CAP$**	**$238,100**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
DROP-OFF CAPITAL COST ESTIMATE SUMMARY (1)(2)

Citizen Drop-Off Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Materials Bunkers Area	1,700	SY	$ 60	$ 102,000	*Concrete for tires, white goods, scrap metal*
Concrete Bunker Walls	80	CY	$ 600	$ 48,000	*3 bunkers 60'x 35' each*
Bulk Excavation & Structural Fill	0	CY	$ 13	$ -	*Suitable on-site soils*
Waste Unloading Area	0	SY	$ 60	$ -	*None*
Roll-Off Area	0	SY	$ 60	$ -	*None*
Concrete Z-Wall	0	CY	$ 600	$ -	*None*
Market Variability Factor	15%	Capital $	$ 150,000	$ 22,500	*Sitework, horizontal construction*
SUBTOTAL				**$ 172,500**	

Soft Costs	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 172,500	$ 34,500	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 172,500	$ 27,600	*Percentage of total capital*
Permitting (Local)	2%	Capital $	$ 172,500	$ 3,500	*Percentage of total capital*
SUBTOTAL				**$ 65,600**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Roll-off Containers	0	EA	$ 8,000	$ -	*1 glass; existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from WTE*
Skid Loader	0	EA	$ 50,000	$ -	*Share from RRC*
Mid-Size Loader	0	EA	$ 300,000	$ -	*Share from RRC*
SUBTOTAL				**$ -**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/11/2021		
Facility:	SCENARIO 5: WTE Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,772,800**

SCENARIO 5
CRLCSWA WTE w/ NEW LANDFILL OPTION
OPERATIONS COST ESTIMATE SUMMARY [1]

Scalehouse Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 246,000	
Scalehouse Personnel	3	FTE	$ 82,000	$ 246,000		
Utilities					$ 4,300	
Electricity	6,000	kWh	$ 0.15	$ 900		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 1,000	$ 1,000		*Estimate - small building*
Heating Fuel	1	LS	$ 1,000	$ 1,000		*Estimate 1-2 Therms/SF/year*
Phones	12	months	$ 120	$ 1,400		*Estimate*
Maintenance and Repairs					$ 9,000	
Building	1%	Capital $	$ 150,000	$ 1,500		*Percentage of building capital*
Scales	2%	Capital $	$ 375,000	$ 7,500		*Percentage of scales capital*
Mobile Equipment	0	hours	$ 15	$ -		*None*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 525,000	$ 1,600	$ 1,600	*Percentage of building & scales total capital*
Cash Reserves Bldg/Equip Replacement					$ 31,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Scales	3	EA	$ 8,333	$ 25,000		*Capital divided by 15-yr life*
Scalehouse Building	1	EA	$ 6,000	$ 6,000		*Capital divided by 25-yr life*
SUBTOTAL SCALEHOUSE & SCALES					**$ 293,900**	

Administration & Educational Center Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Agency Labor:					$ 1,583,500	*Estimate 40% from CRLCSWA FY2022 Budget*
Executive Director	1	FTE				
Site Engineer	1	FTE				
Director of Education	1	FTE				
Hazardous Materials Manager	1	FTE				
Operations Foreman	1	FTE				
Admin Personnel	2	FTE				
Utilities					$ 47,500	
Electricity	110,000	kWh	$ 0.15	$ 16,500		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 5,000	$ 5,000		*Estimate - office building*
Natural Gas/Heating Fuel	1	LS	$ 8,000	$ 8,000		*Estimate 1 Therms/SF/year*
Phones	12	months	$ 1,500	$ 18,000		*Estimate*
Maintenance and Repairs					$ 34,500	
Building & Grounds	0.5%	Capital $	$ 2,100,800	$ 10,500		*Percentage of capital*
Mobile Equipment	936	hours	$ 5	$ 4,700		*Assume pick-up trucks maintenance*
Office Equipment	1	LS	$ 19,300	$ 19,300		*CRLCSWA FY2022 Budget*
Agency Purchased Services	1	LS	$ 511,700	$ 511,700	$ 511,700	*CRLCSWA FY2022 Budget*
Agency Supplies & Materials	1	LS	$ 20,900	$ 20,900	$ 20,900	*CRLCSWA FY2022 Budget*
Agency Other Costs	1	LS	$ 46,000	$ 46,000	$ 46,000	*CRLCSWA FY2022 Budget*
Other Operating Costs - Services					$ 222,500	
ECICOG	1	LS	$ 10,000	$ 10,000		*CRLCSWA FY2022 Budget*
Public Education	1	LS	$ 37,500	$ 37,500		*CRLCSWA FY2022 Budget*
Media Advertising	1	LS	$ 125,000	$ 125,000		*CRLCSWA FY2022 Budget*
Comprehensive Planning	1	LS	$ 50,000	$ 50,000		*Annual estimate over period*
Fuel	2,808	gallons	$ 3.50	$ 9,800	$ 9,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 2,100,800	$ 6,300	$ 6,300	*Percentage of capital*
Cash Reserves Bldg/Equip Replacement					$ 55,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Admin Building	1	EA	$ 55,000	$ 55,000		*Capital divided by 25 years*
SUBTOTAL ADMINISTRATION & EDUCATIONAL CENTER					**$ 2,537,700**	

Resource Recovery Center/HHW Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**

Project:	CRLCSWA Infrastructure Options		
Date:	11/11/2021		
Facility:	SCENARIO 5: WTE Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,772,800**

Labor					$ 486,300	
Hazardous Materials Manager						*Included w/ Agency Labor in Admin/Ed Center*
RRC Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
HHW Facility Receiving	1.5	FTE	$ 82,000	$ 123,000		
HHW Facility Chemists	2.0	FTE	$ 103,800	$ 207,600		
Utilities					$ 59,600	
Electricity	274,500	kWh	$ 0.15	$ 41,200		*15 kWh/SF, mixed use*
Water & Sewer	1	LS	$ 3,000	$ 3,000		*Estimate*
Natural Gas/Heating Fuel	1	LS	$ 13,000	$ 13,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 200	$ 2,400		*Estimate*
Maintenance and Repairs					$ 43,000	
Building & Grounds	0.5%	Capital $	$ 7,047,000	$ 35,200		*Percentage of capital*
Mobile Equipment	520	hours	$ 15	$ 7,800		*Loader, assume 2 hrs per day*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	1,560	gallons	$ 3.50	$ 5,500	$ 5,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 7,047,000	$ 21,100	$ 21,100	*Percentage of building total capital*
Cash Reserves Bldg/Equip Replacement					$ 243,300	
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Loader	1	EA	$ 42,900	$ 42,900		*Capital cost divided by 7-yr life*
Roll-offs	2	EA	$ 800	$ 1,600		*Capital cost divided by 10-yr life*
RRC/HHW Buildings	1	EA	$ 193,800	$ 193,800		*Capital cost divided by 25-yr life*
Disposal/Management Services					$ 543,600	
HHW Disposal	1	LS	$ 90,000	$ 90,000		*CRLCSWA FY2022 Budget*
Electronics Disposal	1	LS	$ 67,700	$ 67,700		*CRLCSWA FY2022 Budget*
Batteries/Flourescents/Medical Waste	1	LS	$ 13,200	$ 13,200		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 24,900	$ 24,900		*CRLCSWA FY2022 Budget*
Tires	1	LS	$ 48,300	$ 48,300		*CRLCSWA FY2022 Budget*
Recycling Services	1	LS	$ 299,500	$ 299,500		*CRLCSWA FY2022 Budget*
SUBTOTAL RESOURCE RECOVERY CENTER					**$ 1,407,400**	

Maintenance Facility Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 311,400	
Mechanic/Maintenance	3	FTE	$ 103,800	$ 311,400		*Servicing all facilities' mobile equipment*
Utilities					$ 26,700	
Electricity	91,700	kWh	$ 0.15	$ 13,800		*Assume 7 kWh/SF repair shop*
Water & Sewer	1	LS	$ 2,500	$ 2,500		*Estimate*
Heating Fuel	1	LS	$ 9,000	$ 9,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 120	$ 1,400		*Estimate based on # labor*
Maintenance and Repairs					$ 20,100	
Building & Grounds	0.5%	Capital $	$ 2,624,700	$ 13,100		*Percentage of capital*
Crane/Equipment	5%	Capital $	$ 140,000	$ 7,000		*Percentage of equipment capital*
Mobile Equipment	0	hours	$ 15	$ -		*Included w/ LF, TS, MWP, AD or WTE*
Supplies	1	LS	$ 78,600	$ 78,600	$ 78,600	*FY2022 Budget, Tools & Equipment, Shop*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 2,624,700	$ 7,900	$ 7,900	*Percentage of total capital*
Cash Reserves Bldg/Equip Replacement					$ 82,600	
Overhead Crane	1	EA	$ 4,000	$ 4,000		*Capital over 10-year life*
Maintenance Building	1	EA	$ 78,600	$ 78,600		*Capital over 25-year life*
SUBTOTAL MAINTENANCE FACILITY					**$ 527,300**	

Citizen Drop-Off Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:	Included with Labor for LF, TS, MWP, AD or WTE					*Shared Labor*
Utilities					$ -	
Electricity	0	kWh	$ 0.15	$ -		*Outdoors*
Water & Sewer	0	LS	$ -	$ -		*NA*
Heating Fuel	0	LS	$ -	$ -		*NA*
Phones	0	months	$ -	$ -		*NA*
Maintenance and Repairs					$ 2,400	
Paving/Pad Repairs	1%	Capital $	$ 102,000	$ 1,000		*Percentage of capital*
Mobile Equipment	96	hours	$ 15	$ 1,400		*8 hours/month*

Project:	CRLCSWA Infrastructure Options		
Date:	11/11/2021		
Facility:	SCENARIO 5: WTE Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,772,800**

Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	288	gallons	$ 3.50	$ 1,000	$ 1,000	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 102,000	$ 300	$ 300	*Percentage of construction capital*
Cash Reserves Equipment Replacement						
Roll-off Containers	1	EA	$ 800	$ 800	$ 800	*Capital over 10-year life*
Roll-off Truck	0	EA	$ 11,000	$ -	$ -	*Capital over 10-year life*
SUBTOTAL CITIZEN DROP-OFF					**$ 6,500**	

Miscellaneous Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
RRC/HHW Materials					$ 647,900	
Scrap Metal	1	LS	$ 18,000	$ 18,000		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 74,700	$ 74,700		*CRLCSWA FY2022 Budget*
Waste Tires	1	LS	$ 53,900	$ 53,900		*CRLCSWA FY2022 Budget*
Electronic Waste	1	LS	$ 114,300	$ 114,300		*CRLCSWA FY2022 Budget*
HHW	1	LS	$ 57,200	$ 57,200		*CRLCSWA FY2022 Budget*
Commingled Recycling	1	LS	$ 271,400	$ 271,400		*CRLCSWA FY2022 Budget*
Recycling Services Revenue Share	1	LS	$ 58,400	$ 58,400		*CRLCSWA FY2022 Budget*
Other Misc. Revenue	0	LS	$ 29,400	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
SUBTOTAL MISC REVENUES					**$ 647,900**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Table 4 - CRLCSWA Material Handling Projections (In Tons)

Material	FY2020	FY2030	FY2040	FY2050	FY2038	FY2087
	Fiscal Year					
Population	228,600	254,900	276,800	298,900		
Materials Landfilled						
MSW	160,086	178,430	193,760	209,230	190,592	278,007
Disaster Debris	0	2,549	2,768	2,989	2,723	3,972
Special Waste	16,612	20,392	22,144	23,912	21,782	31,772
C&D	25,960	17,843	19,376	20,923	19,059	27,801
Shingles	9,091	2,549	2,768	2,989	2,723	3,972
Subtotal Materials Landfilled	**211,749**	**221,763**	**240,816**	**260,043**	**236,879**	**345,523**
Materials Recycled						
Organics	29,710	35,686	38,752	41,846	38,118	55,601
Single Stream/Drop Box/City	11,872	12,745	13,840	14,945	13,614	19,858
Scrap Metal/White Goods	876	1,098	1,193	1,288	1,173	1,711
Subtotal Materials Recycled	**42,458**	**49,529**	**53,785**	**58,079**	**52,905**	**77,170**
Total Materials	254,207	271,292	294,601	318,122	289,784	422,693
Annual MSW Percent Increase		0.65%	0.83%	0.77%		0.77%

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2088	FY2090
		Fiscal Year (Tons)							
PAPER									
Compostable Paper	9.3%	14,888	16,594	17,735	18,020	19,458		26,054	
High Grade Office Paper	0.8%	1,281	1,427	1,526	1,550	1,674		2,241	
Magazines/Catalogs	1.1%	1,761	1,963	2,098	2,131	2,302		3,082	
Mixed Recyclable Paper	4.2%	6,724	7,494	8,009	8,138	8,788		11,766	
Newsprint	1.0%	1,601	1,784	1,907	1,938	2,092		2,802	
Non-Recyclable Paper	4.6%	7,364	8,208	8,772	8,913	9,625		12,887	
OCC and Kraft Paper	3.4%	5,443	6,067	6,484	6,588	7,114		9,525	
Aseptic/Gable Top Containers	0.1%	160	178	191	194	209		280	
Subtotal Paper	**24.5%**	**39,221**	**43,715**	**46,720**	**47,471**	**51,261**		**68,637**	
PLASTIC									
#1 PET IA Deposit Beverage Container	0.5%	800	892	953	969	1,046		1,401	
#1 PET Beverage Containter	1.2%	1,921	2,141	2,288	2,325	2,511		3,362	
#2 HDPE Containers Natural	0.5%	800	892	953	969	1,046		1,401	
#2 HDPE Containers Colored	0.6%	961	1,071	1,144	1,163	1,255		1,681	
Retail Shopping Bags	0.8%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Plastic Film	8.7%	13,927	15,523	16,590	16,857	18,203		24,373	
Other #1 PET Containers	0.3%	480	535	572	581	628		840	
Plastic Containers #3-#7	2.4%	3,842	4,282	4,577	4,650	5,022		6,724	
Other Plast Containers	0.3%	480	535	572	581	628		840	
Expanded Polystyrene	0.9%	1,441	1,606	1,716	1,744	1,883		2,521	
Other Plastic Products	2.9%	4,642	5,174	5,530	5,619	6,068		8,124	
Subtotal Plastic	**19.1%**	**30,576**	**34,080**	**36,423**	**37,008**	**39,963**		**53,509**	
METAL									
Aluminum Beverage Containers	0.1%	160	178	191	194	209		280	
Aluminum IA Deposit Beverage Containers	0.3%	496	553	591	601	649		868	
Ferrous Food & Beverage Containers	0.8%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Aluminum Containers	0.3%	496	553	591	601	649		868	
Other Ferrous Scrap Metals	1.2%	1,921	2,141	2,288	2,325	2,511		3,362	
Other Non-Ferrous Scrap Metals	0.7%	1,121	1,249	1,335	1,356	1,465		1,961	
Subtotal Metal	**3.4%**	**5,475**	**6,102**	**6,522**	**6,627**	**7,156**		**9,581**	
GLASS									
Blue Glass	0.0%	32	36	38	39	42		56	
Brown Glass	0.0%	48	54	57	58	63		84	
Clear Glass	0.9%	1,425	1,588	1,697	1,724	1,862		2,493	
Glass IA Deposit Containers	0.6%	928	1,035	1,106	1,124	1,214		1,625	
Green Glass	0.0%	32	36	38	39	42		56	
Other Mixed Cullet	0.6%	928	1,035	1,106	1,124	1,214		1,625	
Subtotal Glass	**2.1%**	**3,394**	**3,783**	**4,043**	**4,108**	**4,436**		**5,939**	
ORGANICS									
Yard Waste	1.0%	1,601	1,784	1,907	1,938	2,092		2,802	
Food Waste - Loose	15.3%	24,525	27,335	29,214	29,684	32,054		42,919	
Food Waste - Packaged	6.8%	10,918	12,169	13,005	13,214	14,269		19,106	
Textiles and Leather	2.9%	4,675	5,210	5,568	5,658	6,110		8,180	
Diapers	2.9%	4,675	5,210	5,568	5,658	6,110		8,180	
Rubber	2.4%	3,874	4,318	4,615	4,689	5,063		6,780	
Subtotal Organics	**31.4%**	**50,267**	**56,027**	**59,878**	**60,841**	**65,698**		**87,967**	
DURABLE									
Cell Phones & Chargers	0.1%	80	89	95	97	105		140	
Central Processing Units / Peripherals	0.3%	448	500	534	543	586		784	
Computer Monitors / TVs	0.2%	320	357	381	388	418		560	
Electrical and Household Appliances	0.9%	1,441	1,606	1,716	1,744	1,883		2,521	
Subtotal Durable	**1.4%**	**2,289**	**2,552**	**2,727**	**2,771**	**2,992**		**4,006**	
CONSTRUCTION & DEMOLITION									
Wood - Untreated	0.3%	480	535	572	581	628		840	

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2088	FY2090
		Fiscal Year (Tons)							
Wood - Treated	5.5%	8,805	9,814	10,488	10,657	11,508		15,408	
Asphalt Pavement, Brick, Rock, & Concrete	0.0%	64	71	76	78	84		112	
Asphalt Roofing	0.0%	48	54	57	58	63		84	
Drywall/Gypsum Board	0.0%	64	71	76	78	84		112	
Carpet & Carpet Padding	1.3%	2,081	2,320	2,479	2,519	2,720		3,642	
Subtotal C&D	**7.2%**	**11,542**	**12,865**	**13,749**	**13,970**	**15,085**		**20,199**	
HOUSEHOLD HAZARDOUS MATERIALS (HHM)									
Chemicals	0.5%	800	892	953	969	1,046		1,401	
Lead-Acid Batteries	0.1%	80	89	95	97	105		140	
Mercury Containing Products	0.0%	64	71	76	78	84		112	
Lithium Batteries	0.1%	160	178	191	194	209		280	
Other Batteries	0.1%	80	89	95	97	105		140	
Sharps	0.0%	64	71	76	78	84		112	
Prescription Medications	0.0%	64	71	76	78	84		112	
Subtotal HHM	**0.8%**	**1,313**	**1,463**	**1,564**	**1,589**	**1,716**		**2,297**	
OTHER									
Other Organics	4.4%	7,044	7,851	8,391	8,525	9,206		12,327	
Other Inorganics	1.2%	1,921	2,141	2,288	2,325	2,511		3,362	
Other C&D	1.1%	1,761	1,963	2,098	2,131	2,302		3,082	
Other Durables	1.3%	2,081	2,320	2,479	2,519	2,720		3,642	
Other HHM	0.1%	160	178	191	194	209		280	
Fines	1.6%	2,561	2,855	3,051	3,100	3,348		4,482	
Other	0.3%	480	535	572	581	628		840	
Subtotal Other	**10.0%**	**16,009**	**17,843**	**19,069**	**19,376**	**20,923**		**28,015**	
TOTALS - MSW	**100.0%**	**160,086**	**178,430**	**190,694**	**193,760**	**209,230**	**263,453**	**280,150**	**284,488**
						0.77%			
		160,086	178,430	190,694	193,760	209,230	Check	280,150	

Project:	CRLCSWA Infrastructure Options
Date:	2/8/2022
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**OTHER SROI INPUTS**

SCENARIO 6
CRLCSWA MWP-RDF w/ REGIONAL LANDFILL OPTION
OTHER SROI INPUTS (2021$)

Timing of Capital Costs

SCENARIO 6 CAMPUS	2022	2023	2024	2025	2026	2027
Land Acquisition/Legal/Env	0%	0%	5%	10%	10%	10%
MWP-RDF Facility	0%	0%	0%	0%	0%	0%
Transfer Station	0%	0%	0%	0%	0%	0%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 6 CAMPUS	2028	2029	2030	2031	2032	2033
Land Acquisition/Legal/Env	15%	50%	0%	0%	0%	0%
MWP-RDF Facility	0%	0%	0%	1%	2%	2%
Transfer Station	0%	0%	0%	0%	1%	1%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 6 CAMPUS	2034	2035	2036	2037	2038	2039
MWP-RDF Facility	2%	7%	40%	45%	1%	0%
Transfer Station	2%	6%	40%	45%	5%	0%
Compost Facility	5%	10%	40%	30%	15%	0%
Scalehouse	0%	5%	45%	50%	0%	0%
Admin/Educational Center	0%	5%	30%	55%	10%	0%
RRC/HHW	5%	10%	30%	50%	5%	0%
Maintenance Shop	0%	5%	30%	55%	10%	0%
Citizen Drop-Off	0%	5%	60%	30%	5%	0%

Travel Distances

RDF Haul:

RDF Trailer Payload =	18	tons per load	
One-way Distance =	50	miles	Assumes cement kilns or other end-markets available
Average Speed =	55	mph	
RDF Production, Year 2038 =	185,914	tons RDF	
Calculated # Loads in Year 2038 =	10329	trailer loads	

Organics Fines Haul:

Organics/Fines Trailer Payload =	20	tons per load	
One-way Distance =	30	miles	Assumes use as ADC at LFs within 30 miles.

Project:	CRLCSWA Infrastructure Options
Date:	2/8/2022
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**OTHER SROI INPUTS**

Average Speed =	50	mph
Organics Production, Year 2038 =	23,903	tons Organics/Fines
Calculated # Loads in Year 2038 =	1195	trailer loads

TS Haul: Rejects/Process Residue & Non-Processed Waste to on-site Transfer Station.

TS Trailer Payload =	20	tons per load	
One-way Distance =	115	miles	Need to go further out to find landfill(s) with capacity
Average Speed =	65	mph	
Transferred Waste, Year 2038 =	68,593	tons waste	
Calculated # Loads in Year 2038 =	3430	trailer loads	

Recovered Materials to Markets Assumptions:

1. Ferrous & Non-Ferrous Metals to local scrap dealers in Cedar Rapids, Iowa.
2. Plastics to MRF in Cedar Rapids, Iowa for baling.
3. OCC to MRF in Cedar Rapids, Iowa for baling.
4. Compost to local markets.

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**SUMMARY**

SCENARIO 6
CRLCSWA MWP-RDF w/ REGIONAL LANDFILL OPTION
SUMMARY (2021$)

Facility	Minimum Land Required (Acres)	Land Purchase (Acres)	Liner / Pad Areas (Acres)	Building Size (SF)	Year 1, TPY	Year 50, TPY
MWP-RDF Facility	22	---	---	128,000	265,592	403,007
Transfer Station	12	---	---	10,500	68,593	102,643
Compost Facility	30	---	21	---	38,118	55,601
Scalehouse	10	---	---	600	---	---
Admin/Educational Center	2	---	---	5,500	---	---
RRC/HHW	4	---	---	18,300	4,045	5,943
Maintenance Shop	2	---	---	9,000	---	---
Citizen Drop-Off	2	---	0.4	---	1,173	1,711
TOTAL	**84**	**90**	**---**	**171,900**	**---**	**---**

Diversion Tonnages		
Yard Waste/Misc. Food	38,118	55,601
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
MWP - Ferrous Metals	2,656	4,030
MWP - NonFerrous Metals	1,062	1,612
MWP - Plastics #1	531	806
MWP - Plastics #2	266	403
MWP- Papers	1,886	2,861
MWP - OCC	2,656	4,030
MWP - Organics Fines	23,903	36,271
RDF	185,914	282,105
Diversion Subtotal	**262,211**	**395,374**
Landfill Tonnages	**90,375**	**134,415**
% Diversion/Reduction from LF	**74%**	**75%**
% Diversion w/out RDF & Organic Fines	**15%**	**15%**

Facility	Full Build-Out Total Facilities Capital $	Year 1 O&M$ O&M $	O&M - Haul$	Disposal in Regional LF	Year 1 Revenues $ Other Revenues$	Energy/ Materials Revenues$	Other Tip Fee Revenues$
MWP-RDF Facility	$170,098,900	$10,000,400	$2,797,500	$0	$335,700	($3,012,700)	$6,975,000
Transfer Station	$7,583,400	$549,000	$1,652,300	$2,606,500	$0	$0	$0
Compost Facility	$9,052,700	$1,171,200	---	$0	$0	$1,091,100	$0
Scalehouse	$2,189,600	$293,900	---	---	$0	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0	$0
RRC/HHW	$9,933,900	$1,407,400	---	$0	$0	$647,900	$0
Maintenance Shop	$2,567,500	$385,800	---	---	$0	$0	$0
Citizen Drop-Off	$238,100	$6,500	---	---	$0	$0	$0
	$204,542,200	**$16,351,900**	**$4,449,800**	**$2,606,500**	**$335,700**	**($1,273,700)**	**$6,975,000**

SCENARIO 6 CAMPUS	Quantity	Unit	Unit Price	Total	
Land Acquisition - Purchase	90	Acres	$25,000	$2,250,000	*3 Qtr Sections*
Land Acquisition - Legal/Support	25%	LS	$2,250,000	$562,500	*% Land Purchase*
Social Justice/Env Impact/Legal	1	RS	$7,000,000	$7,000,000	*Risk Factor*
SUBTOTAL				**$9,812,500**	
Facilities Capital				$155,641,900	
Contingency, Permitting, Eng/Construction Observation/CQA				$45,436,300	
Equipment/Mobile Equipment				$3,464,000	
SUBTOTAL				**$204,542,200**	
Estimated Financing Costs - All Facilities				$94,836,000	*20 yrs, 4% APR*
SUBTOTAL				**$94,836,000**	
TOTAL CAPITAL$				**$309,190,700**	

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**SUMMARY**

SCENARIO 6 TIPPING FEE ESTIMATE (2021$)

	Capital$[1]	Annual O&M$[2]	Annual Haul$[2]	Annual Disposal$[2]	Total - Gross
Total Costs - Facilities	$204,542,200	$16,351,900	$4,449,800	$2,606,500	
Total Costs - Financing	$94,836,000	---	---	---	
Total Costs-Land/Legal/Env Impact	$9,812,500	---	---	---	
CRLCSWA Process & Transfer Tons	13,076,000	215,100	215,100	215,100	
$/Ton	**$23.65**	**$76.02**	**$20.69**	**$12.12**	**$120.35**

	Annual Other Revenues[3]	Annual Mat'l/ Energy Revenues[4]	Other Tip Fee Revenues[5]	Total - Revenues Before Fees
Revenues	$335,700	($1,273,700)	$6,975,000	
CRLCSWA Process & Transfer Tons	215,100	215,100	215,100	
	$1.56	**($5.92)**	**$32.43**	**$28.07**

ESTIMATED NET TIP FEE	**$92.29**
Rounded ESTIMATED NET TIP FEE	**$93.00**

Notes:

1. Capital costs include full build out of facilities for 50-year period divided by projected processed & landfilles tons Year 2038-2087.
   Financing costs assume constant annual 4% interest rate on Facilities Capital plus Contingency, Permitting, Engineering & Construction Observation/CQA.
   Land acquisition costs including social justice, environmental impacts and legal.
2. Annual O&M costs include replacement reserves for equipment and rehab/rebuild of buildings over 50-year period. Divided by Year 2038 processed & landfilled tons.
3. Other Revenues obtained from CRLCSWA FY2022 budget including grants, investments, non-cash adjustments, other misc. revenues.
   Divided by Year 2038 processed & landfilled tons.
4. Annual Material/Energy Revenues includes recycled materials revenues through RRC (from FY2022 budget), composting tip fees at $24/ton, compost sales at $24/ton, MWP-RDF net materials revenues, and estimated LFG-to-energy revenues. Divided by Year 2038 processed & landfilled tons.
5. Other Tip Fee Revenues from non-CRLCSWA waste delivered to the MWP-RDF facility.

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MWP-RDF Sizing**

SCENARIO 6
CRLCSWA MWP-RDF w/ REGIONAL LANDFILL OPTION
SIZING MIXED WASTE PROCESSING-RDF FACILITY

Waste Flow (Tons)	**Year 1 FY2038**	**Year 25 FY2062**	**Year 50 FY2087**		**Assumptions/Comments**
Waste thru MWP-RDF Facility					
CRLCSWA MSW	190,592	229,433	278,007		*From projections memo*
Regional MSW	75,000	100,000	125,000		*Estimate, mixed MSW w/ recyclables content*
Initial Rejects	*26,559*	*32,943*	*40,301*	10%	*of all MSW*
Processed Waste, TPY	239,033	296,490	362,706		*CRLCSWA + Regional MSW - Initial Rejects*
Processed Waste, TPD	790	970	1190	306	*days/year*
Processed Waste, TPH	99	81	99	8	*hrs/day (1 shift); Yr 25/Yr 50 @ 1.5 shift*
Processed Waste/Line/Shift, TPH	49	40	50	2	*process lines; increase shifts by Year 25*
Recovered Recyclables					
Ferrous Metals Recovery	2,656	3,294	4,030	1.0%	*50% of Ferrous from MSW Composition*
Non-Ferrous Metals Recovery	1,062	1,318	1,612	0.4%	*30% of Non-Ferrous from MSW Composition*
Plastics #1	531	659	806	0.2%	*10% of #1 Plastics - Flexible AI system*
Plastics #2	266	329	403	0.1%	*10% of #2 Plastics - Flexible AI system*
Papers	1,886	2,339	2,861	0.7%	*10% of recyclable papers*
OCC	2,656	3,294	4,030	1.0%	*30% of OCC/Kraft from MSW Composition*
Diversion - Recyclables, TPY	9,057	11,234	13,743		
Recovered Organics Fines					*Mechanical separation*
Organic Materials Recovery	23,903	29,649	36,271	9.0%	*2" minus fines/organics; 30% of 30% of MSW*
Process Waste					
Shrinkage	2,656	3,294	4,030	1.0%	*of MSW*
PVC Removal	2,390	2,965	3,627	0.9%	*30% of Other Plastic Products in MSW*
Process Residue	15,139	18,778	22,971	5.7%	*of MSW, Adjust % until Remaining = RDF*
Remaining MSW, TPY	185,888	230,570	282,064	70.0%	*Remaining MSW should = RDF output*
RDF	**185,914**	**230,603**	**282,105**	70%	*of MSW*
Number of RDF Loads per Day	34	42	51	18	*tons per trailer*
Waste to Transfer Station					
Disaster Debris	2,723	3,278	3,972		
C&D	19,059	22,943	27,801		
Shingles	2,723	3,278	3,972		
From MWP-RDF Facility:					
Initial Rejects	26,559	32,943	40,301		
PVC Removed	2,390	2,965	3,627		
Process Residue	15,139	18,778	22,971		
Transferred Waste, TPY	68,593	84,184	102,643		
Transferred Waste, TPD	**230**	**280**	**350**	296	*days/year*
Transfer Station Waste, TPH	26	31	39	9	*hours/day*
Waste to Landfill:					
Direct to Landfill:					

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MWP-RDF Sizing**

Special Waste	21,782	26,777	31,772
From Transfer Station:	68,593	84,184	102,643
Landfilled Waste	90,375	110,961	134,415
% of Scenario 1 Landfilled	38.2%		38.9%

MWP-RDF Building Sizing	**Year 1 FY2038**	**Year 25 FY2062**	**Year 50 FY2087**		**Assumptions/Comments**
Sizing Assumptions					
Unloading Bays	10	12	15		*Avg 4 tons/veh, peak factor 2.0, 12 min unload*
Minimum Width (ft)	200	240	300		*20 ft per bay, accounting for structure*
Waste Storage on Tip Floor (CY)	3,559	4,284	5,192	350	*lbs/CY and 1 day waste*
Recovered Material Storage (CY)	1,393	1,728	2,114	250	*lbs/CY & 1 week*
RDF Storage (CY)	14,301	17,739	21,700	500	*lbs/CY & 1 week*
Estimated Square Feet					
Tipping Floor	19,600	23,600	29,000		*Waste piled avg 10' high + unloading area*
Processing System Area	42,000	42,000	42,000		*Assume 300' L x 140' W for 2 process lines*
Recovered Material Storage	6,270	7,780	9,510	6	*ft high average*
RDF Storage	32,180	39,910	48,830	12	*ft high average*
RDF & Recyclables Load-out	7,200	7,200	7,200		*100' x loadout bays; 2 trailers+2 roll-offs*
Rejects/Fines Loadout Area	2,160	2,160	2,160		*60' x loadout bays; 2 roll-offs, trucks, trailers*
Office/Breakroom/Restrooms	2,190	2,450	2,770	2.0%	*of area from tip floor thru loadout*
Spare Parts/Shop Room	2,190	2,450	2,770	2.0%	*of area from tip floor thru loadout*
Building SF	113,790	127,550	144,240		
Estimate MWP-RDF Land Requirements (Acres)					
Building	2.6	2.9	3.3		
Surrounding Area	17.6	18.1	18.7	300	*ft buffer area*
Entrance Area	0.0	0.0	0.0		*Included w/ scalehouse*
Required Land (Acres)	20.2	21.0	22.0		
Contingency Acres	5.0	5.3	5.5	25%	
	25.2	26.3	27.5		*Land purchase acres*

MWP Transfer Station Sizing	**Year 1 FY2038**	**Year 25 FY2062**	**Year 50 FY2088**		
Sizing Assumptions					
Unloading Bays	4	5	6		*Avg 3 tons/veh, peak factor 2.0, 12 min unload*
Minimum Width (ft)	80	100	120		*20 ft per unloading bay*
Waste Storage on Tip Floor (CY)	927	1,138	1,387	500	*lbs/CY and 1 day waste*
Estimated Square Feet					
Tipping Floor	6,500	8,070	9,750		*Waste piled avg 10' high + unloading area*
Transfer Loadout Area	2,400	2,400	2,400		*60' x 2 trailer load-out lane*
MWP TS Building (SF)	**8,900**	**10,470**	**12,150**		
Estimate MWP TS Land Requirements (Acres)					
Buildings	0.2	0.2	0.3		
Surrounding Area	10.9	11.1	11.3	300	*ft buffer area*
Entrance Area	0.0	0.0	0.0		*Included w/ scalehouse*
Land (Acres)	11.1	11.3	11.6		

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MWP-RDF Sizing**

Tonnage Projections-Total Processed or Landfilled

Year	CRLCSWA Projections		Annual % Increase
2020	-	tons	0.46%
2030	221,763	tons	0.83%
2040	240,816	tons	0.77%
2050	260,043	tons	

YR	Calculate Annual Tonnage Processed/Transferred	Tons per Year	TPD	*CRLCSWA TPY*	
1	2038	290,097	980	215,097	
2	2039	292,578	988	216,877	
3	2040	295,080	997	218,672	
4	2041	297,604	1005	220,358	
5	2042	300,150	1014	222,057	
6	2043	302,717	1023	223,770	
7	2044	305,306	1031	225,495	
8	2045	307,917	1040	227,234	
9	2046	310,551	1049	228,986	
10	2047	313,207	1058	230,752	
11	2048	315,886	1067	232,531	
12	2049	318,588	1076	234,324	
13	2050	321,313	1086	236,131	
14	2051	324,061	1095	237,952	
15	2052	326,833	1104	239,787	
16	2053	329,628	1114	241,636	
17	2054	332,447	1123	243,499	
18	2055	335,291	1133	245,376	
19	2056	338,158	1142	247,269	
20	2057	341,051	1152	249,175	
21	2058	343,968	1162	251,097	
22	2059	346,910	1172	253,033	
23	2060	349,877	1182	254,984	
24	2061	352,869	1192	256,950	
25	2062	358,931	1213	258,931	0.86%
26	2063	361,826	1222	260,928	
27	2064	364,744	1232	262,940	
28	2065	367,685	1242	264,968	
29	2066	370,650	1252	267,011	
30	2067	373,639	1262	269,070	
31	2068	376,653	1272	271,144	
32	2069	379,690	1283	273,235	
33	2070	382,752	1293	275,342	
34	2071	385,839	1304	277,465	
35	2072	388,950	1314	279,605	
36	2073	392,087	1325	281,761	
37	2074	395,249	1335	283,933	
38	2075	398,436	1346	286,123	
39	2076	401,649	1357	288,329	
40	2077	404,888	1368	290,552	

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**MWP-RDF Sizing**

41	2078	408,153		1379	292,793	
42	2079	411,445		1390	295,051	
43	2080	414,763		1401	297,326	
44	2081	418,108		1413	299,618	
45	2082	421,479		1424	301,929	
46	2083	424,878		1435	304,257	
47	2084	428,305		1447	306,603	
48	2085	431,759		1459	308,967	
49	2086	435,241		1470	311,350	
50	2087	*438,750*		1482	313,750	0.81%
	2088					
TOTAL ESTIMATED FOR POTENTIAL PROCESSED/TS		**18,028,636**	**tons**		**13,076,023**	

Project:	CRLCSWA Infrastructure Options			
Date:	2/2/2022			
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design			
Costs:	2021$	Process Size:	970 TPD	
Location:	Linn County, Iowa	Required Land:	22 Acres	
Worksheet:	**MWP-RDF Capital Cost**	**TOTAL MWP-RDF CAP$**		**$170,098,900**

SCENARIO 6
CRLCSWA MWP-RDF w/ REGIONAL LANDFILL OPTION
MWP-RDF CAPITAL COST ESTIMATE SUMMARY (1)(2)

MWP-RDF Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
MWP-RDF Building	128,000	SF	$ 200	$ 25,600,000	*Includes building, foundations, floors, HVAC*
Equipment-RDF Process	2	EA	$ 10,000,000	$ 20,000,000	*Shredders, magnets, screens, eddy current*
Equipment-AI/Optical Sorters, Robotics	2	EA	$ 17,000,000	$ 34,000,000	*On both process lines*
Equipment-Install & Start-up	20%	LS	$ 54,000,000	$ 10,800,000	*Vendor cost*
Dust Collection System	1	EA	$ 3,000,000	$ 3,000,000	
Site Investigations	1	LS	$ 250,000	$ 250,000	*Geotech*
Site Work					
Mobilization/Demob	1	LS	$ 300,000	$ 300,000	
Clear & Grub	11	Acres	$ 2,000	$ 22,000	*Assume no demolition; half of area*
Bulk Excavation/Grading	19,000	CY	$ 3	$ 57,000	*Adequate quantity & quality of soils on-site*
Structural Fill	19,000	CY	$ 10	$ 190,000	*Assume 100% of bulk excavation quantities*
Roadways	5,000	SY	$ 45	$ 225,000	*4" asphalt over 6" granular base*
Stormwater Pond	1	LS	$ 200,000	$ 200,000	
Site Drainage/Erosion Control	1	EA	$ 50,000	$ 50,000	
Site Utilities					
Electrical - New Service to Site	1	LS	$ 2,000,000	$ 2,000,000	*From 1 mile away; extra for MWP-RDF*
Water Supply & Fire Protection	1	LS	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Sanitary Sewer	1	EA	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Natural Gas System	1	LS	$ 1,500,000	$ 1,500,000	*Estimate, From 1 mile away*
Surveying	1	EA	$ 25,000	$ 25,000	
Screening, Landscaping, Signage	1	EA	$ 60,000	$ 60,000	*Allowance*
Fencing	3,900	LF	$ 35	$ 136,500	*Site Perimeter*
Market Variability Factor	30%	Capital $	$ 101,535,500	$ 30,460,700	*Vertical construction*
SUBTOTAL MWP-RDF CONSTRUCTION				**$ 131,996,200**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	LS	$ 67,196,200	$ 13,439,200	*Without Land & Equip*
Contingency - Process/Sort Equip	10%	LS	$ 64,800,000	$ 6,480,000	*Process equipment only*
Eng., Design, Constr. Admin & CQA	12%	LS	$ 131,996,200	$ 15,839,500	*Percentage of total capital less land*
Permitting (Local & IDNR)	1%	LS	$ 131,996,200	$ 1,320,000	*Percentage of total capital less land*
SUBTOTAL MWP-RDF SOFT COSTS				**$ 37,078,700**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Loader (large)	2	EA	$ 400,000	$ 800,000	
Skid Loader	1	EA	$ 50,000	$ 50,000	
Roll-Off Truck	1	EA	$ 110,000	$ 110,000	
Roll-Off Containers	8	EA	$ 8,000	$ 64,000	*Rejects & Process Residue/Fines, Mat'ls*
Forklift	0	EA	$ 50,000	$ -	
Yard Tractor	0	EA	$ 100,000	$ -	
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*
Transfer Trucks & Trailers - See Haul Costs					*Included in haul cost per ton*
SUBTOTAL				**$ 1,024,000**	

ASSUMPTIONS:

1. No sales tax is included. Assumed facility is tax exempt.
2. Costs rounded to nearest thousand.
3. Does not include financing costs.
4. Assumed project to be competitively bid under one general contract.
5. Assumed construction to be during normal working hours.
6. The construction costs are used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Project:	CRLCSWA Infrastructure Options		
Date:	2/8/2022	**OTHER TIP FEE REV$**	**$6,975,000**
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design		
Costs:	2021$ Process Size 970 TPD	**MAT'L REV$**	**($3,012,700)**
Location:	Linn County, Iowa	**OTHER REVENUES$**	**$335,700**
Worksheet:	**MWP-RDF O&M Costs**	**ANNUAL MWP-RDF O&M$**	**$10,000,400**

SCENARIO 6
CRLCSWA MWP-RDF w/ REGIONAL LANDFILL OPTION
MWP-RDF OPERATIONS COST ESTIMATE SUMMARY (1)

MWP-RDF Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 1,556,600	*FY2021 fully-burdened salary, escalated*
Scalehouse Personnel	0	FTE	$ 82,000	$ -		*Included w/ Scalehouse operations*
MWP-RDF Manager	1	FTE	$ 124,800	$ 124,800		*Estimated rate*
Loader Operator	3	FTE	$ 103,800	$ 311,400		
Spotters/Laborers	2	FTE	$ 52,000	$ 104,000		*Estimated rate, at tipping floor*
Sorters	0	FTE	$ 41,600	$ -		*No manual sorting; robotics/AI assumed*
Process Operators	4	FTE	$ 100,200	$ 400,800		*Estimate*
Roll-Off/Misc. Equip/Helper	2	FTE	$ 100,200	$ 200,400		*Estimate*
Maint/Mechanic/Electrician	4	FTE	$ 103,800	$ 415,200		*Maintain building & process equipment*
Transfer Drivers - See Haul Costs						*Included in haul costs per ton*
Utilities					$ 425,200	
Electricity	2,560,000	kWh	$ 0.15	$ 384,000		*20 kWh/SF estimate*
Water & Sewer	1	LS	$ 7,000	$ 7,000		*Estimate - limited commercial/industrial*
Natural Gas/Heating Fuel	1	LS	$ 27,000	$ 27,000		*Avg 0.3 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 600	$ 7,200		*Estimate based on FTE*
Maintenance and Repairs					$ 905,500	
Building	1%	Capital $	$ 25,600,000	$ 256,000		*Percentage of building capital*
Process Equipment	1%	Capital $	$ 20,000,000	$ 200,000		*Percentage of process equipment capital*
AI/Optical & Robotics	1%	Capital $	$ 34,000,000	$ 340,000		*Percentage of equipment capital*
Mobile Equipment	7,300	hours	$ 15	$ 109,500		*Avg mobile equip operating hrs; not include transfer*
Supplies	1	LS	$ 100,000	$ 100,000	$ 100,000	*Estimate*
Fuel	21,900	gallons	$ 3.50	$ 76,700	$ 76,700	*Assume 3 gallons per hour operating*
Consulting/Eng Services	1	LS	$ 200,000	$ 200,000	$ 200,000	*Estimate-MWP-RDF plus existing facilities*
MWP-RDF Facility Insurance	0.1%	Capital $	$ 131,996,200	$ 132,000	$ 132,000	*Percentage of MWP total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL MWP-RDF DIRECT OPERATIONS					**$ 3,396,000**	

MWP-RDF Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Mobile Equipment Replacement					$ 142,400	
Loaders	2	EA	$ 57,143	$ 114,300		*Capital cost divided by 7-yr life*
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Roll-Off Truck	1	EA	$ 11,000	$ 11,000		*Capital cost divided by 10-yr life*
Roll-Off Containers	8	EA	$ 800	$ 6,400		*Capital cost divided by 10-yr life*
Forklift	0	EA	$ 5,000	$ -		*Capital cost divided by 10-yr life*
Yard Tractor	0	EA	$ 10,000	$ -		*Capital cost divided by 10-yr life*
Pick-up Truck	1	EA	$ 5,714	$ 5,700		*Capital cost divided by 7-yr life*
Trucks & Trailers - See Haul Costs						*Included in haul costs per ton*
Process Equipment					$ 5,400,000	
RDF Process Equipment	2	EA	$ 1,000,000	$ 2,000,000		*Capital cost divided by 10-yr life*
Optical & Robotics Equip	2	EA	$ 1,700,000	$ 3,400,000		*Capital cost divided by 10-yr life*
Building Replacement	1	EA	$ 1,024,000	$ 1,024,000	$ 1,024,000	*Bldg capital cost divided by 25-yr life*
Operating Cash Reserve	1	LS	$ 38,000	$ 38,000	$ 38,000	*CRLCSWA FY2021 Budget, rounded*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*Estimate from Agency, NA if compost w/ MWP*
SUBTOTAL CASH RESERVES					**$ 6,604,400**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Grants/Investments/ Other	1	LS	$ 281,300	$ 281,300	$ 281,300	*CRLCSWA FY2022 Budget*
Non-Cash Adjustments	1	LS	$ 25,000	$ 25,000	$ 25,000	*CRLCSWA FY2022 Budget*
Other Misc. Revenue	1	LS	$ 29,400	$ 29,400	$ 29,400	*CRLCSWA FY2022 Budget*
Ferrous Recovered Mat'ls Rev	2,656	Tons	$ 140	$ 371,800	$ 371,800	*Source: Price of Scrap Metals.com Iowa*
Non-Ferrous Recovered Mat'ls Re	1,062	Tons	$ 660	$ 701,200	$ 701,200	*Source: Price of Scrap Metals.com Iowa*
Plastics #1 Mat'ls Rev	531	Tons	$ 320	$ 170,000	$ 170,000	*Source: Resource Recycling, national avg Oct 2021*
Plastics #2 Mat'ls Rev	266	Tons	$ 1,580	$ 419,600	$ 419,600	*Source: Resource Recycling, national avg Oct 2021*
Papers Mat'ls Rev	1,886	Tons	$ 70	$ 132,000	$ 132,000	*Source: Resource Recycling, national avg Oct 2021*
OCC Recovered Mat'ls Rev	2,656	Tons	$ 120	$ 318,700	$ 318,700	*Source: Resource Recycling, national avg Oct 2021*

Project:	CRLCSWA Infrastructure Options			
Date:	2/8/2022		OTHER TIP FEE REV$	$6,975,000
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design			
Costs:	2021$	Process Size 970 TPD	MAT'L REV$	($3,012,700)
Location:	Linn County, Iowa		OTHER REVENUES$	$335,700
Worksheet:	**MWP-RDF O&M Costs**		**ANNUAL MWP-RDF O&M$**	**$10,000,400**

Organics Fines	23,903	Tons	($20)	($478,100)	($478,100)	*Assume ADC use at LF (reduced tip fee)*
RDF Revenue	185,914	Tons	($25)	($4,647,900)	($4,647,900)	*RDF 6000 BTU/lb, Coal Offset $0.75/MMBTU; Pay end users to create market*
Tip Fee Revenues	75,000	Tons	$93	$ 6,975,000	$ 6,975,000	*Non-CRLCSWA waste*
SUBTOTAL OTHER REVENUES					**$ 4,298,000**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   No Shifts = 1 8 hours per shift
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options		
Date:	2/8/2022		
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design		
Costs:	2021$		
Location:	Linn County, Iowa		
Worksheet:	**RDF Haul Costs**	**ANNUAL HAUL$**	**$2,489,900**

SCENARIO 6
CRLCSWA MWP-RDF w/ REGIONAL LANDFILL OPTION
RDF HAUL COST ESTIMATE SUMMARY

	50-Mile Radius	**100-Mile Radius**	***Comments***
Number of Trailer Loads	10,329	10,329	*Assumes average 18 ton payload for RDF*
Tonnage (tpy):	**185,914**	**185,914**	*Year 1 - RDF Production*
Load & Unload Time (minutes):	30	30	*Estimate*
One-Way Distance (miles)	**50**	**100**	
Average Speed (mph):	55	60	*From route mapping in area*
Average Trips/Year:	10,329	10,329	
Average Trips/Month:	861	861	
Average Trips/Week:	199	199	
Hours Per Trip	2.3	3.8	
Weekly Freight Hours:	461	763	
Wkly Prorated Veh Inspect/Breaks:	6.0	6.0	*1 hour per day*
Annual Freight Hours:	23,989	39,667	*Freight hours only for vehicle fuel, oil & grease cost*
Total Miles/Yr	1,032,900	2,065,800	

Annual Costs Assumptions:			
Driver Labor			
Drivers (based on total time)	12	20	
Driver annual salary	$62,200	$62,200	*Bureau of Labor Statistics-CR, Iowa, heavy truck driver*
Fringe benefits (% of salary)	35%	35%	*Included in annual salary*
Fuel, Oil & Grease			
Fuel Cost per Gallon	$3.50	$3.50	*Diesel Fuel 2021-US EIA, Mid-West average*
Miles per Gallon	6.5	6.5	*North American Council for Freight Efficiency*
Oil & Grease ($/freight hour)	$0.50	$0.50	*Estimate*
Tires			
New Tires Price	$425	$425	*Estimate*
# New Tires Per 50,000 Miles	18	18	*6 tires on tractor & 12 tires on trailers*
Maintenance & Repairs			
Mechanic Labor annual salary	$81,000	$81,000	*Bureau of Labor Statistics-CR, Iowa, heavy equip mech*
Mechanic Labor % per Truck	2%	2%	
Parts, Repairs, Overhaul ($/mile)	$0.25	$0.25	
Truck Amortization			
Number of Tractors	12	20	*Update based on loads/day*
Capital Cost - per semi-truck	$115,000	$115,000	*New truck price based on historic vendor/project data*
Resale Value (% of truck $)	30%	30%	*Used trucks good condition $25K to $40K*
Replacement Schedule (years)	7	7	
Interest Rate	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	
Trailer Amortization			
Number of Trailers	13	22	*Includes spares at 10%*
Capital Cost -- per trailer	$70,000	$70,000	*Walking floor - new*
Resale Value (% of purchase $)	15%	15%	*Used trailers good condition $7K to $10K*
Replacement Schedule (years)	7	7	
Interest Rate	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	
Insurance, License & Taxes (per yr/truck) @ 2.5% $ Capital Cost	$2,900	$2,900	*Estimate % of capital cost of truck*

Project:	CRLCSWA Infrastructure Options		
Date:	2/8/2022		
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design		
Costs:	2021$		
Location:	Linn County, Iowa		
Worksheet:	**RDF Haul Costs**	**ANNUAL HAUL$**	**$2,489,900**

Overhead & Profit - Contract Haul @ % of O&M 20% 20% *Contingency or OHP on contract haul*

Annual Haul Cost to Market:	**50-Mile Radius**	**100-Mile Radius**	**Comments**
Driver Labor	$746,400	$1,244,000	Time Based
Fuel, Oil & Grease	$568,200	$1,132,200	Mileage & Time Based
Tires	$158,000	$316,100	Mileage Based
Maintenance & Repairs	$277,700	$548,900	Mileage & Time Based
Truck Amortization	$160,900	$268,200	100% Utilized
Trailer Amortization	$128,900	$218,100	100% Utilized
Insurance, Licensing & Taxes	$34,800	$58,000	No. trucks
Overhead & Profit	$415,000	$757,100	
RDF Haul Cost to Kiln/Other	**$2,489,900**	**$4,542,600**	
Total Haul Cost/Ton	**$13.39**	**$24.43**	

Transfer Trucks Capital Cost	$1,380,000	$2,300,000
Transfer Trailers Capital Cost	$910,000	$1,540,000
Total Truck/Trailers Capital	**$2,290,000**	**$3,840,000**

Project:	CRLCSWA Infrastructure Options
Date:	2/8/2022
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Organics Haul Costs** **ANNUAL HAUL$** **$307,600**

SCENARIO 6
CRLCSWA MWP-RDF w/ REGIONAL LANDFILL OPTION
ORGANICS FINES HAUL COST ESTIMATE SUMMARY

	30-Mile Radius	800-Mile Radius	*Comments*
Number of Trailer Loads	1,328	1,328	*Assumes average 20 ton payload for Organics Fines*
Tonnage (tpy):	**23,903**	**23,903**	*Year 1 - Organics Fines Production*
Load & Unload Time (minutes):	30	30	*Estimate*
One-Way Distance (miles)	**30**	**80**	
Average Speed (mph):	50	60	*From route mapping in area*
Average Trips/Year:	1,328	1,328	
Average Trips/Month:	111	111	
Average Trips/Week:	26	26	
Hours Per Trip	1.7	3.2	
Weekly Freight Hours:	44	82	
Wkly Prorated Veh Inspect/Breaks:	6.0	6.0	*1 hour per day*
Annual Freight Hours:	2,298	4,281	*Freight hours only for vehicle fuel, oil & grease cost*
Total Miles/Yr	79,680	212,480	

Annual Costs Assumptions:			
Driver Labor			
Drivers (based on total time)	2	3	
Driver annual salary	$62,200	$62,200	*Bureau of Labor Statistics-CR, Iowa, heavy truck driver*
Fringe benefits (% of salary)	35%	35%	*Included in annual salary*
Fuel, Oil & Grease			
Fuel Cost per Gallon	$3.50	$3.50	*Diesel Fuel 2021-US EIA, Mid-West average*
Miles per Gallon	6.5	6.5	*North American Council for Freight Efficiency*
Oil & Grease ($/freight hour)	$0.50	$0.50	*Estimate*
Tires			
New Tires Price	$425	$425	*Estimate*
# New Tires Per 50,000 Miles	18	18	*6 tires on tractor & 12 tires on trailers*
Maintenance & Repairs			
Mechanic Labor annual salary	$81,000	$81,000	*Bureau of Labor Statistics-CR, Iowa, heavy equip mech*
Mechanic Labor % per Truck	2%	2%	
Parts, Repairs, Overhaul ($/mile)	$0.25	$0.25	
Truck Amortization			
Number of Tractors	2	3	*Update based on loads/day*
Capital Cost - per semi-truck	$115,000	$115,000	*New truck price based on historic vendor/project data*
Resale Value (% of truck $)	30%	30%	*Used trucks good condition $25K to $40K*
Replacement Schedule (years)	7	7	
Interest Rate	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	
Trailer Amortization			
Number of Trailers	2	3	*Includes spares at 10%*
Capital Cost -- per trailer	$70,000	$70,000	*Walking floor - new*
Resale Value (% of purchase $)	15%	15%	*Used trailers good condition $7K to $10K*
Replacement Schedule (years)	7	7	
Interest Rate	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	
Insurance, License & Taxes (per yr/truck) @ 2.5% $ Capital Cost	$2,900	$2,900	*Estimate % of capital cost of truck*

Project:	CRLCSWA Infrastructure Options	
Date:	2/8/2022	
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design	
Costs:	2021$	
Location:	Linn County, Iowa	
Worksheet:	**Organics Haul Costs** **ANNUAL HAUL$**	**$307,600**

Overhead & Profit - Contract Haul
@ % of O&M 20% 20% *Contingency or OHP on contract haul*

Annual Haul Cost to Market:	30-Mile Radius	800-Mile Radius	Comments
Driver Labor	$124,400	$186,600	Time Based
Fuel, Oil & Grease	$44,100	$116,600	Mileage & Time Based
Tires	$12,200	$32,500	Mileage Based
Maintenance & Repairs	$23,200	$58,000	Mileage & Time Based
Truck Amortization	$26,800	$40,200	100% Utilized
Trailer Amortization	$19,800	$29,700	100% Utilized
Insurance, Licensing & Taxes	$5,800	$8,700	No. trucks
Overhead & Profit	$51,300	$94,500	
RDF Haul Cost to Kiln/Other	**$307,600**	**$566,800**	
Total Haul Cost/Ton	**$12.87**	**$23.71**	

Transfer Trucks Capital Cost	$230,000	$345,000
Transfer Trailers Capital Cost	$140,000	$210,000
Total Truck/Trailers Capital	**$370,000**	**$555,000**

Project:	CRLCSWA Infrastructure Options				
Date:	2/2/2022				
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design				
Costs:	2021$	TS Size:	280	TPD	
Location:	Linn County, Iowa	Required Land:	12	Acres	
Worksheet:	**MWP Transfer Station Capital Cost**	**TOTAL CAP$**			**$7,583,400**

SCENARIO 6
CRLCSWA MWP-RDF w/ REGIONAL LANDFILL OPTION
MWP TS CAPITAL COST ESTIMATE SUMMARY (1)(2)

Transfer Station Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Transfer Station Building	10,500	SF	$ 300	$ 3,150,000	*Bldg, foundations, floors, concrete walls, etc.*
Site Investigations	1	LS	$ 100,000	$ 100,000	*Geotech in area of TS*
Site Work					
Mobilization/Demob	1	LS	$ 100,000	$ 100,000	*Assume portion to TS*
Clear & Grub	6	Acres	$ 2,000	$ 12,000	*Assume no demolition; half of required land*
Bulk Excavation/Quantities	5,400	CY	$ 3	$ 16,200	*Adequate quantity & quality of soils on-site*
Structural Fill	5,400	CY	$ 10	$ 54,000	*Assume 100% of bulk excavation quantities*
Roadways	2,000	SY	$ 45	$ 90,000	*4" asphalt over 6" granular base, 500LF*
Manuevering Pad	280	CY	$ 600	$ 168,000	*9" reinforced concrete slab on grade*
Stormwater Pond	-	LS	$ 200,000	$ -	*Assume included w/ MWP-RDF facility*
Site Drainage/Erosion Control	-	EA	$ 50,000	$ -	*Assume included w/ MWP-RDF facility*
Site Utilities					
Electrical - Service to Facility	1	LS	$ 100,000	$ 100,000	*Extended to TS*
Water Supply & Fire Protection	1	LS	$ 50,000	$ 50,000	*Extended to TS*
Sanitary Sewer	1	EA	$ 50,000	$ 50,000	*Extended to TS*
Natural Gas System	-	LS	$ -	$ -	*Assume included w/ MWP-RDF facility*
Surveying	1	EA	$ 25,000	$ 25,000	
Screening, Landscaping, Signage	1	EA	$ 60,000	$ 60,000	*Allowance*
Fencing	-	LF	$ 35	$ -	*Included in MWP-RDF facility*
Market Variability Factor	30%	Capital $	$ 3,975,200	$ 1,192,600	*Vertical construction*
SUBTOTAL TRANSFER STATION				**$ 5,167,800**	

Soft Costs	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	LS	$ 5,167,800	$ 1,033,600	
Eng., Design, Constr. Admin & CQA	16%	LS	$ 5,167,800	$ 827,000	*Percentage of TS total capital*
Permitting (Local & IDNR)	3%	LS	$ 5,167,800	$ 155,000	*Percentage of TS total capital*
SUBTOTAL TS SOFT COSTS				**$ 2,015,600**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Loader	1	EA	$ 400,000	$ 400,000	
Yard Tractor	0	EA	$ 100,000	$ -	
Transfer Trucks & Trailers - See Haul Costs					*Included in haul cost per ton*
SUBTOTAL				**$ 400,000**	

ASSUMPTIONS:

1. No sales tax is included. Assumed facility is tax exempt.
2. Costs rounded to nearest thousand.
3. Does not include financing costs.
4. Assumed project to be competitively bid under one general contract.
5. Assumed construction to be during normal working hours.
6. The construction costs are used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Project:	CRLCSWA Infrastructure Options		
Date:	2/2/2022		
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design		
Costs:	2021$ TS Size: 280 TPD		
Location:	Linn County, Iowa		
Worksheet:	**MWP Transfer Station O&M Costs**	**ANNUAL MWP TS O&M$**	**$549,000**

SCENARIO 6
CRLCSWA MWP-RDF w/ REGIONAL LANDFILL OPTION
MWP TS OPERATIONS COST ESTIMATE SUMMARY [1]

TS Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 207,600	*FY2021 fully-burdened salary, escalated*
Scalehouse	0	FTE	$ 82,000	$ -		*Included w/ Scalehouse operations*
TS Loader Operators	2	FTE	$ 103,800	$ 207,600		
TS Roll-off Operator /Misc. Equipment	0	FTE	$ 100,200	$ -		*Included in MWP-RDF costs*
TS Transfer Drivers - See Haul Costs						*See TS Haul$*
TS Utilities					$ 15,000	
Electricity	73,500	kWh	$ 0.15	$ 11,000		*7 kWh/SF estimate avg warehouse/office*
Water & Sewer	1	LS	$ 1,500	$ 1,500		*Estimate*
Heating Fuel	1	LS	$ 1,500	$ 1,500		*Estimate*
Phones	12	months	$ 80	$ 1,000		*Estimate*
Maintenance and Repairs					$ 93,700	
Building & Grounds	1%	Capital $	$ 5,167,800	$ 51,700		*Percentage of TS total capital*
Mobile Equipment	2,800	hours	$ 15	$ 42,000		*Avg equip ops hours, 6 days/wk, 9 hrs/day (1 loader); not include trucks, trailers*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	8,400	gallons	$ 3.50	$ 29,400	$ 29,400	*Assume 3 gallons per hour operating*
Professional Services & Eng.	1	LS	$ 10,000	$ 10,000	$ 10,000	*Estimate-inspection, permitting, legal*
TS Insurance	0.1%	Capital $	$ 5,167,800	$ 5,200	$ 5,200	*Percentage of TS total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL TS DIRECT OPERATIONS					**$ 365,900**	

TS Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 57,100	
Loaders	1	EA	$ 57,100	$ 57,100		*Capital cost divided by 7-yr life*
Yard Tractor	0	EA	$ 10,000	$ -		*Capital cost divided by 10-yr life*
Trucks & Trailers - See Haul Costs						*Included in haul costs per ton*
TS Rehab/Replacement	1	EA	$ 126,000	$ 126,000	$ 126,000	*Capital cost divided by 25-yr life*
Operating Cash Reserve	0	LS	$ -	$ -	$ -	*Included in AD costs*
Site #3 Other Developments	0	LS	$ -	$ -	$ -	*NA if no Site #3 composting*
SUBTOTAL TS CASH RESERVES					**$ 183,100**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.5 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options		
Date:	2/8/2022		
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**LF DISPOSAL$**	**$2,606,500**
Worksheet:	**MWP Transfer Station Haul Costs**	**ANNUAL HAUL$**	**$1,652,300**

SCENARIO 6

CRLCSWA MWP-RDF w/ REGIONAL LF OPTION
MWP TS HAUL COST ESTIMATE SUMMARY

	30-Mile Radius	80-Mile Radius	115-Mile Radius	*Comments*
Number of Trailer Loads	3,430	3,430	3,430	*Assumes average 20 ton payload*
Tonnage (tpy):	**68,593**	**68,593**	**68,593**	*Year 1*
Load & Unload Time (minutes):	30	30	30	*Estimate*
One-Way Distance (miles)	**30**	**80**	**115**	
Average Speed (mph):	50	60	65	*From route mapping in area*
Average Trips/Year:	3,430	3,430	3,430	
Average Trips/Month:	286	286	286	
Average Trips/Week:	66	66	66	
Hours Per Trip	1.7	3.2	4.0	
Weekly Freight Hours:	112	209	267	
Wkly Prorated Veh Inspect/Breaks:	6.0	6.0	6.0	*1 hour per day*
Annual Freight Hours:	5,834	10,868	13,860	*Freight hours only for vehicle fuel, oil & grease cost*
Total Miles/Yr	205,800	548,800	788,900	

Annual Costs Assumptions:				
Driver Labor				
Drivers (based on total time)	3	6	7	
Driver annual salary	$60,400	$60,400	$60,400	*Bureau of Labor Statistics-CR, Iowa, heavy truck driver*
Fringe benefits (% of salary)	35%	35%	35%	*Included in annual salary*
Fuel, Oil & Grease				
Fuel Cost per Gallon	$3.50	$3.50	$3.50	*Diesel Fuel 2021-US EIA, Mid-West average*
Miles per Gallon	6.5	6.5	6.5	*North American Council for Freight Efficiency*
Oil & Grease ($/freight hour)	$0.50	$0.50	$0.50	*Estimate*
Tires				
New Tires Price	$425	$425	$425	*Estimate*
# New Tires Per 50,000 Miles	18	18	18	*6 tires on tractor & 12 tires on trailers*
Maintenance & Repairs				
Mechanic Labor annual salary	$78,700	$78,700	$78,700	*Bureau of Labor Statistics-CR, Iowa, heavy equip mech*
Mechanic Labor % per Truck	2%	2%	2%	
Parts, Repairs, Overhaul ($/mile)	$0.25	$0.25	$0.25	
Truck Amortization				
Number of Tractors	3	6	7	*Update based on loads/day*
Capital Cost - per semi-truck	$115,000	$115,000	$115,000	*New truck price based on historic vendor/project data*
Resale Value (% of truck $)	30%	30%	30%	*Used trucks good condition $25K to $40K*
Replacement Schedule (years)	7	7	7	
Interest Rate	4%	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	0.1666	
Trailer Amortization				
Number of Trailers	4	7	8	*Includes spares at 10%*
Capital Cost -- per trailer	$70,000	$70,000	$70,000	*Walking floor - new*
Resale Value (% of purchase $)	15%	15%	15%	*Used trailers good condition $7K to $10K*
Replacement Schedule (years)	7	7	7	
Interest Rate	4%	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	0.1666	
Insurance, License & Taxes (per yr/truck) @ 2.5% $ Capital Cost	$2,900	$2,900	$2,900	*Estimate % of capital cost of truck*
Overhead & Profit - Contract Haul @ % of O&M	20%	20%	20%	*Contingency or OHP on contract haul*

Annual Haul Cost to Disposal:	30-Mile Radius	80-Mile Radius	115-Mile Radius	Comments
Driver Labor	$181,200	$362,400	$422,800	Time Based
Fuel, Oil & Grease	$113,700	$300,900	$431,700	Mileage & Time Based
Tires	$31,500	$84,000	$120,700	Mileage Based
Maintenance & Repairs	$56,200	$146,600	$208,200	Mileage & Time Based

Project:	CRLCSWA Infrastructure Options		
Date:	2/8/2022		
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**LF DISPOSAL$**	**$2,606,500**
Worksheet:	**MWP Transfer Station Haul Costs**	**ANNUAL HAUL$**	**$1,652,300**

Truck Amortization	$40,200	$80,500	$93,900	100% Utilized
Trailer Amortization	$39,700	$69,400	$79,300	100% Utilized
Insurance, Licensing & Taxes	$8,700	$17,400	$20,300	No. trucks
Overhead & Profit	$94,200	$212,200	$275,400	
MSW Haul Cost to Landfill	**$565,400**	**$1,273,400**	**$1,652,300**	
Total Haul Cost/Ton	**$8.24**	**$18.56**	**$24.09**	

Transfer Trucks Capital Cost	$345,000	$690,000
Transfer Trailers Capital Cost	$280,000	$490,000
Total Truck/Trailers Capital	**$625,000**	**$1,180,000**

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
COMPOST FACILITY SIZING

Compost Feedstock	***Initial Development, Year 2038***	***Long Term, Year 2087***	
Incoming Yard Waste/Misc. Food (tons)	38,118	55,601	*From SW Volumes Memo 6-10-2021*
% as Food Waste	10%	10%	*Food target percent for windrow ops*
Processing Days per Year	296	296	
Tons per Day	129	188	
Yard Waste Density (lb/cy)	650	650	
Yard Waste C:N Ratio	25	25	
Yard Waste Moisture Content	40%	40%	
Food Waste Density (lb/cy)	1,000	1,000	
Food Waste C:N Ratio	45	45	
Food Waste Moisture Content	60%	60%	
Target C:N Ratio	30 to 45	30 to 45	
Target Moisture Content	60%	60%	
Net Bulk Density at Arrival (lb/cy)	685	685	
Target Bulk Density (lb/cy)	850	850	
Net C:N Ratio	27	27	
Net Moisture Content	42%	42%	
Water to Add Initially (gal/yr)	**1,647,375**	**2,402,939**	
Annual Infeed Volume Processed (cy)	**111,295**	**162,340**	
Finished Compost Volume (cy)	61,212	89,287	
Density of Finished Compost (lb/cy)	800	800	
Finished Compost (tons)	**24,485**	**35,715**	
Composting Parameters			
Composting Period (days)	120	120	*6 months from incoming to screening*
Curing Period (days)	40	40	*Recommended*
Storage Period, Pre-Screening (days)	30	30	
Storage Period, Post-Screening (days)	30	30	*Total 60 days compost storage*
Initial Windrow Shrinkage Factor	10%	10%	
Compost Shrinkage Factor	30%	30%	
Curing Shrinkage Factor	5%	5%	
Unloading/Receiving Area			
Yard Waste Daily Pile Volume (cy)	357	520	
2x YW for Peak Day (cy)	713	1040	*Daily yard waste*
YW Pile Height (ft)	10	10	
YW Pile Area (sf)	*1,926*	*2,809*	
Wood & Leaves Pile Volumes (cy)	10,556	15,397	*Assume 10% of annual raw material*
Wood/Leaves Pile Height (ft)	10	10	*For raw material mixing ratios*
Wood/Leaves Pile Area (sf)	*28,501*	*41,573*	*Storage piles for wood chips & leaves*
Food Waste Pile Volume (cy)	26	38	
2x FW for Peak Day (cy)	52	75	*Daily food waste*
FW Pile Height (ft)	5	5	

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

FW Pile Area (sf)	*278*	*406*	
Hours per Day YW/FW Receipt	9	9	
Vehicles Peaking Factor	1.5	1.5	
Vehicles Payload (avg tons/vehicle)	2	2	*Assumption*
Unloading Time for Loads (minutes)	10	10	*Assumption*
No. Vehicles per Hour (vph)	11	16	
Total Number Unloading Bays	2	3	
Area per Unloading Bay (sf)	720	720	
Unloading Bay Space (sf)	*1,440*	*2,160*	
Maneuvering Space (sf)	*3,600*	*5,400*	
Total Unloading/Receiving Space (sf)	**35,745**	**52,347**	
Compost Pad			
Average Volume on Compost Pad (cy)	32,931	48,035	
Compost Windrow Length (ft)	200	200	
Compost Windrow Height (ft)	6	6	
Compost Windrow Width (ft)	14	14	
Volume per Row (cy)	373	373	
Number of Rows	89	129	
Spacing Between Windrows (ft)	8	8	
Total Compost Pad Area (sf)	**391,600**	**567,600**	
Compost Curing Pad			
Average Volume on Curing Pad (cy)	7,318	10,674	
Curing Windrow Length (ft)	100	100	
Curing Windrow Height (ft)	7	7	*New windrow turner to handle up to 7'x16'*
Curing Windrow Width (ft)	16	16	
Volume per Row (cy)	249	249	
Number of Rows	30	43	
Spacing Between Windrows (ft)	6	6	
Total Curing Pad Area (sf)	**66,000**	**94,600**	
Storage Pad1 - PreScreening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	
Total Storage Pad1 Area (sf)	**12,937**	**18,871**	
Finished Compost Screening Area			
Loading Traffic Area Width (ft)	50	50	
Loading Traffic Area Length (ft)	100	100	
Loading Traffic Area (sf)	*5,000*	*5,000*	
Mixing Bin/Screen w/ Stockpile Width (ft)	75	75	
Mixing Bin/Screen w/ Stockpile Length (ft)	100	100	
Mixing Bin/Screen w/ Stockpile Area (sf)	*7,500*	*7,500*	
Total Screening Area (sf)	**12,500**	**12,500**	
Storage Pad2 - Post-Screening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

Total Storage Pad2 Area (sf)	**12,937**	**18,871**	
Traffic Lanes for Operations			
Traffic Lane Width (ft)	20	20	
Cummulative Processing Area (sf)	531,719	764,789	
Square Root (ft)	729	875	
Traffic Lane Length =	2,917	3,498	
Total Operations Traffic Lanes Area (sf)	**58,335**	**69,962**	
Retention/Leachate Pond			
Area Contributing to Pond (sf)	590,054	834,751	*Total of Areas above*
100-Yr 24 hr Stor Event Rainfall Intensity I	0.310	0.310	PF Map: Contiguous US (noaa.gov)
Area A (acres)	13.5	19.2	
Run-off Factor C	0.60	0.60	
Flow Rate Q (cfs)	2.5	3.6	*using Rational Formula Q=CIA*
Time to Retain (hours)	24	24	
Volume of Water to Retain (cf)	217,394	307,547	
Depth of Pond (ft)	6	6	
Side Slopes of Pond #:1	4	4	
Pond Area at 1/2 Depth (sf)	36,232	51,258	*Volume divided by Depth*
Length & Width at 1/2 Depth (ft)	190	226	
Total Pond Area (sf)	**45,945**	**62,701**	*at grade*
SUMMARY OF COMPOST AREAS			
Unloading/Receiving Area	35,745	52,347	
Compost Pad	391,600	567,600	
Compost Curing Pad	66,000	94,600	
Storage Pad1 - Pre-Screening	12,937	18,871	
Finished Compost Screening Area	12,500	12,500	
Storage Pad2 - Post-Screening	12,937	18,871	
Traffic Lanes for Operations	58,335	69,962	
Retention/Leachate Pond	45,945	62,701	
TOTAL REQUIRED AREA (sf)	**635,999**	**897,452**	
TOTAL REQUIRED AREA (acres)	**14.60**	**20.60**	
Site - Composting & Buffer (acres)	**23**	**30**	*Assume 100' buffer*

Project:	CRLCSWA Infrastructure Options			
Date:	11/9/2021			
Facility:	New Aerobic Organics Compost Site - Windrows - No Design			
Costs:	2021$	Facility Size:	21 Acres	
Location:	Linn County, Iowa	Required Land:	30 Acres	
Worksheet:	**Composting Capital Costs**	**TOTAL COMPOST CAP$**		**$9,052,700**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
CAPITAL COST ESTIMATE SUMMARY (1)(2)

Compost Site Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations	1	LS	$ 50,000	$ 50,000	*Assumption*
Site Work					
Mobilization/Demob	1	LS	$ 50,000	$ 50,000	
Clear & Grub	11	Acres	$ 2,000	$ 22,000	*Assume no demolition; half compost area*
Grading/Excavation	67,800	CY	$ 3	$ 203,400	*Assume 2' across compost area*
Structural Fill	20,300	CY	$ 10	$ 203,000	*Assume 30% of excavation quantities*
Roadways	9,100	SY	$ 45	$ 409,500	*4" asphalt over 6" granular base*
Site Utilities					
Stormwater Pond	-	LS	$ 200,000	$ -	*See Compost Leachate Lagoon*
Site Drainage/Erosion Control	1	EA	$ 25,000	$ 25,000	
Electrical - Service to Site	-	LS	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Water Supply & Fire Protection	1	LS	$ 100,000	$ 100,000	*Extend water supply to compost facility*
Sanitary Sewer	-	EA	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Natural Gas System	-	LS	$ -	$ -	*NA*
Surveying	1	EA	$ 10,000	$ 10,000	*For composting area only*
Landscaping, Signage	1	EA	$ 20,000	$ 20,000	*For composting area only*
Fencing	4,600	LF	$ 35	$ 161,000	*Around composting area*
Pads & Leachate Collection					
Composting & Curing Pads	73,600	SY	$ 45	$ 3,312,000	*Asphalt Pad - Full Buildout*
Screening/Storage Areas	5,600	SY	$ 25	$ 140,000	*Compacted Gravel Pad - Full Buildout*
Compost Leachate Lagoon, Lined	1	LS	$ 500,000	$ 500,000	*Approximate 2 acres*
Market Variability Factor	15%	Capital $	$ 5,205,900	$ 781,000	*Sitework, horizontal construction*
SUBTOTAL COMPOST SITE CAPITAL				**$ 5,986,900**	

Engineering (3)	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 5,986,900	$ 1,197,400
Engineering & Design	4%	Capital $	$ 5,986,900	$ 239,500
Permitting (Local & IDNR)	2%	Capital $	$ 5,986,900	$ 119,700
Construction Observation/CQA	6%	Capital $	$ 5,986,900	$ 359,200
SUBTOTAL COMPOST SOFT COSTS				**$ 1,915,800**

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Windrow Turner	1	EA	$ 750,000	$ 750,000	*Replacement*
Loader (large)	1	EA	$ 400,000	$ 400,000	*Replacement*
Water Truck	0	EA	$ 200,000	$ -	*Existing*
Screen Compost Finish	0	EA	$ 300,000	$ -	*Existing*
Grinder/Shredder	0	EA	$ 600,000	$ -	*Existing*
Conveyors	0	EA	$ 75,000	$ -	*NA - included w/ screener or grinder*
SUBTOTAL				**$ 1,150,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing co: Does not include financing costs.

Assumed cell projects to be c Assumed cell projects to be competitively bid under one general contract.

Assumed construction to be d Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	New Aerobic Organics Compost Site - Windrows - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**COMPOST REV$**	**$1,091,100**
Worksheet:	**Composting O&M Costs**	**TOTAL COMPOST O&M$**	**$1,171,200**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
OPERATIONS COST ESTIMATE SUMMARY [1]

Compost Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 511,800	*FY2021 fully-burdened salary, escalated*
Scalehouse	0	FTE	$ 82,000	$ -		*Included in LF, TS, MWP, AD or WTE*
Windrow Turner Operator	1	FTE	$ 103,800	$ 103,800		
Loader Operator	2	FTE	$ 103,800	$ 207,600		
Misc. Equip Operator	2	FTE	$ 100,200	$ 200,400		*Water truck, grinder, screen, turner, loader*
Utilities					$ 27,400	
Electricity	0	kWh	$ 0.15	$ -		*NA*
Water	1	LS	$ 25,000	$ 25,000		*130 gal/ton for composting, dust control*
Leachate	0	gallons	$ 0.15	$ -		*NA - Compost leachate NPDES Discharge*
Heating Fuel	0	LS	$ 2,500	$ -		*NA*
Phones	12	months	$ 200	$ 2,400		*Estimate based on # labor*
Maintenance and Repairs					$ 153,500	
Roadways, Pads Repair & Misc Maintenance	0.3%	Capital $	$ 5,986,900	$ 18,000		*Percentage of Compost capital*
Windrow Turner	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Loader	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Truck/Screen Equipment	2,368	hours	$ 15	$ 35,500		*80% of personnel hours*
Grinder	208	hours	$ 25	$ 5,200		*Estimate 4 hours per week*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	21,936	gallons	$ 3.50	$ 76,800	$ 76,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Insurance	0.1%	Capital $	$ 5,986,900	$ 6,000	$ 6,000	*Percentage of compost total capital*
Compost Lab Testing	1	LS	$ 5,000	$ 5,000	$ 5,000	*Portion from CRLCSWA FY2022 Budget*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL COMPOST DIRECT OPERATIONS					**$ 785,500**	

Compost Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 385,700	*Rounded*
Windrow Turner	1	EA	$ 150,000	$ 150,000		*Capital cost divided by 5-yr life*
Loader	1	EA	$ 57,143	$ 57,100		*Capital cost divided by 7-yr life*
Water Truck	1	EA	$ 28,600	$ 28,600		*Shared w/ TS for roads dust control*
Screen Compost Finish	1	EA	$ 30,000	$ 30,000		*Capital cost divided by 10-yr life*
Grinder/Shredder	1	EA	$ 120,000	$ 120,000		*Capital cost divided by 5-yr life*
Conveyors	0	EA	$ 7,500	$ -		*Included w/ screen or grinder*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 composting*
SUBTOTAL LF CASH RESERVES					**$ 385,700**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Compost Sales	7,345	Ton	$ 24	$ 176,300	$ 176,300	*Assume 30% compost sales to businesses*
Tip Fees	38,118	Ton	$ 24	$ 914,800	$ 914,800	*Current CRLCSWA unit price*
Non-Cash Adjustments	0	LS	$ 25,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
SUBTOTAL OTHER REVENUES					**$ 1,091,100**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	10	Acres
Location:	Linn County, Iowa			
Worksheet:	**Scalehouse & Scales Capital Costs**	**TOTAL CAP$**		**$2,189,600**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
SCALEHOUSE CAPITAL COST ESTIMATE SUMMARY (1)(2)

Scalehouse Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scalehouse	600	SF	$ 250	$ 150,000	*Approx. current size*
Entrance & Queuing Roads	13,300	SY	$ 60	$ 798,000	*Concrete 4" over 6" granular base, 3000LF*
Road, Scale Approach, Parking	1,200	SY	$ 60	$ 72,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 15,000	$ 15,000	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,035,000	$ 310,500	*Vertical construction*
SUBTOTAL				**$ 1,345,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,345,500	$ 269,100	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,345,500	$ 161,500	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,345,500	$ 13,500	*Percentage of total capital*
SUBTOTAL				**$ 444,100**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scales	3	EA	$ 125,000	$ 375,000	*New*
Software	1	EA	$ 25,000	$ 25,000	*Software used for LF, Compost, RRC, etc.*
SUBTOTAL				**$ 400,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/23/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$	Land:	2 Acres
Location:	Linn County, Iowa		
Worksheet:	**Admin/Educational Center Capital Cost**	**TOTAL CAP$**	**$2,878,100**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
ADMIN CAPITAL COST ESTIMATE SUMMARY (1)(2)

Administration & Educational Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Two-Story Building	5,500	SF	$ 250	$ 1,375,000	*Building footprint SF; same size as current*
Access Road & Parking	2,300	SY	$ 45	$ 103,500	*Asphalt 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 137,500	$ 137,500	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,616,000	$ 484,800	*Vertical construction*
SUBTOTAL				**$ 2,100,800**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 2,100,800	$ 420,200	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 2,100,800	$ 336,100	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 2,100,800	$ 21,000	*Percentage of total capital*
SUBTOTAL				**$ 777,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**
None at Admin Center				
SUBTOTAL				**$ -**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$	Land:	4 Acres
Location:	Linn County, Iowa		
Worksheet:	**Resource Recovery Center Capital Cost**	**TOTAL CAP$**	**$9,933,900**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
RRC CAPITAL COST ESTIMATE SUMMARY (1)(2)

RRC Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
HHM Canopy - Covered Drive	2,000	SF	$ 25	$ 50,000	*CRLCSWA current size*
HHM Facility	8,000	SF	$ 300	$ 2,400,000	*CRLCSWA current size*
RRC Bldg	6,700	SF	$ 250	$ 1,675,000	*Size for just recyclables transfer*
RRC Office/Breakroom/Restrooms	3,600	SF	$ 200	$ 720,000	*CRLCSWA current size*
Access Road, Parking & Maneuvering	5,600	SY	$ 60	$ 336,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 239,750	$ 239,800	*5% of buildings cost*
Market Variability Factor	30%	Capital $	$ 5,420,800	$ 1,626,200	*Vertical construction*
SUBTOTAL				**$ 7,047,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 7,047,000	$ 1,409,400	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 7,047,000	$ 986,600	*Percentage of total capital*
Permitting (Local & IDNR)	2%	Capital $	$ 7,047,000	$ 140,900	*Percentage of total capital*
SUBTOTAL				**$ 2,536,900**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Baler	0	EA	$ 1,000,000	$ -	*Assumes RRC recyclabes transfer only*
Forklift	1	EA	$ 50,000	$ 50,000	*For HHM Facility*
Skid Loader	0	EA	$ 50,000	$ -	*Existing*
Mid-Size Loader	1	EA	$ 300,000	$ 300,000	*Share w/ Citizen Drop-Off and Bunkers*
Roll-off Containers	0	EA	$ 8,000	$ -	*Existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from Citizen Drop-Off*
Trailers	0	EA	$ 30,000	$ -	*Assume provided by end market*
Trucks	0	EA	$ 115,000	$ -	*Assume provided by end market*
SUBTOTAL				**$ 350,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

(3) Sizing for RRC Building

RRC Transfer Sizing	**Year 1**	**Year 50**	
Incoming Recyclables, TPY	4,045	5,943	*Single stream recyclables/drop box handled by CRLCSWA*
Incoming Recyclables, TPD	16	23	*5 days/week*
Incoming Recyclables, TPH	2	3	*8 hours/day*
Number of Unloading Bays	2	2	*Avg 3 tons/veh, 2x peak factor, 15 min unload + 1 extra*
Recyclables - Floor Storage (CY)	247	363	*126 lbs/CY, 1 day worth*
Recyclables - Trailer Payload	7	7	*tons/trailer* *126 lbs/CY*
Area Needed (SF):			
Tipping Floor	3,700	4,400	*Recyclables piled avg 4' high + unloading area*
Transfer Loadout Area Area	1,200	1,200	*60' x 1 trailer load-out lane*
Flex Area	1,000	1,100	*20% extra*
RRC Transfer Building (SF)	**5,900**	**6,700**	

Project:	CRLCSWA Infrastructure Options		
Date:	2/2/2022		
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design		
Costs:	2021$	Land:	2 Acres
Location:	Linn County, Iowa		
Worksheet:	**Maintenance Shop Capital Cost**	**TOTAL CAP$**	**$2,567,500**

SCENARIO 6
CRLCSWA MWP-RDF W/ REGIONAL LANDFILL OPTION
MAINT SHOP CAPITAL COST ESTIMATE SUMMARY (1)(2)

Maintenance Facility Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Maintenance Facility	9,000	SF	$ 150	$ 1,350,000	*CRLCSWA current sizes, LF+Site #3 compost*
Access Road & Maneuvering Area	1,200	SY	$ 45	$ 54,000	*Asphalt 4" over 6" granular base*
Market Variability Factor	30%	Capital $	$ 1,404,000	$ 421,200	*Vertical construction*
SUBTOTAL				**$ 1,825,200**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,825,200	$ 365,000	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,825,200	$ 219,000	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,825,200	$ 18,300	*Percentage of total capital*
SUBTOTAL				**$ 602,300**	

Maintenance Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
5-ton Overhead Crane w/ Hoist	1	EA	$ 40,000	$ 40,000	*Crane vendors $35K w/ $5k installed*
Maint/Repair Equipment	1	EA	$ 100,000	$ 100,000	*Estimate*
SUBTOTAL				**$ 140,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/10/2021			
Facility:	SCENARIO 6: Mixed Waste Processing-RDF Concept w/ Regional - No Design			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Citizen Drop-Off Center Capital Cost**	**TOTAL CAP$**		**$238,100**

SCENARIO 6
CRLCSWA MWP-RDF W/ REGIONAL LANDFILL OPTION
DROP-OFF CAPITAL COST ESTIMATE SUMMARY (1)(2)

Citizen Drop-Off Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Materials Bunkers Area	1,700	SY	$ 60	$ 102,000	*Concrete for tires, white goods, scrap metal*
Concrete Bunker Walls	80	CY	$ 600	$ 48,000	*3 bunkers 60'x 35' each*
Bulk Excavation & Structural Fill	0	CY	$ 13	$ -	*Suitable on-site soils*
Waste Unloading Area	0	SY	$ 60	$ -	*Citizens drop-off at MWP-RDF facility*
Roll-Off Area	0	SY	$ 60	$ -	*Citizens drop-off at MWP-RDF facility*
Concrete Z-Wall	0	CY	$ 600	$ -	*Citizens drop-off at MWP-RDF facility*
Market Variability Factor	15%	Capital $	$ 150,000	$ 22,500	*Sitework, horizontal construction*
SUBTOTAL				**$ 172,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 172,500	$ 34,500	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 172,500	$ 27,600	*Percentage of total capital*
Permitting (Local)	2%	Capital $	$ 172,500	$ 3,500	*Percentage of total capital*
SUBTOTAL				**$ 65,600**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Roll-off Containers	0	EA	$ 8,000	$ -	*1 glass; existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from MWP-RDF*
Skid Loader	0	EA	$ 50,000	$ -	*Share from RRC*
Mid-Size Loader	0	EA	$ 300,000	$ -	*Share from RRC*
SUBTOTAL				**$ -**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used
Does not include financing costs.
Assumed project to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	10/28/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,631,300**

SCENARIO 6
CRLCSWA SOLID WASTE CAMPUS FACILITIES OPTION
OPERATIONS COST ESTIMATE SUMMARY [(1)]

Scalehouse Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 246,000	
Scalehouse Personnel	3	FTE	$ 82,000	$ 246,000		
Utilities					$ 4,300	
Electricity	6,000	kWh	$ 0.15	$ 900		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 1,000	$ 1,000		*Estimate - small building*
Heating Fuel	1	LS	$ 1,000	$ 1,000		*Estimate 1-2 Therms/SF/year*
Phones	12	months	$ 120	$ 1,400		*Estimate*
Maintenance and Repairs					$ 9,000	
Building	1%	Capital $	$ 150,000	$ 1,500		*Percentage of building capital*
Scales	2%	Capital $	$ 375,000	$ 7,500		*Percentage of scales capital*
Mobile Equipment	0	hours	$ 15	$ -		*None*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 525,000	$ 1,600	$ 1,600	*Percentage of building & scales total capital*
Cash Reserves Bldg/Equip Replacement					$ 31,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Scales	3	EA	$ 8,333	$ 25,000		*Capital divided by 15-yr life*
Scalehouse Building	1	EA	$ 6,000	$ 6,000		*Capital divided by 25-yr life*
SUBTOTAL SCALEHOUSE & SCALES					**$ 293,900**	

Administration & Educational Center Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Agency Labor:					$ 1,583,500	*Estimate 40% from CRLCSWA FY2022 Budget*
Executive Director	1	FTE				
Site Engineer	1	FTE				
Director of Education	1	FTE				
Hazardous Materials Manager	1	FTE				
Operations Foreman	1	FTE				
Admin Personnel	2	FTE				
Utilities					$ 47,500	
Electricity	110,000	kWh	$ 0.15	$ 16,500		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 5,000	$ 5,000		*Estimate - office building*
Natural Gas/Heating Fuel	1	LS	$ 8,000	$ 8,000		*Estimate 1 Therms/SF/year*
Phones	12	months	$ 1,500	$ 18,000		*Estimate*
Maintenance and Repairs					$ 34,500	
Building & Grounds	0.5%	Capital $	$ 2,100,800	$ 10,500		*Percentage of capital*
Mobile Equipment	936	hours	$ 5	$ 4,700		*Assume pick-up trucks maintenance*
Office Equipment	1	LS	$ 19,300	$ 19,300		*CRLCSWA FY2022 Budget*
Agency Purchased Services	1	LS	$ 511,700	$ 511,700	$ 511,700	*CRLCSWA FY2022 Budget*
Agency Supplies & Materials	1	LS	$ 20,900	$ 20,900	$ 20,900	*CRLCSWA FY2022 Budget*
Agency Other Costs	1	LS	$ 46,000	$ 46,000	$ 46,000	*CRLCSWA FY2022 Budget*
Other Operating Costs - Services					$ 222,500	
ECICOG	1	LS	$ 10,000	$ 10,000		*CRLCSWA FY2022 Budget*
Public Education	1	LS	$ 37,500	$ 37,500		*CRLCSWA FY2022 Budget*
Media Advertising	1	LS	$ 125,000	$ 125,000		*CRLCSWA FY2022 Budget*
Comprehensive Planning	1	LS	$ 50,000	$ 50,000		*Annual estimate over period*
Fuel	2,808	gallons	$ 3.50	$ 9,800	$ 9,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 2,100,800	$ 6,300	$ 6,300	*Percentage of capital*
Cash Reserves Bldg/Equip Replacement					$ 55,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Admin Building	1	EA	$ 55,000	$ 55,000		*Capital divided by 25 years*
SUBTOTAL ADMINISTRATION & EDUCATIONAL CENTER					**$ 2,537,700**	

Project:	CRLCSWA Infrastructure Options		
Date:	10/28/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,631,300**

Resource Recovery Center/HHW Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor					$ 486,300	
Hazardous Materials Manager						*Included w/ Agency Labor in Admin/Ed Center*
RRC Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
HHW Facility Receiving	1.5	FTE	$ 82,000	$ 123,000		
HHW Facility Chemists	2.0	FTE	$ 103,800	$ 207,600		
Utilities					$ 59,600	
Electricity	274,500	kWh	$ 0.15	$ 41,200		*15 kWh/SF, mixed use*
Water & Sewer	1	LS	$ 3,000	$ 3,000		*Estimate*
Natural Gas/Heating Fuel	1	LS	$ 13,000	$ 13,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 200	$ 2,400		*Estimate*
Maintenance and Repairs					$ 43,000	
Building & Grounds	0.5%	Capital $	$ 7,047,000	$ 35,200		*Percentage of capital*
Mobile Equipment	520	hours	$ 15	$ 7,800		*Loader, assume 2 hrs per day*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	1,560	gallons	$ 3.50	$ 5,500	$ 5,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 7,047,000	$ 21,100	$ 21,100	*Percentage of building total capital*
Cash Reserves Bldg/Equip Replacement					$ 243,300	
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Loader	1	EA	$ 42,900	$ 42,900		*Capital cost divided by 7-yr life*
Roll-offs	2	EA	$ 800	$ 1,600		*Capital cost divided by 10-yr life*
RRC/HHW Buildings	1	EA	$ 193,800	$ 193,800		*Capital cost divided by 25-yr life*
Disposal/Management Services					$ 543,600	
HHW Disposal	1	LS	$ 90,000	$ 90,000		*CRLCSWA FY2022 Budget*
Electronics Disposal	1	LS	$ 67,700	$ 67,700		*CRLCSWA FY2022 Budget*
Batteries/Flourescents/Medical Waste	1	LS	$ 13,200	$ 13,200		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 24,900	$ 24,900		*CRLCSWA FY2022 Budget*
Tires	1	LS	$ 48,300	$ 48,300		*CRLCSWA FY2022 Budget*
Recycling Services	1	LS	$ 299,500	$ 299,500		*CRLCSWA FY2022 Budget*
SUBTOTAL RESOURCE RECOVERY CENTER					**$ 1,407,400**	

Maintenance Facility Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 207,600	
Mechanic/Maintenance	2	FTE	$ 103,800	$ 207,600		*Servicing all facilities' mobile equipment*
Utilities					$ 20,000	
Electricity	63,000	kWh	$ 0.15	$ 9,500		*Assume 7 kWh/SF repair shop*
Water & Sewer	1	LS	$ 2,500	$ 2,500		*Estimate*
Heating Fuel	1	LS	$ 7,000	$ 7,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 80	$ 1,000		*Estimate*
Maintenance and Repairs					$ 16,100	
Building & Grounds	0.5%	Capital $	$ 1,825,200	$ 9,100		*Percentage of capital*
Crane/Equipment	5%	Capital $	$ 140,000	$ 7,000		*Percentage of equipment capital*
Mobile Equipment	0	hours	$ 15	$ -		*Included w/ LF, TS, MWP, AD or WTE*
Supplies	1	LS	$ 78,600	$ 78,600	$ 78,600	*FY2022 Budget, Tools & Equipment, Shop*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 1,825,200	$ 5,500	$ 5,500	*Percentage of total capital*
Cash Reserves Bldg/Equip Replacement					$ 58,000	
Overhead Crane	1	EA	$ 4,000	$ 4,000		*Capital over 10-year life*
Maintenance Building	1	EA	$ 54,000	$ 54,000		*Capital over 25-year life*
SUBTOTAL MAINTENANCE FACILITY					**$ 385,800**	

Citizen Drop-Off Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:	Included with Labor for LF, TS, MWP, AD or WTE					*Shared Labor*
Utilities					$ -	
Electricity	0	kWh	$ 0.15	$ -		*Outdoors*
Water & Sewer	0	LS	$ -	$ -		*NA*

Project:	CRLCSWA Infrastructure Options		
Date:	10/28/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,631,300**

	Quantity	Unit	Unit Price	Annual Costs	Total	
Heating Fuel	0	LS	$ -	$ -		*NA*
Phones	0	months	$ -	$ -		*NA*
Maintenance and Repairs					$ 2,400	
Paving/Pad Repairs	1%	Capital $	$ 102,000	$ 1,000		*Percentage of pad capital*
Mobile Equipment	96	hours	$ 15	$ 1,400		*Assume 8 hours/month*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	288	gallons	$ 3.50	$ 1,000	$ 1,000	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 102,000	$ 300	$ 300	*Percentage of construction capital*
Cash Reserves Equipment Replacement						
Roll-off Containers	1	EA	$ 800	$ 800	$ 800	*Capital over 10-year life*
Roll-off Truck	0	EA	$ 11,000	$ -	$ -	*Capital over 10-year life*
SUBTOTAL CITIZEN DROP-OFF					**$ 6,500**	

Miscellaneous Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
RRC/HHW Materials					$ 647,900	
Scrap Metal	1	LS	$ 18,000	$ 18,000		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 74,700	$ 74,700		*CRLCSWA FY2022 Budget*
Waste Tires	1	LS	$ 53,900	$ 53,900		*CRLCSWA FY2022 Budget*
Electronic Waste	1	LS	$ 114,300	$ 114,300		*CRLCSWA FY2022 Budget*
HHW	1	LS	$ 57,200	$ 57,200		*CRLCSWA FY2022 Budget*
Commingled Recycling	1	LS	$ 271,400	$ 271,400		*CRLCSWA FY2022 Budget*
Recycling Services Revenue Share	1	LS	$ 58,400	$ 58,400		*CRLCSWA FY2022 Budget*
Other Misc. Revenue	0	LS	$ 29,400	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
SUBTOTAL MISC REVENUES					**$ 647,900**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Table 4 - CRLCSWA Material Handling Projections (In Tons)

Material	FY2020	FY2030	FY2040	FY2050	Year 1 FY2038	Year 50 FY2087
	Fiscal Year					
Population	228,600	254,900	276,800	298,900		
Materials Landfilled						
MSW	160,086	178,430	193,760	209,230	190,592	278,007
Disaster Debris	0	2,549	2,768	2,989	2,723	3,972
Special Waste	16,612	20,392	22,144	23,912	21,782	31,772
C&D	25,960	17,843	19,376	20,923	19,059	27,801
Shingles	9,091	2,549	2,768	2,989	2,723	3,972
Subtotal Materials Landfilled	**211,749**	**221,763**	**240,816**	**260,043**	**236,879**	**345,523**
Materials Recycled						
Organics	29,710	35,686	38,752	41,846	38,118	55,601
Single Stream/Drop Box/City	11,872	12,745	13,840	14,945	13,614	19,858
Scrap Metal/White Goods	876	1,098	1,193	1,288	1,173	1,711
Subtotal Materials Recycled	**42,458**	**49,529**	**53,785**	**58,079**	**52,905**	**77,170**
Total Materials	254,207	271,292	294,601	318,122	289,784	422,693
Annual MSW Percent Increase		0.65%	0.83%	0.77%		0.77%

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2088	FY2090
		Fiscal Year (Tons)							
PAPER									
Compostable Paper	9.30%	14,888	16,594	17,735	18,020	19,458		26,054	
High Grade Office Paper	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Magazines/Catalogs	1.10%	1,761	1,963	2,098	2,131	2,302		3,082	
Mixed Recyclable Paper	4.20%	6,724	7,494	8,009	8,138	8,788		11,766	
Newsprint	1.00%	1,601	1,784	1,907	1,938	2,092		2,802	
Non-Recyclable Paper	4.60%	7,364	8,208	8,772	8,913	9,625		12,887	
OCC and Kraft Paper	3.40%	5,443	6,067	6,484	6,588	7,114		9,525	
Aseptic/Gable Top Containers	0.10%	160	178	191	194	209		280	
Subtotal Paper	**24.5%**	**39,221**	**43,715**	**46,720**	**47,471**	**51,261**		**68,637**	
PLASTIC									
#1 PET IA Deposit Beverage Container	0.50%	800	892	953	969	1,046		1,401	
#1 PET Beverage Containter	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
#2 HDPE Containers Natural	0.50%	800	892	953	969	1,046		1,401	
#2 HDPE Containers Colored	0.60%	961	1,071	1,144	1,163	1,255		1,681	
Retail Shopping Bags	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Plastic Film	8.70%	13,927	15,523	16,590	16,857	18,203		24,373	
Other #1 PET Containers	0.30%	480	535	572	581	628		840	
Plastic Containers #3-#7	2.40%	3,842	4,282	4,577	4,650	5,022		6,724	
Other Plastic Containers	0.30%	480	535	572	581	628		840	
Expanded Polystyrene	0.90%	1,441	1,606	1,716	1,744	1,883		2,521	
Other Plastic Products	2.90%	4,642	5,174	5,530	5,619	6,068		8,124	
Subtotal Plastic	**19.1%**	**30,576**	**34,080**	**36,423**	**37,008**	**39,963**		**53,509**	
METAL									
Aluminum Beverage Containers	0.10%	160	178	191	194	209		280	
Aluminum IA Deposit Beverage Containers	0.31%	496	553	591	601	649		868	
Ferrous Food & Beverage Containers	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Aluminum Containers	0.31%	496	553	591	601	649		868	
Other Ferrous Scrap Metals	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
Other Non-Ferrous Scrap Metals	0.70%	1,121	1,249	1,335	1,356	1,465		1,961	
Subtotal Metal	**3.4%**	**5,475**	**6,102**	**6,522**	**6,627**	**7,156**		**9,581**	
GLASS									
Blue Glass	0.02%	32	36	38	39	42		56	
Brown Glass	0.03%	48	54	57	58	63		84	
Clear Glass	0.89%	1,425	1,588	1,697	1,724	1,862		2,493	
Glass IA Deposit Containers	0.58%	928	1,035	1,106	1,124	1,214		1,625	
Green Glass	0.02%	32	36	38	39	42		56	
Other Mixed Cullet	0.58%	928	1,035	1,106	1,124	1,214		1,625	
Subtotal Glass	**2.1%**	**3,394**	**3,783**	**4,043**	**4,108**	**4,436**		**5,939**	
ORGANICS									
Yard Waste	1.00%	1,601	1,784	1,907	1,938	2,092		2,802	
Food Waste - Loose	15.32%	24,525	27,335	29,214	29,684	32,054		42,919	
Food Waste - Packaged	6.82%	10,918	12,169	13,005	13,214	14,269		19,106	
Textiles and Leather	2.92%	4,675	5,210	5,568	5,658	6,110		8,180	
Diapers	2.92%	4,675	5,210	5,568	5,658	6,110		8,180	
Rubber	2.42%	3,874	4,318	4,615	4,689	5,063		6,780	
Subtotal Organics	**31.4%**	**50,267**	**56,027**	**59,878**	**60,841**	**65,698**		**87,967**	
DURABLE									
Cell Phones & Chargers	0.05%	80	89	95	97	105		140	
Central Processing Units / Peripherals	0.28%	448	500	534	543	586		784	
Computer Monitors / TVs	0.20%	320	357	381	388	418		560	
Electrical and Household Appliances	0.90%	1,441	1,606	1,716	1,744	1,883		2,521	
Subtotal Durable	**1.4%**	**2,289**	**2,552**	**2,727**	**2,771**	**2,992**		**4,006**	
CONSTRUCTION & DEMOLITION									
Wood - Untreated	0.30%	480	535	572	581	628		840	

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2088	FY2090
		Fiscal Year (Tons)							
Wood - Treated	5.50%	8,805	9,814	10,488	10,657	11,508		15,408	
Asphalt Pavement, Brick, Rock, & Concrete	0.04%	64	71	76	78	84		112	
Asphalt Roofing	0.03%	48	54	57	58	63		84	
Drywall/Gypsum Board	0.04%	64	71	76	78	84		112	
Carpet & Carpet Padding	1.30%	2,081	2,320	2,479	2,519	2,720		3,642	
Subtotal C&D	**7.2%**	**11,542**	**12,865**	**13,749**	**13,970**	**15,085**		**20,199**	
HOUSEHOLD HAZARDOUS MATERIALS (HHM)									
Chemicals	0.50%	800	892	953	969	1,046		1,401	
Lead-Acid Batteries	0.05%	80	89	95	97	105		140	
Mercury Containing Products	0.04%	64	71	76	78	84		112	
Lithium Batteries	0.10%	160	178	191	194	209		280	
Other Batteries	0.05%	80	89	95	97	105		140	
Sharps	0.04%	64	71	76	78	84		112	
Prescription Medications	0.04%	64	71	76	78	84		112	
Subtotal HHM	**0.8%**	**1,313**	**1,463**	**1,564**	**1,589**	**1,716**		**2,297**	
OTHER									
Other Organics	4.40%	7,044	7,851	8,391	8,525	9,206		12,327	
Other Inorganics	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
Other C&D	1.10%	1,761	1,963	2,098	2,131	2,302		3,082	
Other Durables	1.30%	2,081	2,320	2,479	2,519	2,720		3,642	
Other HHM	0.10%	160	178	191	194	209		280	
Fines	1.60%	2,561	2,855	3,051	3,100	3,348		4,482	
Other	0.30%	480	535	572	581	628		840	
Subtotal Other	**10.0%**	**16,009**	**17,843**	**19,069**	**19,376**	**20,923**		**28,015**	
TOTALS - MSW	**100.0%**	**160,086**	**178,430**	**190,694**	**193,760**	**209,230**	**263,453**	**280,150**	**284,488**
						0.77%			
		160,086	178,430	190,694	193,760	209,230	Check	280,150	

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**OTHER SROI INPUTS**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
OTHER SROI INPUTS (2021$)

Timing of Capital Costs

SCENARIO 7 CAMPUS	2022	2023	2024	2025	2026	2027
Land Acquisition/Legal/Env	0%	0%	5%	10%	10%	10%
Anaerobic Digesters	0%	0%	0%	0%	0%	0%
Transfer Station	0%	0%	0%	0%	0%	0%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 7 CAMPUS	2028	2029	2030	2031	2032	2033
Land Acquisition/Legal/Env	15%	50%	0%	0%	0%	0%
Anaerobic Digesters	0%	0%	0%	0%	0%	1%
Transfer Station	0%	0%	0%	0%	0%	0%
Compost Facility	0%	0%	0%	0%	0%	1%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 7 CAMPUS	2034	2035	2036	2037	2038	2039
Anaerobic Digesters	2%	6%	45%	45%	1%	0%
Transfer Station	2%	5%	40%	50%	3%	0%
Compost Facility	2%	5%	40%	50%	2%	0%
Scalehouse	0%	5%	45%	50%	0%	0%
Admin/Educational Center	0%	5%	30%	55%	10%	0%
RRC/HHW	5%	10%	30%	50%	5%	0%
Maintenance Shop	0%	5%	30%	55%	10%	0%
Citizen Drop-Off	0%	5%	60%	30%	5%	0%

Travel Distances

Digestate to on-site Solid Waste Campus, Compost Facility.

Rejects to on-site Transfer Station.

TS Trailer Payload =	20	tons per load	
One-way Distance =	115	miles	Need to go further out to find landfill(s) with capacity
Average Speed =	65	mph	
Transferred Waste, Year 2038 =	206,297	tons waste	
Calculated # Loads in Year 2038 =	10315	trailer loads	

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**SUMMARY**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
SUMMARY (2021$)

Facility	Minimum Land Required (Acres)	Land Purchase (Acres)	Liner / Pad Areas (Acres)	Building(s) Size (SF)	Year 1, TPY	Year 50, TPY
AD Facility	15	---	---	16,000	18,930	41,870
Transfer Station	14	---	0	23,500	206,297	300,710
ASP Compost Facility	17	---	10	30,200	68,128	98,552
Scalehouse	10	---	---	600	---	---
Admin/Educational Center	2	---	---	5,500	---	---
RRC/HHW	4	---	---	18,300	4,045	5,943
Maintenance Shop	2	---	---	9,000	---	---
Citizen Drop-Off	2	---	0.4	---	1,173	1,711
TOTAL	**66**	**80**	**---**	**103,100**	**---**	**---**

Diversion Tonnages		
Composted Organics-YW, FW	65,288	92,271
Composted Organics-Digestate	2,840	6,281
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
AD - Organics, Less Digestate	16,091	35,590
Diversion Subtotal	**89,436**	**141,796**
Landfill Tonnages	**206,297**	**300,710**
% Diversion/Reduction from LF	**30%**	**32%**

Facility	Full Build-Out Total Facilities Capital $	Year 1 O&M$ O&M $	O&M - Haul$	Disposal in Regional LF$	Year 1 Revenues $ Other Revenues$	Energy/ Materials Revenues$	Other Tip Fee Revenues$
AD Facility	$48,594,100	$2,212,600	---	---	$335,700	$197,100	$783,000
Transfer Station	$15,778,800	$978,400	$4,951,900	$7,839,300	$0	$0	$0
ASP Compost Facility	$24,579,500	$1,764,700	---	---	$0	$1,192,900	$1,658,800
Scalehouse	$2,189,600	$293,900	---	---	$0	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0	$0
RRC/HHW	$9,933,900	$1,407,400	---	---	$0	$647,900	$0
Maintenance Shop	$2,567,500	$385,800	---	---	$0	$0	$0
Citizen Drop-Off	$238,100	$6,500	---	---	$0	$0	$0
	$106,759,600	**$9,587,000**	**$4,951,900**	**$7,839,300**	**$335,700**	**$2,037,900**	**$2,441,800**

SCENARIO 7 CAMPUS	Quantity	Unit	Unit Price	Total	
Land Acquisition - Purchase	80	Acres	$25,000	$2,000,000	*3 Qtr Sections*
Land Acquisition - Legal/Support	25%	LS	$2,000,000	$500,000	*% Land Purchase*
Social Justice/Env Impact/Legal	1	RS	$7,000,000	$7,000,000	*Risk Factor*
SUBTOTAL				**$9,500,000**	
Facilities Capital				$77,451,600	
Contingency, Permitting, Eng/Construction Observation/CQA				$24,542,000	
Equipment/Mobile Equipment				$4,766,000	
SUBTOTAL				**$106,759,600**	
Estimated Financing Costs - All Other Facilities				$48,104,000	*20 yrs, 4% APR*
SUBTOTAL				**$48,104,000**	
TOTAL CAPITAL$				**$164,363,600**	

SCENARIO 7 TIPPING FEE ESTIMATE (2021$)

	Capital$[1]	Annual O&M$[2]	Annual Haul$[2]	Annual Disposal$[2]	Total - Gross
Total Costs - Facilities	$106,759,600	$9,587,000	$4,951,900	$7,839,300	
Total Costs - Financing	$48,104,000	---	---	---	
Total Costs-Land/Legal/Env Impact	$9,500,000	---	---	---	
CRLCSWA Process & Transfer Tons	13,076,023	215,100	215,100	215,100	
$/Ton	**$12.57**	**$44.57**	**$23.02**	**$36.44**	**$80.16**

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**SUMMARY**

	Annual Other Revenues[3]	**Annual Mat'l/ Energy Revenues[4]**	**Other Tip Fee Revenues[5]**	**Total - Revenues Before Fees**
Revenues	$335,700	$2,037,900	$2,441,800	
CRLCSWA Process & Transfer Tons	215,100	215,100	215,100	
	$1.56	**$9.47**	**$11.35**	**$22.39**

ESTIMATED NET TIP FEE	**$57.77**
Rounded ESTIMATED NET TIP FEE	**$58.00**

Notes:

1. Capital costs include full build out of facilities for 50-year period divided by projected processed & landfilles tons Year 2038-2087.
   Financing costs assume constant annual 4% interest rate on Facilities Capital plus Contingency, Permitting, Engineering & Construction Observation/CQA.
   Land acquisition costs including social justice, environmental impacts and legal.
2. Annual O&M costs include replacement reserves for equipment and rehab/rebuild of buildings over 50-year period. Divided by Year 2038 processed & transfer tons.
3. Other Revenues obtained from CRLCSWA FY2022 budget including grants, investments, non-cash adjustments, other misc. revenues.
   Divided by Year 2038 processed & landfilled tons.
4. Annual Material/Energy Revenues includes recycled materials revenues through RRC (from FY2022 budget), composting tip fees at $24/ton, compost sales at $24/ton, AD energy
5. Other Tip Fee Revenues from non-CRLCSWA waste.

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**AD Sizing & Waste Flows**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
SIZING ANAEROBIC DIGESTION FACILITY

Waste Flow (Tons)	**Year 1 FY2038**	**Year 25 FY2062**	**Year 50 FY2087**		**Assumptions/Comments**
CRLCSWA MSW - Total	190,592	229,433	278,007		*From June 2021 memo*
Food Waste-Packaged	12,998	15,647	18,960	7%	*of MSW composition; to AD*
Food Waste-Loose	29,199	35,149	42,591	15%	*of MSW composition*
Compostable Paper	17,725	21,337	25,855	9%	*of MSW composition*
OCC & Kraft Paper	6,480	7,801	9,452	3%	*of MSW composition*
Regional MSW					
Iowa City	128,000	145,000	164,000	0.5%	*Annual % increase; Yr 1 =FY2019 MSW tons*
Food Waste-Packaged	10,880	12,325	13,940	9%	*of MSW composition; to AD*
Food Waste-Loose	20,864	23,635	26,732	16%	*of MSW composition*
Compostable Paper	9,344	10,585	11,972	7%	*of MSW composition*
OCC & Kraft Paper	3,968	4,495	5,084	3%	*of MSW composition*
Black Hawk County	189,000	214,000	242,000	0.5%	*Annual % increase; Yr 1 =FY2019 MSW tons*
Food Waste-Packaged	20,034	22,684	25,652	11%	*of MSW composition; to AD*
Food Waste-Loose	25,326	28,676	32,428	13%	*of MSW composition*
Compostable Paper	13,986	15,836	17,908	7%	*of MSW composition*
OCC & Kraft Paper	5,859	6,634	7,502	3%	*of MSW composition*
Dubuque	145,000	164,000	186,000	0.5%	*Annual % increase; Yr 1 =FY2019 MSW tons*
Food Waste-Packaged	10,730	12,136	13,764	7%	*of MSW composition; to AD*
Food Waste-Loose	15,225	17,220	19,530	11%	*of MSW composition*
Compostable Paper	10,440	11,808	13,392	7%	*of MSW composition*
OCC & Kraft Paper	8,555	9,676	10,974	6%	*of MSW composition*
CRLCSWA & Regional Food Waste/Papers to SW Campus					
CRLCSWA Capture Rate[1]	10,700	12,900	15,600	20%	*of loose Food Waste/Papers Stream, voluntary*
Iowa City Capture	6,800	7,700	8,800	20%	*of loose Food Waste/Papers Stream, voluntary*
Black Hawk Capture	9,000	10,200	11,600	20%	*of loose Food Waste/Papers Stream, voluntary*
Dubuque Capture	2,100	2,300	2,600	6%	*20 % of loose Food/Papers Stream at 30% committed to regional facility*
Pre-Processing Rejects	*1,430*	*1,655*	*1,930*	5%	*of Captured Waste Stream*
FW/Papers to Composting, TPY	27,170	31,445	36,670		*Sum of Captured Waste less Rejects*
Waste to Compost Facility					
CRLCSWA Yard Waste/Misc.	38,118	45,887	55,601		*Includes miscellaneous food waste*
Papers Waste	11,987	13,874	16,186		*CRLCSWA/Regional, less Pre-Process Rejects*
Food Waste	15,183	17,571	20,484	28%	*max 30% of total composted less papers (ASP)*
ASP Composting Waste, TPY	65,288	77,332	92,271		*Total - See 7Compost Size sheet*
ASP Composting Waste, TPD	179	212	253	365	*days/year*
Waste to AD Facility					
Food Waste-Packaged Capture	9,400	10,900	12,500		*Capture rates same as above*

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**AD Sizing & Waste Flows**

Pre-Processing Rejects	470	550	630	5%	*of Captured Waste Stream*
Food Waste-Packaged to AD	8,930	10,350	11,870		
Other Food Waste to AD	0	0	0		*Excess Food Waste from CRLCSWA*
Industrial Waste to AD	10,000	20,000	30,000		*Assumed Industrial Waste Stream redirected*
AD Processed Waste, TPY	18,930	30,350	41,870		*tons per year*
AD Processed Waste, TPD	52	84	115	365	*days/year*
AD Pounds Per Day	104,000	168,000	230,000		
Gallons Per Day[2]	12,470	20,144	27,578	8.34	*pounds per gallon, recirculate dilution water*
AD Receiving, TPD	64	103	141	296	*days/year*
Digester Calculations					
Wet Tons Received, TPY	18,930	30,350	41,870		
Total Solids, TPY	5,679	9,105	12,561	30%	*solids content of wet tons (cake) received*
Volatile Solids (VS), lbs per day	26,450	42,407	58,503		*at 85% of total solids*
Gallons Per Year Treated	5,447,482	8,733,813	12,048,921	25%	
Gallons Per Day	14,925	23,928	33,011		
Feed Rate	14.78	14.78	14.78		*VS /gallons per day converted to pounds*
Effluent/Digestate					
Effluent to Dewatering, Gals/Day	12,470	20,144	27,578		*Can use liquids for fertilizer*
Digestate	2,840	4,553	6,281	15%	*of Processed Waste (assumes 30% solids post digestion)*
Diversion - Composting, TPY	2,840	4,553	6,281		

Notes:

[1] Capture rate assumes high recovery percentage of the food waste/compostable material in MSW under voluntary system.

[2] Assumes wet AD system for preliminary analysis. Total costs are simliar between wet AD and dry AD systems.

Waste to Transfer Station					
CRLCSWA MSW - Remaining	179,892	216,533	262,407		
Disaster Debris	2,723	3,278	3,972		
C&D	19,059	22,943	27,801		
Shingles	2,723	3,278	3,972		
From AD & Compost Facility:					
Pre-Process Rejects	1,430	1,655	1,930		
AD Rejects	470	550	630		
Transferred Waste, TPY	206,297	248,236	300,710		
Transferred Waste, TPD	**700**	**840**	**1,020**	296	*days/year*
Transfer Station Waste, TPH	78	93	113	9	*hours/day*

Waste to Landfill			
Direct to Landfill:			
Special Waste	21,782	26,777	31,772
From Transfer Station:	206,297	248,236	300,710
Landfilled Waste	228,079	275,014	332,483
% of Scenario 1 Landfilled	96.3%		96.2%

	Year 1	**Year 25**	**Year 50**
AD Building Sizing	**FY2038**	**FY2062**	**FY2087**

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**AD Sizing & Waste Flows**

Sizing Assumptions					
Unloading Bays	1	2	3		*Avg 3 tons/veh, peak factor 2.0, 12 min unload*
Minimum Width (ft)	20	40	60		*20 ft per bay, accounting for structure*
Waste Storage on Tip Floor (CY)	365	586	808	350	*lbs/CY and 1 day waste*
Effluent Storage, # Tanks	2	3	4		*20K gallon tanks, 3 days storage*
Estimated Square Feet - Receiving & Preprocessing Building					
Tipping Floor	2,600	4,600	6,600		*Waste piled avg 6' high + unloading area*
Pre-Processing System Area	10,000	10,000	10,000		*Assume 200' L x 50' W*
Rejects/Fines Loadout Area	1,200	1,200	1,200		*60' x loadout bays; 1 roll-offs, trucks, trailers*
Office/Breakroom/Restrooms	280	320	360	2.0%	*of area from tip floor thru loadout*
Spare Parts/Shop Room	280	320	360	2.0%	*of area from tip floor thru loadout*
Building SF	14,360	16,440	18,520		
Estimated Square Feet - Anaerobic Digestion System					
Digesters	10,000	15,000	20,000		*Assumes 100'x100' Year 1, prorated*
Biogas to Power System	2,400	2,400	2,400		*Energy production bldg*
Digestate/Effluent Management	1,250	1,875	2,500		*approximate 25' diameter per tank*
Digester System SF	13,650	19,275	24,900		
Estimate AD Land Requirements (Acres)					
Building	0.3	0.4	0.4		
AD System	0.3	0.4	0.6		
Surrounding Area	12.9	13.5	14.0	300	*ft buffer area*
Entrance Area	0.0	0.0	0.0		*included w/ scalehouse*
Land (Acres)	13.5	14.3	15.0		

AD Transfer Station Sizing	**Year 1 FY2038**	**Year 25 FY2062**	**Year 50 FY2087**		
Sizing Assumptions					
Unloading Bays	10	12	14		*Avg 3 tons/veh, peak factor 2.0, 10 min unload*
Minimum Width (ft)	200	240	280		*20 ft per unloading bay*
Waste Storage on Tip Floor (CY)	2,788	3,355	4,064	500	*lbs/CY and 1 day waste*
Estimated Square Feet					
Tipping Floor	17,530	21,060	24,970		*Waste piled avg 10' high + unloading area*
Transfer Loadout Area	2,400	2,400	2,400		*60' x 2 trailer load-out lane*
AD TS Building (SF)	**19,930**	**23,460**	**27,370**		
Estimate AD TS Land Requirements (Acres)					
Buildings	0.5	0.5	0.6		
Surrounding Area	12.2	12.5	12.8	300	*ft buffer area*
Entrance Area	0.0	0.0	0.0		*Included w/ scalehouse*
Land (Acres)	12.6	13.0	13.5		

YR	**Calculate Annual Tonnage Processed/Transferred**	**Tons per Year**	**TPD**	***CRLCSWA TPY***
1	2038	252,397	853	215,097
2	2039	254,569	860	216,877
3	2040	256,760	867	218,672
4	2041	258,970	875	220,358

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**AD Sizing & Waste Flows**

5	2042	261,199	882	222,057	
6	2043	263,447	890	223,770	
7	2044	265,714	898	225,495	
8	2045	268,001	905	227,234	
9	2046	270,307	913	228,986	
10	2047	272,634	921	230,752	
11	2048	274,980	929	232,531	
12	2049	277,347	937	234,324	
13	2050	279,734	945	236,131	
14	2051	282,141	953	237,952	
15	2052	284,569	961	239,787	
16	2053	287,019	970	241,636	
17	2054	289,489	978	243,499	
18	2055	291,980	986	245,376	
19	2056	294,493	995	247,269	
20	2057	297,028	1003	249,175	
21	2058	299,584	1012	251,097	
22	2059	302,162	1021	253,033	
23	2060	304,763	1030	254,984	
24	2061	307,386	1038	256,950	
25	2062	310,031	1047	258,931	0.86%
26	2063	312,541	1056	260,928	
27	2064	315,070	1064	262,940	
28	2065	317,620	1073	264,968	
29	2066	320,191	1082	267,011	
30	2067	322,782	1090	269,070	
31	2068	325,395	1099	271,144	
32	2069	328,028	1108	273,235	
33	2070	330,683	1117	275,342	
34	2071	333,360	1126	277,465	
35	2072	336,058	1135	279,605	
36	2073	338,778	1145	281,761	
37	2074	341,520	1154	283,933	
38	2075	344,284	1163	286,123	
39	2076	347,070	1173	288,329	
40	2077	349,879	1182	290,552	
41	2078	352,711	1192	292,793	
42	2079	355,565	1201	295,051	
43	2080	358,443	1211	297,326	
44	2081	361,344	1221	299,618	
45	2082	364,269	1231	301,929	
46	2083	367,217	1241	304,257	
47	2084	370,189	1251	306,603	
48	2085	373,185	1261	308,967	
49	2086	376,206	1271	311,350	
50	2087	379,250	1281	313,750	0.81%
	2088				
TOTAL ESTIMATED FOR POTENTIAL PROCESSED/LF		**15,628,342**	**tons**	**13,076,023**	

Project:	CRLCSWA Infrastructure Options			
Date:	2/9/2022			
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design			
Costs:	2021$	Process Size:	52	TPD, Year 1
Location:	Linn County, Iowa	Required Land:	15	Acres
Worksheet:	**AD Capital Cost**	**TOTAL AD CAP$**		**$48,594,100**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
AD CAPITAL COST ESTIMATE SUMMARY (1)(2)

AD Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
AD Building	16,000	SF	$ 200	$ 3,200,000	*Includes building, foundations, floors, HVAC*
Pre-Processing Equipment	1	EA	$ 5,000,000	$ 5,000,000	*To de-package & remove contamination*
AD Digesters	1	EA	$ 8,000,000	$ 8,000,000	*To handle initial 20K TPY*
Effluent Management Equipment	1	EA	$ 2,000,000	$ 2,000,000	*Pumping system, tanks*
Biogas Upgrade to Power	1	EA	$ -	$ -	*Included in Digester Costs*
Equipment & AD Install & Start-up	20%	LS	$ 15,000,000	$ 3,000,000	*Vendor cost on Rows 14-17*
Site Investigations	1	LS	$ 200,000	$ 200,000	*Geotech*
Site Work					
Mobilization/Demob	1	LS	$ 300,000	$ 300,000	
Clear & Grub	8	Acres	$ 2,000	$ 15,000	*Assume no demolition; half of area*
Bulk Excavation/Grading	2,400	CY	$ 3	$ 7,200	*Adequate quantity & quality of soils on-site*
Structural Fill	2,400	CY	$ 10	$ 24,000	*Assume 100% of bulk excavation quantities*
Roadways	-	SY	$ 45	$ -	*4" asphalt over 6" granular base*
Stormwater Pond	1	LS	$ 200,000	$ 200,000	
Site Drainage/Erosion Control	1	EA	$ 50,000	$ 50,000	
Site Utilities					
Electrical - New Service to Site	1	LS	$ 2,000,000	$ 2,000,000	*From 1 mile away; extra for AD*
Water Supply & Fire Protection	1	LS	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Sanitary Sewer	1	EA	$ 1,560,000	$ 1,560,000	*From 1 mile away*
Natural Gas System	1	LS	$ 1,500,000	$ 1,500,000	*Estimate, From 1 mile away*
Surveying	1	EA	$ 25,000	$ 25,000	
Screening, Landscaping, Signage	1	EA	$ 60,000	$ 60,000	*Allowance*
Fencing	3,200	LF	$ 35	$ 112,000	*Site Perimeter*
Market Variability Factor	30%	Capital $	$ 28,813,200	$ 8,644,000	*Vertical construction*
SUBTOTAL AD CONSTRUCTION				**$ 37,457,200**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	LS	$ 19,457,200	$ 3,891,400	*Without Land & Process Equipment*
Contingency - Process/AD Equip	10%	LS	$ 18,000,000	$ 1,800,000	*Process Equipment only Rows 14-18*
Eng., Design, Constr. Admin & CQA	12%	LS	$ 37,457,200	$ 4,494,900	*Percentage of total capital*
Permitting (Local & IDNR)	1%	LS	$ 37,457,200	$ 374,600	*Percentage of total capital*
SUBTOTAL AD COSTS				**$ 10,560,900**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Loader (large)	1	EA	$ 400,000	$ 400,000	
Skid Loader	1	EA	$ 50,000	$ 50,000	
Roll-Off Truck	1	EA	$ 110,000	$ 110,000	
Roll-Off Containers	2	EA	$ 8,000	$ 16,000	*Rejects*
Forklift	0	EA	$ 50,000	$ -	*None*
Yard Tractor	0	EA	$ 100,000	$ -	*None*
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*
SUBTOTAL				**$ 576,000**	

ASSUMPTIONS:

1. No sales tax is included. Assumed facility is tax exempt.
2. Costs rounded to nearest thousand.
3. Does not include financing costs.
4. Assumed project to be competitively bid under one general contract.
5. Assumed construction to be during normal working hours.
6. The construction costs are used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Project:	CRLCSWA Infrastructure Options		
Date:	2/28/2022	**OTHER TIP FEE REV$**	**$783,000**
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional LF Concept - N	**ENERGY REV$**	**$197,100**
Costs:	2021$ Process Size 84 TPD	**MAT'L REV$**	**$0**
Location:	Linn County, Iowa	**OTHER REVENUES$**	**$335,700**
Worksheet:	**AD O&M Costs**	**ANNUAL AD O&M$**	**$2,212,600**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
AD OPERATIONS COST ESTIMATE SUMMARY [1]

AD Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 633,000	*FY2021 fully-burdened salary, escalated*
Scalehouse Personnel	0	FTE	$ 82,000	$ -		*Included w/ Scalehouse operations*
AD Manager	1	FTE	$ 124,800	$ 124,800		*Estimated rate*
Loader Operator	1	FTE	$ 103,800	$ 103,800		*Estimate*
Spotters/Laborers	0	FTE	$ 52,000	$ -		*Assume none at AD receiving facility*
Sorters	0	FTE	$ 41,600	$ -		*No manual sorting*
Process Operators	2	FTE	$ 100,200	$ 200,400		*Estimate*
Roll-Off/Misc. Equip	1	FTE	$ 100,200	$ 100,200		*Rejects to LF; Digestate to Composting*
Maintenance/Mechanic	1	FTE	$ 103,800	$ 103,800		*Maintain building & process equipment*
Utilities					$ 96,900	
Electricity	260,000	kWh	$ 0.15	$ 39,000		*10 kWh/SF estimate + AD System*
Water & Sewer	1	LS	$ 50,000	$ 50,000		*Estimate - water for slurry*
Natural Gas/Heating Fuel	1	LS	$ 5,000	$ 5,000		*Avg 0.3 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 240	$ 2,900		*Estimate based on FTE*
Maintenance and Repairs					$ 217,000	
Building	1%	Capital $	$ 3,200,000	$ 32,000		*Percentage of building capital*
Process Equipment	1%	Capital $	$ 8,000,000	$ 80,000		*Percentage of process equipment capital*
Mobile Equipment	7,000	hours	$ 15	$ 105,000		*Avg mobile equip operating hrs*
Supplies	1	LS	$ 25,000	$ 25,000	$ 25,000	*Estimate*
Fuel	21,000	gallons	$ 3.50	$ 73,500	$ 73,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	1	LS	$ 150,000	$ 150,000	$ 150,000	*Estimate-AD plus SW campus facilities*
AD Facility Insurance	0.1%	Capital $	$ 37,457,200	$ 37,500	$ 37,500	*Percentage of AD total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL AD DIRECT OPERATIONS					**$ 1,232,900**	

AD Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Mobile Equipment Replacement					$ 80,400	
Loaders	1	EA	$ 57,143	$ 57,100		*Capital cost divided by 7-yr life*
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Roll-Off Truck	1	EA	$ 11,000	$ 11,000		*Capital cost divided by 10-yr life*
Roll-Off Containers	2	EA	$ 800	$ 1,600		*Capital cost divided by 10-yr life*
Forklift	0	EA	$ 5,000	$ -		*Capital cost divided by 10-yr life*
Yard Tractor	0	EA	$ 10,000	$ -		*Capital cost divided by 10-yr life*
Pick-up Truck	1	EA	$ 5,714	$ 5,700		*Capital cost divided by 7-yr life*
AD Plant	1	EA	$ 733,333	$ 733,300	$ 733,300	*Capital cost divided by 15-yr life*
Building Replacement	1	EA	$ 128,000	$ 128,000	$ 128,000	*Bldg capital cost divided by 25-yr life*
Operating Cash Reserve	1	LS	$ 38,000	$ 38,000	$ 38,000	*CRLCSWA FY2021 Budget, rounded*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 operations*
SUBTOTAL CASH RESERVES					**$ 979,700**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Rev**	**Total**	
Grants/Investments/ Other	1	LS	$ 281,300	$ 281,300	$ 281,300	*CRLCSWA FY2022 Budget*
Non-Cash Adjustments	1	LS	$ 25,000	$ 25,000	$ 25,000	*CRLCSWA FY2022 Budget*
Other Misc. Revenue	1	LS	$ 29,400	$ 29,400	$ 29,400	*CRLCSWA FY2022 Budget*
AD Energy Revenue	6,570,000	kWh	$ 0.03	$ 197,100	$ 197,100	*Assuming 750 KW power output*
AD Digestate to Composting	2,840	Tons	$ -	$ -	$ -	*Add'l Compost$ w/ Composting Facility*
Carbon Credits	0	Ton CO2	$ 3	$ -	$ -	*Diversion to AD may include carbon credits*
Other Tip Fee Revenues	13,500	Tons	$ 58	$ 783,000	$ 783,000	*Non-CRLCSWA Waste & Industrial Waste to AD*
SUBTOTAL OTHER REVENUES					**$ 1,315,800**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   No Shifts = 1 8 hours per shift
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options				
Date:	2/2/2022				
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design				
Costs:	2021$	TS Size:	840	TPD	
Location:	Linn County, Iowa	Required Land	14	Acres	
Worksheet:	**AD Transfer Station Capital Cost**	**TOTAL CAP$**			**$15,778,800**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
AD TS CAPITAL COST ESTIMATE SUMMARY (1)(2)

Transfer Station Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Transfer Station Building	23,500	SF	$ 300	$ 7,050,000	*Bldg, foundations, floors, concrete walls, etc.*
Site Investigations	1	LS	$ 100,000	$ 100,000	*Geotech in area of TS*
Site Work					
Mobilization/Demob	1	LS	$ 100,000	$ 100,000	*Assume portion to TS*
Clear & Grub	7	Acres	$ 2,000	$ 14,000	*Assume no demolition; half of required land*
Bulk Excavation/Quantities	12,200	CY	$ 3	$ 36,600	*Adequate quantity & quality of soils on-site*
Structural Fill	12,200	CY	$ 10	$ 122,000	*Assume 100% of bulk excavation quantities*
Roadways	4,000	SY	$ 45	$ 180,000	*4" asphalt over 6" granular base, 1000LF*
Manuevering Pad	670	CY	$ 600	$ 402,000	*9" reinforced concrete slab on grade*
Stormwater Pond	-	LS	$ 200,000	$ -	*Assume included w/ AD*
Site Drainage/Erosion Control	-	EA	$ 50,000	$ -	*Assume included w/ AD*
Site Utilities					
Electrical - Service to Facility	1	LS	$ 100,000	$ 100,000	*Extended to TS*
Water Supply & Fire Protection	1	LS	$ 50,000	$ 50,000	*Extended to TS*
Sanitary Sewer	1	EA	$ 50,000	$ 50,000	*Extended to TS*
Natural Gas System	-	LS	$ -	$ -	*Assume included w/ AD*
Surveying	1	EA	$ 25,000	$ 25,000	
Screening, Landscaping, Signage	1	EA	$ 60,000	$ 60,000	*Allowance*
Fencing	-	LF	$ 35	$ -	*Included in AD*
Market Variability Factor	30%	Capital $	$ 8,289,600	$ 2,486,900	*Vertical construction*
SUBTOTAL TRANSFER STATION				**$ 10,776,500**	

Soft Costs	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	LS	$ 10,776,500	$ 2,155,300	
Eng., Design, Constr. Admin & CQA	16%	LS	$ 10,776,500	$ 1,724,000	*Percentage of TS total capital*
Permitting (Local & IDNR)	3%	LS	$ 10,776,500	$ 323,000	*Percentage of TS total capital*
SUBTOTAL TS SOFT COSTS				**$ 4,202,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Loader	2	EA	$ 400,000	$ 800,000	
Yard Tractor	0	EA	$ 100,000	$ -	
Transfer Trucks & Trailers - See Haul Costs					*Included in haul cost per ton*
SUBTOTAL				**$ 800,000**	

ASSUMPTIONS:

1. No sales tax is included. Assumed facility is tax exempt.
2. Costs rounded to nearest thousand.
3. Does not include financing costs.
4. Assumed project to be competitively bid under one general contract.
5. Assumed construction to be during normal working hours.
6. The construction costs are used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Project:	CRLCSWA Infrastructure Options			
Date:	2/2/2022			
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design			
Costs:	2021$	TS Size:	840 TPD	
Location:	Linn County, Iowa			
Worksheet:	**AD Transfer Station O&M Costs**	**ANNUAL WTE TS O&M$**		**$978,400**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LF OPTION
AD TS OPERATIONS COST ESTIMATE SUMMARY [1]

TS Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 311,400	*FY2021 fully-burdened salary, escalated*
Scalehouse	0	FTE	$ 82,000	$ -		*Included w/ Scalehouse operations*
TS Loader Operators	3	FTE	$ 103,800	$ 311,400		
TS Roll-off Operator /Misc. Equipment	0	FTE	$ 100,200	$ -		*Included in AD costs*
TS Transfer Drivers - See Haul Costs						*See TS Haul$*
TS Utilities					$ 30,100	
Electricity	164,500	kWh	$ 0.15	$ 24,700		*7 kWh/SF estimate avg warehouse/office*
Water & Sewer	1	LS	$ 2,000	$ 2,000		*Estimate*
Heating Fuel	1	LS	$ 2,000	$ 2,000		*Estimate*
Phones	12	months	$ 120	$ 1,400		*Estimate*
Maintenance and Repairs					$ 170,800	
Building & Grounds	1%	Capital $	$ 10,776,500	$ 107,800		*Percentage of TS total capital*
Mobile Equipment	4,200	hours	$ 15	$ 63,000		*Avg equip ops hours, 6 days/wk, 9 hrs/day (1.5 loader); not include trucks, trailers*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	12,600	gallons	$ 3.50	$ 44,100	$ 44,100	*Assume 3 gallons per hour operating*
Professional Services & Eng.	1	LS	$ 10,000	$ 10,000	$ 10,000	*Estimate-inspection, permitting, legal*
TS Insurance	0.1%	Capital $	$ 10,776,500	$ 10,800	$ 10,800	*Percentage of TS total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL TS DIRECT OPERATIONS					**$ 582,200**	

TS Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 114,200	
Loaders	2	EA	$ 57,100	$ 114,200		*Capital cost divided by 7-yr life*
Yard Tractor	0	EA	$ 10,000	$ -		*Capital cost divided by 10-yr life*
Trucks & Trailers - See Haul Costs						*Included in haul costs per ton*
TS Rehab/Replacement	1	EA	$ 282,000	$ 282,000	$ 282,000	*Capital cost divided by 25-yr life*
Operating Cash Reserve	0	LS	$ -	$ -	$ -	*Included in AD costs*
Site #3 Other Developments	0	LS	$ -	$ -	$ -	*NA if no Site #3 composting*
SUBTOTAL TS CASH RESERVES					**$ 396,200**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.5 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options		
Date:	2/1/2022		
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**LF DISPOSAL$**	**$7,839,300**
Worksheet:	**AD Transfer Station Haul Costs**	**ANNUAL HAUL$**	**$4,951,900**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LF OPTION
WTE TS & ASH HAUL COST ESTIMATE SUMMARY

	30-Mile Radius	80-Mile Radius	115-Mile Radius	*Comments*
Number of Trailer Loads	10,315	10,315	10,315	*Assumes average 20 ton payload*
Tonnage (tpy):	**206,297**	**206,297**	**206,297**	*Year 1*
Load & Unload Time (minutes):	30	30	30	*Estimate*
One-Way Distance (miles)	**30**	**80**	**115**	
Average Speed (mph):	50	60	65	*From route mapping in area*
Average Trips/Year:	10,315	10,315	10,315	
Average Trips/Month:	860	860	860	
Average Trips/Week:	199	199	199	
Hours Per Trip	1.7	3.2	4.0	
Weekly Freight Hours:	338	630	804	
Wkly Prorated Veh Inspect/Breaks:	6.0	6.0	6.0	*1 hour per day*
Annual Freight Hours:	17,592	32,769	41,790	*Freight hours only for vehicle fuel, oil & grease cost*
Total Miles/Yr	618,900	1,650,400	2,372,450	

Annual Costs Assumptions:				
Driver Labor				
Drivers (based on total time)	9	16	21	
Driver annual salary	$60,400	$60,400	$60,400	*Bureau of Labor Statistics-CR, Iowa, heavy truck driver*
Fringe benefits (% of salary)	35%	35%	35%	*Included in annual salary*
Fuel, Oil & Grease				
Fuel Cost per Gallon	$3.50	$3.50	$3.50	*Diesel Fuel 2021-US EIA, Mid-West average*
Miles per Gallon	6.5	6.5	6.5	*North American Council for Freight Efficiency*
Oil & Grease ($/freight hour)	$0.50	$0.50	$0.50	*Estimate*
Tires				
New Tires Price	$425	$425	$425	*Estimate*
# New Tires Per 50,000 Miles	18	18	18	*6 tires on tractor & 12 tires on trailers*
Maintenance & Repairs				
Mechanic Labor annual salary	$78,700	$78,700	$78,700	*Bureau of Labor Statistics-CR, Iowa, heavy equip mech*
Mechanic Labor % per Truck	2%	2%	2%	
Parts, Repairs, Overhaul ($/mile)	$0.25	$0.25	$0.25	
Truck Amortization				
Number of Tractors	9	16	21	*Update based on loads/day*
Capital Cost - per semi-truck	$115,000	$115,000	$115,000	*New truck price based on historic vendor/project data*
Resale Value (% of truck $)	30%	30%	30%	*Used trucks good condition $25K to $40K*
Replacement Schedule (years)	7	7	7	
Interest Rate	4%	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	0.1666	
Trailer Amortization				
Number of Trailers	10	18	23	*Includes spares at 10%*
Capital Cost -- per trailer	$70,000	$70,000	$70,000	*Walking floor - new*
Resale Value (% of purchase $)	15%	15%	15%	*Used trailers good condition $7K to $10K*
Replacement Schedule (years)	7	7	7	
Interest Rate	4%	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	0.1666	
Insurance, License & Taxes (per yr/truck) @ 2.5% $ Capital Cost	$2,900	$2,900	$2,900	*Estimate % of capital cost of truck*
Overhead & Profit - Contract Haul @ % of O&M	20%	20%	20%	*Contingency or OHP on contract haul*

Annual Haul Cost to Disposal:	30-Mile Radius	80-Mile Radius	115-Mile Radius	Comments
Driver Labor	$543,600	$966,400	$1,268,400	Time Based
Fuel, Oil & Grease	$342,000	$905,100	$1,298,400	Mileage & Time Based
Tires	$94,700	$252,500	$363,000	Mileage Based
Maintenance & Repairs	$168,900	$437,800	$626,200	Mileage & Time Based

Project:	CRLCSWA Infrastructure Options
Date:	2/1/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**AD Transfer Station Haul Costs**

LF DISPOSAL$	**$7,839,300**
ANNUAL HAUL$	**$4,951,900**

Truck Amortization	$120,700	$214,600	$281,700	100% Utilized
Trailer Amortization	$99,100	$178,400	$228,000	100% Utilized
Insurance, Licensing & Taxes	$26,100	$46,400	$60,900	No. trucks
Overhead & Profit	$279,000	$600,200	$825,300	
MSW Haul Cost to Landfill	**$1,674,100**	**$3,601,400**	**$4,951,900**	
Total Haul Cost/Ton	**$8.12**	**$17.46**	**$24.00**	

Transfer Trucks Capital Cost	$1,035,000	$1,840,000
Transfer Trailers Capital Cost	$700,000	$1,260,000
Total Truck/Trailers Capital	**$1,735,000**	**$3,100,000**

Project:	CRLCSWA Infrastructure Options
Date:	2/8/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
ASP AEROBIC COMPOSTING FACILITY SIZING

Compost Feedstock	***Initial Development, Year 2038***	***Long Term, Year 2087***	
Incoming Yard Waste/Misc. Food (tons)	38,118	55,601	*From SW Volumes Memo 6-10-2021*
Incoming Food Scraps (tons)	15,183	20,484	*From 7AD-TS Size sheet*
Incoming Papers (tons)	11,987	16,186	*From 7AD-TS Size sheet*
Incoming Digestate (tons)	2,840	6,281	*From AD system*
Total Incoming Materials (tons)	**68,128**	**98,552**	
% as Food Waste	25%	24%	*Assumes 5% food waste in Incoming Yard Waste/Misc. Food*
Processing Days per Year	296	296	
Tons per Day	**230**	**333**	**TPD**
Yard Waste Density (lb/cy)	650	650	
Yard Waste C:N Ratio	25	25	
Yard Waste Moisture Content	40%	40%	
Digestate Density (lb/cy)	1,000	1,000	*Assumption*
Digestate C:N Ratio	45	45	*Assumption*
Digestate Moisture Content	60%	60%	*Assumption*
Papers Density (lb/cy)	500	500	*Assumption*
Papers C:N Ratio	100	100	*Assumption*
Papers Moisture Content	30%	30%	*Assumption*
Food Waste Density (lb/cy)	1,200	1,200	
Food Waste C:N Ratio	25	25	
Food Waste Moisture Content	60%	60%	
Target C:N Ratio	30 to 45	30 to 45	
Target Moisture Content	60%	60%	
Target Bulk Density (lb/cy) - post grind	850	850	
Net Bulk Density at Arrival (lb/cy)	776	778	
Net C:N Ratio	39	39	
Net Moisture Content	44%	44%	
Water to Add Initially (gal/yr)	**2,602,318**	**3,702,290**	
Annual Infeed Volume Processed (cy)	**175,553**	**253,509**	
Finished Compost Volume (cy)	96,554	139,430	
Density of Finished Compost (lb/cy)	800	800	
Finished Compost (tons)	**38,622**	**55,772**	

Composting Parameters			
Composting Period (days)	28	28	*ASP System*
Curing Period (days)	36	36	*ASP System*
Storage Period, Pre-Screening (days)	30	30	
Storage Period, Post-Screening (days)	30	30	*Total 60 days compost storage*
Initial ASP Shrinkage Factor	10%	10%	
Compost Shrinkage Factor	30%	30%	
Curing Shrinkage Factor	5%	5%	

Unloading/Receiving Area

Project:	CRLCSWA Infrastructure Options
Date:	2/8/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

Yard Waste Daily Pile Volume (cy)	376	549	
2x YW for Peak Day (cy)	753	1098	*Daily yard waste*
YW Pile Height (ft)	10	10	
YW Pile Area (sf)	*2,033*	*2,965*	
Wood & Leaves Pile Volumes (cy)	38	55	*Assume 10% of annual raw material*
Wood/Leaves Pile Height (ft)	10	10	*For raw material mixing ratios*
Wood/Leaves Pile Area (sf)	*102*	*148*	*Storage piles for wood chips & leaves*
Digestate Pile Volumes (cy)	58	127	*3-days Digestate*
Digestate Pile Height (ft)	5	5	*For raw material mixing ratios*
Digestate Pile Area (sf)	*311*	*687*	
Papers/Food Waste Pile Volume (cy)	247	334	
2x FW for Peak Day (cy)	495	668	*Daily food waste/papers*
FW Pile Height (ft)	5	5	
FW Pile Area (sf)	*2673*	*3608*	
Hours per Day YW/FW Receipt	9	9	
Vehicles Peaking Factor	1.5	1.5	
Vehicles Payload (avg tons/vehicle)	2	2	*Assumption*
Unloading Time for Loads (minutes)	10	10	*Assumption*
No. Vehicles per Hour (vph)	20	28	
Total Number Unloading Bays	4	5	
Area per Unloading Bay (sf)	720	720	
Unloading Bay Space (sf)	*2,880*	*3,600*	
Maneuvering Space (sf)	*7,200*	*9,000*	
Total Unloading/Receiving Space (sf)	**15,200**	**20,000**	

Mixing/Grinding Area

Load Traffic Area Width (ft)	50	50
Load Traffic Area Length (ft)	150	150
Load Traffic Area (sf)	7500	7500
Grinder w/ Stockpiles Width (ft)	50	50
Grinder w/ Stockpiles Length (ft)	150	200
Grinder w/ Stockpiles Area (sf)	7,500	10,000
Total Mixing/Grinding Area	**15,000**	**17,500**

Compost Pad

Average Volume on Compost Pad (cy)	12,120	17,503
ASP Compost Length (ft)	100	100
ASP Compost Height (ft)	10	10
ASP Compost Width (ft)	16	16
Volume per Row (cy)	356	356
Number of Rows	35	50
Spacing Between ASP Windrows (ft)	4	4
Total Compost Pad Area (sf)	**70,000**	**100,000**

Bio Filter

Average Volume on Compost Pad (cy)	12,120	17,503	
Tons of Compost on Compost Pad (wet)	4,704	6,804	
Dry Tons of Compost	2,630	3,786	
Flow rate through compost (cfm/dry ton)	20	20	*On Farm Compost Handbook*
Total Flow rate from Compost (cfm)	52,595	75,725	
Bio Filter size criteria (cf per min/sf biofilter)	4	4	

Project:	CRLCSWA Infrastructure Options		
Date:	2/8/2022		
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa		
Worksheet:	**Aerobic Organics Composting - Sizing**		

Total Bio Filter Area (sf)	**13,800**	**19,900**	*with 5% contingency*
Compost Curing Pad			
Average Volume on Curing Pad (cy)	10,389	15,002	
Curing Windrow Length (ft)	100	100	
Curing Windrow Height (ft)	8	8	
Curing Windrow Width (ft)	16	16	
Volume per Row (cy)	284	284	
Number of Rows	37	53	
Spacing Between Windrows (ft)	6	6	
Total Curing Pad Area (sf)	**81,400**	**116,600**	
Storage Pad1 - PreScreening			
Average Volume on Storage Pad (cy)	7,936	11,460	
Storage Windrow/Pile Height (ft)	15	15	
Total Storage Pad1 Area (sf)	**20,400**	**29,500**	
Finished Compost Screening Area			
Loading Traffic Area Width (ft)	50	50	
Loading Traffic Area Length (ft)	100	100	
Loading Traffic Area (sf)	*5,000*	*5,000*	
Mixing Bin/Screen w/ Stockpile Width (ft)	75	75	
Mixing Bin/Screen w/ Stockpile Length (ft)	100	100	
Mixing Bin/Screen w/ Stockpile Area (sf)	*7,500*	*7,500*	
Total Screening Area (sf)	**12,500**	**12,500**	
Storage Pad2 - Post-Screening			
Average Volume on Storage Pad (cy)	7,936	11,460	
Storage Windrow/Pile Height (ft)	15	15	
Total Storage Pad2 Area (sf)	**20,400**	**29,500**	
Traffic Lanes for Operations			
Traffic Lane Width (ft)	20	20	
Cummulative Processing Area (sf)	248,700	345,500	
Square Root (ft)	499	588	
Traffic Lane Length =	1,995	2,351	
Total Operations Traffic Lanes Area (sf)	**39,900**	**47,000**	
Retention/Leachate Pond			
Area Contributing to Pond (sf)	288,600	392,500	*Total of Areas above*
100-Yr 24 hr Stor Event Rainfall Intensity I	0.310	0.310	PF Map: Contiguous US (noaa.gov)
Area A (acres)	6.6	9.0	
Run-off Factor C	0.60	0.60	
Flow Rate Q (cfs)	1.2	1.7	*using Rational Formula Q=CIA*
Time to Retain (hours)	24	24	
Volume of Water to Retain (cf)	106,329	144,609	
Depth of Pond (ft)	5	5	
Side Slopes of Pond #:1	4	4	
Pond Area at 1/2 Depth (sf)	21,266	28,922	*Volume divided by Depth*
Length & Width at 1/2 Depth (ft)	146	170	

Project:	CRLCSWA Infrastructure Options
Date:	2/8/2022
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

Total Pond Area (sf)	**27,500**	**36,100**	*at grade*

SUMMARY OF COMPOST AREAS

Unloading/Receiving Area	15,200	20,000
Grinding/Mixing Area	15,000	17,500
Compost Pad	70,000	100,000
Bio Filter	13,800	19,900
Compost Curing Pad	81,400	116,600
Storage Pad1 - Pre-Screening	20,400	29,500
Finished Compost Screening Area	12,500	12,500
Storage Pad2 - Post-Screening	20,400	29,500
Traffic Lanes for Operations	39,900	47,000
Retention/Leachate Pond	27,500	36,100
TOTAL REQUIRED AREA (sf)	**316,100**	**428,600**
TOTAL REQUIRED AREA (acres)	**7.26**	**9.84**

Site - Composting & Buffer (acres)	**13**	**17**	*Assume 100' buffer*

Project:	CRLCSWA Infrastructure Options			
Date:	2/9/2022			
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design			
Costs:	2021$	Facility Size:	10 Acres	
Location:	Linn County, Iowa	Required Land:	17 Acres	
Worksheet:	**Composting Capital Costs**	**TOTAL COMPOST CAP$**		**$24,579,500**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
ASP COMPOSTING CAPITAL COST ESTIMATE SUMMARY (1)(2)

Compost Site Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations	1	LS	$ 50,000	$ 50,000	*Assumption*
Site Work					
Mobilization/Demob	1	LS	$ 100,000	$ 100,000	
Clear & Grub	5	Acres	$ 2,000	$ 10,000	*Assume no demolition; half compost area*
Grading/Excavation	32,300	CY	$ 3	$ 96,900	*Assume 2' across compost area*
Structural Fill	9,700	CY	$ 10	$ 97,000	*Assume 30% of excavation quantities*
Roadways	6,600	SY	$ 45	$ 297,000	*4" asphalt over 6" granular base*
Site Utilities					
Stormwater Pond	-	LS	$ 200,000	$ -	*See Compost Leachate Lagoon*
Site Drainage/Erosion Control	1	EA	$ 25,000	$ 25,000	
Electrical Service	1	LS	$ 200,000	$ 200,000	*Extend electrical to compost facility*
Water Supply & Fire Protection	1	LS	$ 100,000	$ 100,000	*Extend water supply to compost facility*
Sanitary Sewer	-	EA	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Natural Gas System	-	LS	$ -	$ -	*NA*
Surveying	1	EA	$ 10,000	$ 10,000	*For composting area only*
Landscaping, Signage	1	EA	$ 20,000	$ 20,000	*For composting area only*
Fencing	3,400	LF	$ 35	$ 119,000	*Around composting area*
Building - Receiving/Pre-Process	30,200	SF	$ 200	$ 6,040,000	*Bldg, foundations, floors, concrete walls, etc.*
ASP System				$ -	
Aerated Bed Compost Pad	70,000	SF	$ 40	$ 2,800,000	
Bio Filter	13,800	SF	$ 35	$ 483,000	
Aerated Bed Curing Pad	81,400	SF	$ 25	$ 2,035,000	
Aerated System Head Walls	720	CY	$ 1,200	$ 864,000	
Air Manifold & Blowers	650	LF	$ 1,000	$ 650,000	
Storage/Screening & Leachate Collection					
Screening/Storage Areas	7,900	SY	$ 25	$ 198,000	*Compacted Pad - Full Buildout*
Compost Leachate Lagoon, Lined	1	LS	$ 350,000	$ 350,000	*Approximate 1 acres*
Market Variability Factor	15%	Capital $	$ 14,544,900	$ 2,182,000	*Sitework, horizontal construction*
SUBTOTAL COMPOST SITE CAPITAL				**$ 16,726,900**	

Engineering (3)	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 16,726,900	$ 3,345,400
Engineering & Design	4%	Capital $	$ 16,726,900	$ 669,100
Permitting (Local & IDNR)	2%	Capital $	$ 16,726,900	$ 334,500
Construction Observation/CQA	6%	Capital $	$ 16,726,900	$ 1,003,600
SUBTOTAL COMPOST SOFT COSTS				**$ 5,352,600**

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Windrow Turner	0	EA	$ 750,000	$ -	*None*
Loader (large)	2	EA	$ 400,000	$ 800,000	*Replacement*
Pre-sort Contaminant Removal	1	EA	$ 300,000	$ 300,000	*New*
Mixer/Shredder	1	EA	$ 700,000	$ 700,000	*New w/ conveyor*
Aeration Equipment	1	EA	$ 500,000	$ 500,000	*New*
Dump Truck	1	EA	$ 200,000	$ 200,000	*New*
Water Truck	0	EA	$ 200,000	$ -	*Existing*
Screen Compost Finish	0	EA	$ 300,000	$ -	*Existing*
Grinder/Shredder	0	EA	$ 600,000	$ -	*Existing*
Conveyors	0	EA	$ 75,000	$ -	*NA - included w/ mixer, screener or grinder*
SUBTOTAL				**$ 2,500,000**	

Project:	CRLCSWA Infrastructure Options			
Date:	2/9/2022			
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design			
Costs:	2021$	Facility Size:	10 Acres	
Location:	Linn County, Iowa	Required Land:	17 Acres	
Worksheet:	**Composting Capital Costs**	**TOTAL COMPOST CAP$**		**$24,579,500**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.
Assumed cell projects to be competitively bid under one general contract.
Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options		
Date:	2/4/2022		
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design		
Costs:	2021$	**OTHER TIP FEE REV$**	**$1,658,800**
Location:	Linn County, Iowa	**CRLCSWA COMPOST REV$**	**$1,192,900**
Worksheet:	**Composting O&M Costs**	**TOTAL COMPOST O&M$**	**$1,764,700**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LF OPTION
ASP COMPOSTING OPERATIONS COST ESTIMATE SUMMARY [1]

Compost Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 667,600	*FY2021 fully-burdened salary, escalated*
Scalehouse	0	FTE	$ 82,000	$ -		*Included in LF, TS, MWP, AD or WTE*
Shredder/Mixer/Dump Truck	1	FTE	$ 103,800	$ 103,800		
Loader Operator	2	FTE	$ 103,800	$ 207,600		
Misc. Equip Operator	2	FTE	$ 100,200	$ 200,400		*Water truck, grinder, screen, turner, loader*
Laborers	1	FTE	$ 52,000	$ 52,000		
Mechanic	1	FTE	$ 103,800	$ 103,800		
Utilities					$ 242,400	
Electricity	1,300,000	kWh	$ 0.15	$ 195,000		
Water	1	LS	$ 45,000	$ 45,000		*130 gal/ton for composting, dust control*
Leachate	0	gallons	$ 0.15	$ -		*NA - Compost leachate NPDES Discharge*
Heating Fuel	0	LS	$ 2,500	$ -		*NA*
Phones	12	months	$ 200	$ 2,400		*Estimate based on # labor*
Maintenance and Repairs					$ 297,600	
Roadways, Pads Repair & Misc Maintenance	1.0%	Capital $	$ 495,000	$ 5,000		*Percentage of capital*
Bio Filter Refresh	2,600	CY	$ 40	$ 104,000		*Every 2 years; average annual shown*
ASP System	1.0%	Capital $	$ 6,349,000	$ 63,500		*Percentage of ASP capital*
Loader	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Shredder/Mixer	1,480	hours	$ 25	$ 37,000		*50% of personnel hours*
Truck & Screen Equipment	2,368	hours	$ 15	$ 35,500		*80% of personnel hours*
Grinder	208	hours	$ 25	$ 5,200		*Estimate 4 hours per week - for wood*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	19,272	gallons	$ 3.50	$ 67,500	$ 67,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	1	LS	$ 10,000	$ 10,000	$ 10,000	*For ASP system*
Insurance	0.1%	Capital $	$ 16,726,900	$ 16,700	$ 16,700	*Percentage of compost total capital*
Compost Lab Testing	1	LS	$ 5,000	$ 5,000	$ 5,000	*Portion from CRLCSWA FY2022 Budget*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL COMPOST DIRECT OPERATIONS					**$ 1,311,800**	

Compost Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 452,900	*Rounded*
Windrow Turner	0	EA	$ 150,000	$ -		*Capital cost divided by 5-yr life*
Loader	2	EA	$ 57,143	$ 114,300		*Capital cost divided by 7-yr life*
Mixer/Shredder	1	EA	$ 140,000	$ 140,000		*Capital cost divided by 5-yr life*
Dump Truck	1	EA	$ 20,000	$ 20,000		*Capital cost divided by 10-yr life*
Water Truck	1	EA	$ 28,600	$ 28,600		*Shared w/ TS for roads dust control*
Screen Compost Finish	1	EA	$ 30,000	$ 30,000		*Capital cost divided by 10-yr life*
Grinder/Shredder	1	EA	$ 120,000	$ 120,000		*Capital cost divided by 5-yr life*
Conveyors	0	EA	$ 7,500	$ -		*Included w/ screen, grinder, mixer*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 composting*
SUBTOTAL LF CASH RESERVES					**$ 452,900**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Compost Sales	11,586	Ton	$ 24	$ 278,100	$ 278,100	*Assume 30% compost sales to businesses*
Tip Fees-Source Separated YW	38,118	Ton	$ 24	$ 914,800	$ 914,800	*Current CRLCSWA unit price*
Tip Fees - Food Scraps/Papers	28,600	Ton	$ 58	$ 1,658,800	$ 1,658,800	*Non-CRLCSWA sources*
Digestate	2,840	Ton	$ -	$ -	$ -	

Project:	CRLCSWA Infrastructure Options		
Date:	2/4/2022		
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design		
Costs:	2021$	**OTHER TIP FEE REV$**	**$1,658,800**
Location:	Linn County, Iowa	**CRLCSWA COMPOST REV$**	**$1,192,900**
Worksheet:	**Composting O&M Costs**	**TOTAL COMPOST O&M$**	**$1,764,700**

Non-Cash Adjustments	0	LS	$ 25,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
SUBTOTAL OTHER REVENUES					**$ 2,851,700**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	10 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Scalehouse & Scales Capital Costs**	**TOTAL CAP$**		**$2,189,600**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
SCALEHOUSE CAPITAL COST ESTIMATE SUMMARY (1)(2)

Scalehouse Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scalehouse	600	SF	$ 250	$ 150,000	*Approx. current size*
Entrance & Queuing Roads	13,300	SY	$ 60	$ 798,000	*Concrete 4" over 6" granular base, 3000LF*
Road, Scale Approach, Parking	1,200	SY	$ 60	$ 72,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 15,000	$ 15,000	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,035,000	$ 310,500	*Vertical construction*
SUBTOTAL				**$ 1,345,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,345,500	$ 269,100	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,345,500	$ 161,500	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,345,500	$ 13,500	*Percentage of total capital*
SUBTOTAL				**$ 444,100**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scales	3	EA	$ 125,000	$ 375,000	*New*
Software	1	EA	$ 25,000	$ 25,000	*Software used for LF, Compost, RRC, etc.*
SUBTOTAL				**$ 400,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Admin/Educational Center Capital Cost**	**TOTAL CAP$**		**$2,878,100**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
ADMIN CAPITAL COST ESTIMATE SUMMARY (1)(2)

Administration & Educational Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Two-Story Building	5,500	SF	$ 250	$ 1,375,000	*Building footprint SF; same size as current*
Access Road & Parking	2,300	SY	$ 45	$ 103,500	*Asphalt 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 137,500	$ 137,500	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,616,000	$ 484,800	*Vertical construction*
SUBTOTAL				**$ 2,100,800**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 2,100,800	$ 420,200	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 2,100,800	$ 336,100	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 2,100,800	$ 21,000	*Percentage of total capital*
SUBTOTAL				**$ 777,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**
None at Admin Center				
SUBTOTAL				**$ -**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/9/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	4	Acres
Location:	Linn County, Iowa			
Worksheet:	**Resource Recovery Center Capital Cost**	**TOTAL CAP$**		**$9,933,900**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
RRC CAPITAL COST ESTIMATE SUMMARY (1)(2)

RRC Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
HHM Canopy - Covered Drive	2,000	SF	$ 25	$ 50,000	*CRLCSWA current size*
HHM Facility	8,000	SF	$ 300	$ 2,400,000	*CRLCSWA current size*
RRC Bldg	6,700	SF	$ 250	$ 1,675,000	*Size for just recyclables transfer*
RRC Office/Breakroom/Restrooms	3,600	SF	$ 200	$ 720,000	*CRLCSWA current size*
Access Road, Parking & Maneuvering	5,600	SY	$ 60	$ 336,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 239,750	$ 239,800	*5% of buildings cost*
Market Variability Factor	30%	Capital $	$ 5,420,800	$ 1,626,200	*Vertical construction*
SUBTOTAL				**$ 7,047,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 7,047,000	$ 1,409,400	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 7,047,000	$ 986,600	*Percentage of total capital*
Permitting (Local & IDNR)	2%	Capital $	$ 7,047,000	$ 140,900	*Percentage of total capital*
SUBTOTAL				**$ 2,536,900**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Baler	0	EA	$ 1,000,000	$ -	*Assumes RRC recyclabes transfer only*
Forklift	1	EA	$ 50,000	$ 50,000	*For HHM Facility*
Skid Loader	0	EA	$ 50,000	$ -	*Existing*
Mid-Size Loader	1	EA	$ 300,000	$ 300,000	*Share w/ Citizen Drop-Off and Bunkers*
Roll-off Containers	0	EA	$ 8,000	$ -	*Existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from Citizen Drop-Off*
Trailers	0	EA	$ 30,000	$ -	*Assume provided by end market*
Trucks	0	EA	$ 115,000	$ -	*Assume provided by end market*
SUBTOTAL				**$ 350,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Sizing for RRC Building

RRC Transfer Sizing	**Year 1**	**Year 50**		
Incoming Recyclables, TPY	4,045	5,943	*Single stream recyclables/drop box handled by CRLCSWA*	
Incoming Recyclables, TPD	16	23	*5 days/week*	
Incoming Recyclables, TPH	2	3	*8 hours/day*	
Number of Unloading Bays	2	2	*Avg 3 tons/veh, 2x peak factor, 15 min unload + 1 extra*	
Recyclables - Floor Storage (CY)	247	363	*126 lbs/CY, 1 day worth*	
Recyclables - Trailer Payload	7	7	*tons/trailer*	*126 lbs/CY*
Area Needed (SF):				
Tipping Floor	3,700	4,400	*Recyclables piled avg 4' high + unloading area*	
Transfer Loadout Area Area	1,200	1,200	*60' x 1 trailer load-out lane*	
Flex Area	1,000	1,100	*20% extra*	
RRC Transfer Building (SF)	**5,900**	**6,700**		

Project:	CRLCSWA Infrastructure Options			
Date:	1/31/2022			
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Maintenance Shop Capital Cost**	**TOTAL CAP$**		**$2,567,500**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
MAINT SHOP CAPITAL COST ESTIMATE SUMMARY (1)(2)

Maintenance Facility Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Maintenance Facility	9,000	SF	$ 150	$ 1,350,000	*CRLCSWA current sizes, LF+Site #3 compost*
Access Road & Maneuvering Area	1,200	SY	$ 45	$ 54,000	*Asphalt 4" over 6" granular base*
Market Variability Factor	30%	Capital $	$ 1,404,000	$ 421,200	*Vertical construction*
SUBTOTAL				**$ 1,825,200**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,825,200	$ 365,000	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,825,200	$ 219,000	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,825,200	$ 18,300	*Percentage of total capital*
SUBTOTAL				**$ 602,300**	

Maintenance Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
5-ton Overhead Crane w/ Hoist	1	EA	$ 40,000	$ 40,000	*Crane vendors $35K w/ $5k installed*
Maint/Repair Equipment	1	EA	$ 100,000	$ 100,000	*Estimate*
SUBTOTAL				**$ 140,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	1/31/2022			
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Citizen Drop-Off Center Capital Cost**	**TOTAL CAP$**		**$238,100**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
DROP-OFF CAPITAL COST ESTIMATE SUMMARY (1)(2)

Citizen Drop-Off Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Materials Bunkers Area	1,700	SY	$ 60	$ 102,000	*Concrete for tires, white goods, scrap metal*
Concrete Bunker Walls	80	CY	$ 600	$ 48,000	*3 bunkers 60'x 35' each*
Bulk Excavation & Structural Fill	0	CY	$ 13	$ -	*Suitable on-site soils; unloading area 4'*
Waste Unloading Area	0	SY	$ 60	$ -	*Current access/maneuvering, Concrete*
Roll-Off Area	0	SY	$ 60	$ -	*7 roll-off bays, Concrete*
Concrete Z-Wall	0	CY	$ 600	$ -	*7 roll-off bays*
Market Variability Factor	15%	Capital $	$ 150,000	$ 22,500	*Sitework, horizontal construction*
SUBTOTAL				**$ 172,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 172,500	$ 34,500	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 172,500	$ 27,600	*Percentage of total capital*
Permitting (Local)	2%	Capital $	$ 172,500	$ 3,500	*Percentage of total capital*
SUBTOTAL				**$ 65,600**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Roll-off Containers	0	EA	$ 8,000	$ -	*1 glass; existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from AD Facility*
Skid Loader	0	EA	$ 50,000	$ -	*Share from RRC*
Mid-Size Loader	0	EA	$ 300,000	$ -	*Share from RRC*
SUBTOTAL				**$ -**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	1/31/2022		
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,631,300**

SCENARIO 7
CRLCSWA AD & COMPOSTING w/ REGIONAL LANDFILL OPTION
OPERATIONS COST ESTIMATE SUMMARY [1]

Scalehouse Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 246,000	
Scalehouse Personnel	3	FTE	$ 82,000	$ 246,000		
Utilities					$ 4,300	
Electricity	6,000	kWh	$ 0.15	$ 900		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 1,000	$ 1,000		*Estimate - small building*
Heating Fuel	1	LS	$ 1,000	$ 1,000		*Estimate 1-2 Therms/SF/year*
Phones	12	months	$ 120	$ 1,400		*Estimate*
Maintenance and Repairs					$ 9,000	
Building	1%	Capital $	$ 150,000	$ 1,500		*Percentage of building capital*
Scales	2%	Capital $	$ 375,000	$ 7,500		*Percentage of scales capital*
Mobile Equipment	0	hours	$ 15	$ -		*None*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 525,000	$ 1,600	$ 1,600	*Percentage of building & scales total capital*
Cash Reserves Bldg/Equip Replacement					$ 31,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Scales	3	EA	$ 8,333	$ 25,000		*Capital divided by 15-yr life*
Scalehouse Building	1	EA	$ 6,000	$ 6,000		*Capital divided by 25-yr life*
SUBTOTAL SCALEHOUSE & SCALES					**$ 293,900**	

Administration & Educational Center Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Agency Labor:					$ 1,583,500	*Estimate 40% from CRLCSWA FY2022 Budget*
Executive Director	1	FTE				
Site Engineer	1	FTE				
Director of Education	1	FTE				
Hazardous Materials Manager	1	FTE				
Operations Foreman	1	FTE				
Admin Personnel	2	FTE				
Utilities					$ 47,500	
Electricity	110,000	kWh	$ 0.15	$ 16,500		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 5,000	$ 5,000		*Estimate - office building*
Natural Gas/Heating Fuel	1	LS	$ 8,000	$ 8,000		*Estimate 1 Therms/SF/year*
Phones	12	months	$ 1,500	$ 18,000		*Estimate*
Maintenance and Repairs					$ 34,500	
Building & Grounds	0.5%	Capital $	$ 2,100,800	$ 10,500		*Percentage of capital*
Mobile Equipment	936	hours	$ 5	$ 4,700		*Assume pick-up trucks maintenance*
Office Equipment	1	LS	$ 19,300	$ 19,300		*CRLCSWA FY2022 Budget*
Agency Purchased Services	1	LS	$ 511,700	$ 511,700	$ 511,700	*CRLCSWA FY2022 Budget*
Agency Supplies & Materials	1	LS	$ 20,900	$ 20,900	$ 20,900	*CRLCSWA FY2022 Budget*
Agency Other Costs	1	LS	$ 46,000	$ 46,000	$ 46,000	*CRLCSWA FY2022 Budget*
Other Operating Costs - Services					$ 222,500	
ECICOG	1	LS	$ 10,000	$ 10,000		*CRLCSWA FY2022 Budget*
Public Education	1	LS	$ 37,500	$ 37,500		*CRLCSWA FY2022 Budget*
Media Advertising	1	LS	$ 125,000	$ 125,000		*CRLCSWA FY2022 Budget*
Comprehensive Planning	1	LS	$ 50,000	$ 50,000		*Annual estimate over period*
Fuel	2,808	gallons	$ 3.50	$ 9,800	$ 9,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 2,100,800	$ 6,300	$ 6,300	*Percentage of capital*
Cash Reserves Bldg/Equip Replacement					$ 55,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Admin Building	1	EA	$ 55,000	$ 55,000		*Capital divided by 25 years*
SUBTOTAL ADMINISTRATION & EDUCATIONAL CENTER					**$ 2,537,700**	

Project:	CRLCSWA Infrastructure Options		
Date:	1/31/2022		
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,631,300**

Resource Recovery Center/HHW Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor					$ 486,300	
Hazardous Materials Manager						*Included w/ Agency Labor in Admin/Ed Center*
RRC Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
HHW Facility Receiving	1.5	FTE	$ 82,000	$ 123,000		
HHW Facility Chemists	2.0	FTE	$ 103,800	$ 207,600		
Utilities					$ 59,600	
Electricity	274,500	kWh	$ 0.15	$ 41,200		*15 kWh/SF, mixed use*
Water & Sewer	1	LS	$ 3,000	$ 3,000		*Estimate*
Natural Gas/Heating Fuel	1	LS	$ 13,000	$ 13,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 200	$ 2,400		*Estimate*
Maintenance and Repairs					$ 43,000	
Building & Grounds	0.5%	Capital $	$ 7,047,000	$ 35,200		*Percentage of capital*
Mobile Equipment	520	hours	$ 15	$ 7,800		*Loader, assume 2 hrs per day*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	1,560	gallons	$ 3.50	$ 5,500	$ 5,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 7,047,000	$ 21,100	$ 21,100	*Percentage of building total capital*
Cash Reserves Bldg/Equip Replacement					$ 243,300	
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Loader	1	EA	$ 42,900	$ 42,900		*Capital cost divided by 7-yr life*
Roll-offs	2	EA	$ 800	$ 1,600		*Capital cost divided by 10-yr life*
RRC/HHW Buildings	1	EA	$ 193,800	$ 193,800		*Capital cost divided by 25-yr life*
Disposal/Management Services					$ 543,600	
HHW Disposal	1	LS	$ 90,000	$ 90,000		*CRLCSWA FY2022 Budget*
Electronics Disposal	1	LS	$ 67,700	$ 67,700		*CRLCSWA FY2022 Budget*
Batteries/Flourescents/Medical Waste	1	LS	$ 13,200	$ 13,200		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 24,900	$ 24,900		*CRLCSWA FY2022 Budget*
Tires	1	LS	$ 48,300	$ 48,300		*CRLCSWA FY2022 Budget*
Recycling Services	1	LS	$ 299,500	$ 299,500		*CRLCSWA FY2022 Budget*
SUBTOTAL RESOURCE RECOVERY CENTER					**$ 1,407,400**	

Maintenance Facility Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 207,600	
Mechanic/Maintenance	2	FTE	$ 103,800	$ 207,600		*Servicing all facilities' mobile equipment*
Utilities					$ 20,000	
Electricity	63,000	kWh	$ 0.15	$ 9,500		*Assume 7 kWh/SF repair shop*
Water & Sewer	1	LS	$ 2,500	$ 2,500		*Estimate*
Heating Fuel	1	LS	$ 7,000	$ 7,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 80	$ 1,000		*Estimate*
Maintenance and Repairs					$ 16,100	
Building & Grounds	0.5%	Capital $	$ 1,825,200	$ 9,100		*Percentage of capital*
Crane/Equipment	5%	Capital $	$ 140,000	$ 7,000		*Percentage of equipment capital*
Mobile Equipment	0	hours	$ 15	$ -		*Included w/ LF, TS, MWP, AD or WTE*
Supplies	1	LS	$ 78,600	$ 78,600	$ 78,600	*FY2022 Budget, Tools & Equipment, Shop*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 1,825,200	$ 5,500	$ 5,500	*Percentage of total capital*
Cash Reserves Bldg/Equip Replacement					$ 58,000	
Overhead Crane	1	EA	$ 4,000	$ 4,000		*Capital over 10-year life*
Maintenance Building	1	EA	$ 54,000	$ 54,000		*Capital over 25-year life*
SUBTOTAL MAINTENANCE FACILITY					**$ 385,800**	

Citizen Drop-Off Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:	Included with Labor for LF, TS, MWP, AD or WTE					*Shared Labor*
Utilities					$ -	
Electricity	0	kWh	$ 0.15	$ -		*Outdoors*
Water & Sewer	0	LS	$ -	$ -		*NA*

Project:	CRLCSWA Infrastructure Options			
Date:	1/31/2022			
Facility:	SCENARIO 7: Anaerobic Digestion w/ Regional Landfill Concept - No Design			
Costs:	2021$			
Location:	Linn County, Iowa	**MATERIAL REV$**		**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**		**$4,631,300**

Heating Fuel	0	LS	$ -	$ -		*NA*
Phones	0	months	$ -	$ -		*NA*
Maintenance and Repairs					$ 2,400	
Paving/Pad Repairs	1%	Capital $	$ 102,000	$ 1,000		*Percentage of pad capital*
Mobile Equipment	96	hours	$ 15	$ 1,400		*Assume 8 hours/month*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	288	gallons	$ 3.50	$ 1,000	$ 1,000	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 102,000	$ 300	$ 300	*Percentage of construction capital*
Cash Reserves Equipment Replacement						
Roll-off Containers	1	EA	$ 800	$ 800	$ 800	*Capital over 10-year life*
Roll-off Truck	0	EA	$ 11,000	$ -	$ -	*Capital over 10-year life*
SUBTOTAL CITIZEN DROP-OFF					**$ 6,500**	

Miscellaneous Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
RRC/HHW Materials					$ 647,900	
Scrap Metal	1	LS	$ 18,000	$ 18,000		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 74,700	$ 74,700		*CRLCSWA FY2022 Budget*
Waste Tires	1	LS	$ 53,900	$ 53,900		*CRLCSWA FY2022 Budget*
Electronic Waste	1	LS	$ 114,300	$ 114,300		*CRLCSWA FY2022 Budget*
HHW	1	LS	$ 57,200	$ 57,200		*CRLCSWA FY2022 Budget*
Commingled Recycling	1	LS	$ 271,400	$ 271,400		*CRLCSWA FY2022 Budget*
Recycling Services Revenue Share	1	LS	$ 58,400	$ 58,400		*CRLCSWA FY2022 Budget*
Other Misc. Revenue	0	LS	$ 29,400	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
SUBTOTAL MISC REVENUES					**$ 647,900**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Table 4 - CRLCSWA Material Handling Projections (In Tons)

Material	Fiscal Year FY2020	FY2030	FY2040	FY2050	FY2038	FY2087
Population	228,600	254,900	276,800	298,900		
Materials Landfilled						
MSW	160,086	178,430	193,760	209,230	190,592	278,007
Disaster Debris	0	2,549	2,768	2,989	2,723	3,972
Special Waste	16,612	20,392	22,144	23,912	21,782	31,772
C&D	25,960	17,843	19,376	20,923	19,059	27,801
Shingles	9,091	2,549	2,768	2,989	2,723	3,972
Subtotal Materials Landfilled	**211,749**	**221,763**	**240,816**	**260,043**	**236,879**	**345,523**
Materials Recycled						
Organics	29,710	35,686	38,752	41,846	38,118	55,601
Single Stream/Drop Box/City	11,872	12,745	13,840	14,945	13,614	19,858
Scrap Metal/White Goods	876	1,098	1,193	1,288	1,173	1,711
Subtotal Materials Recycled	**42,458**	**49,529**	**53,785**	**58,079**	**52,905**	**77,170**
Total Materials	254,207	271,292	294,601	318,122	289,784	422,693
Annual MSW Percent Increase		0.65%	0.83%	0.77%		0.77%

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	Fiscal Year (Tons) FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2087	FY2090
PAPER									
Compostable Paper	9.30%	14,888	16,594	17,735	18,020	19,458		26,054	
High Grade Office Paper	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Magazines/Catalogs	1.10%	1,761	1,963	2,098	2,131	2,302		3,082	
Mixed Recyclable Paper	4.20%	6,724	7,494	8,009	8,138	8,788		11,766	
Newsprint	1.00%	1,601	1,784	1,907	1,938	2,092		2,802	
Non-Recyclable Paper	4.60%	7,364	8,208	8,772	8,913	9,625		12,887	
OCC and Kraft Paper	3.40%	5,443	6,067	6,484	6,588	7,114		9,525	
Aseptic/Gable Top Containers	0.10%	160	178	191	194	209		280	
Subtotal Paper	**24.5%**	**39,221**	**43,715**	**46,720**	**47,471**	**51,261**		**68,637**	
PLASTIC									
#1 PET IA Deposit Beverage Container	0.50%	800	892	953	969	1,046		1,401	
#1 PET Beverage Containter	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
#2 HDPE Containers Natural	0.50%	800	892	953	969	1,046		1,401	
#2 HDPE Containers Colored	0.60%	961	1,071	1,144	1,163	1,255		1,681	
Retail Shopping Bags	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Plastic Film	8.70%	13,927	15,523	16,590	16,857	18,203		24,373	
Other #1 PET Containers	0.30%	480	535	572	581	628		840	
Plastic Containers #3-#7	2.40%	3,842	4,282	4,577	4,650	5,022		6,724	
Other Plastic Containers	0.30%	480	535	572	581	628		840	
Expanded Polystyrene	0.90%	1,441	1,606	1,716	1,744	1,883		2,521	
Other Plastic Products	2.90%	4,642	5,174	5,530	5,619	6,068		8,124	
Subtotal Plastic	**19.1%**	**30,576**	**34,080**	**36,423**	**37,008**	**39,963**		**53,509**	
METAL									
Aluminum Beverage Containers	0.10%	160	178	191	194	209		280	
Aluminum IA Deposit Beverage Containers	0.31%	496	553	591	601	649		868	
Ferrous Food & Beverage Containers	0.80%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Aluminum Containers	0.31%	496	553	591	601	649		868	
Other Ferrous Scrap Metals	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
Other Non-Ferrous Scrap Metals	0.70%	1,121	1,249	1,335	1,356	1,465		1,961	
Subtotal Metal	**3.4%**	**5,475**	**6,102**	**6,522**	**6,627**	**7,156**		**9,581**	
GLASS									
Blue Glass	0.02%	32	36	38	39	42		56	
Brown Glass	0.03%	48	54	57	58	63		84	
Clear Glass	0.89%	1,425	1,588	1,697	1,724	1,862		2,493	
Glass IA Deposit Containers	0.58%	928	1,035	1,106	1,124	1,214		1,625	
Green Glass	0.02%	32	36	38	39	42		56	
Other Mixed Cullet	0.58%	928	1,035	1,106	1,124	1,214		1,625	
Subtotal Glass	**2.1%**	**3,394**	**3,783**	**4,043**	**4,108**	**4,436**		**5,939**	
ORGANICS									
Yard Waste	1.00%	1,601	1,784	1,907	1,938	2,092		2,802	
Food Waste - Loose	15.32%	24,525	27,335	29,214	29,684	32,054		42,919	
Food Waste - Packaged	6.82%	10,918	12,169	13,005	13,214	14,269		19,106	
Textiles and Leather	2.92%	4,675	5,210	5,568	5,658	6,110		8,180	
Diapers	2.92%	4,675	5,210	5,568	5,658	6,110		8,180	
Rubber	2.42%	3,874	4,318	4,615	4,689	5,063		6,780	
Subtotal Organics	**31.4%**	**50,267**	**56,027**	**59,878**	**60,841**	**65,698**		**87,967**	
DURABLE									
Cell Phones & Chargers	0.05%	80	89	95	97	105		140	
Central Processing Units / Peripherals	0.28%	448	500	534	543	586		784	
Computer Monitors / TVs	0.20%	320	357	381	388	418		560	
Electrical and Household Appliances	0.90%	1,441	1,606	1,716	1,744	1,883		2,521	
Subtotal Durable	**1.4%**	**2,289**	**2,552**	**2,727**	**2,771**	**2,992**		**4,006**	
CONSTRUCTION & DEMOLITION									
Wood - Untreated	0.30%	480	535	572	581	628		840	

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2087	FY2090
		Fiscal Year (Tons)							
Wood - Treated	5.50%	8,805	9,814	10,488	10,657	11,508		15,408	
Asphalt Pavement, Brick, Rock, & Concrete	0.04%	64	71	76	78	84		112	
Asphalt Roofing	0.03%	48	54	57	58	63		84	
Drywall/Gypsum Board	0.04%	64	71	76	78	84		112	
Carpet & Carpet Padding	1.30%	2,081	2,320	2,479	2,519	2,720		3,642	
Subtotal C&D	**7.2%**	**11,542**	**12,865**	**13,749**	**13,970**	**15,085**		**20,199**	
HOUSEHOLD HAZARDOUS MATERIALS (HHM)									
Chemicals	0.50%	800	892	953	969	1,046		1,401	
Lead-Acid Batteries	0.05%	80	89	95	97	105		140	
Mercury Containing Products	0.04%	64	71	76	78	84		112	
Lithium Batteries	0.10%	160	178	191	194	209		280	
Other Batteries	0.05%	80	89	95	97	105		140	
Sharps	0.04%	64	71	76	78	84		112	
Prescription Medications	0.04%	64	71	76	78	84		112	
Subtotal HHM	**0.8%**	**1,313**	**1,463**	**1,564**	**1,589**	**1,716**		**2,297**	
OTHER									
Other Organics	4.40%	7,044	7,851	8,391	8,525	9,206		12,327	
Other Inorganics	1.20%	1,921	2,141	2,288	2,325	2,511		3,362	
Other C&D	1.10%	1,761	1,963	2,098	2,131	2,302		3,082	
Other Durables	1.30%	2,081	2,320	2,479	2,519	2,720		3,642	
Other HHM	0.10%	160	178	191	194	209		280	
Fines	1.60%	2,561	2,855	3,051	3,100	3,348		4,482	
Other	0.30%	480	535	572	581	628		840	
Subtotal Other	**10.0%**	**16,009**	**17,843**	**19,069**	**19,376**	**20,923**		**28,015**	
TOTALS - MSW	**100.0%**	**160,086**	**178,430**	**190,694**	**193,760**	**209,230**	**263,453**	**280,150**	**284,488**
						0.77%			
		160,086	178,430	190,694	193,760	209,230	Check	280,150	

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**OTHER SROI INPUTS**

SCENARIO 8
CRLCSWA WTE w/ REGIONAL LANDFILL OPTION
OTHER SROI INPUTS (2021$)

Timing of Capital Costs

SCENARIO 5 CAMPUS	2022	2023	2024	2025	2026	2027
Land Acquisition/Legal/Env	0%	0%	5%	10%	10%	10%
WTE Facility	0%	0%	0%	0%	0%	0%
Transfer Station	0%	0%	0%	0%	0%	0%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 3 CAMPUS	2028	2029	2030	2031	2032	2033
Land Acquisition/Legal/Env	15%	50%	0%	0%	0%	0%
WTE Facility	0%	0%	1%	3%	5%	10%
Transfer Station	0%	0%	0%	0%	1%	1%
Compost Facility	0%	0%	0%	0%	0%	0%
Scalehouse	0%	0%	0%	0%	0%	0%
Admin/Educational Center	0%	0%	0%	0%	0%	0%
RRC/HHW	0%	0%	0%	0%	0%	0%
Maintenance Shop	0%	0%	0%	0%	0%	0%
Citizen Drop-Off	0%	0%	0%	0%	0%	0%

SCENARIO 3 CAMPUS	2034	2035	2036	2037	2038	2039
WTE Facility	15%	20%	25%	20%	1%	0%
Transfer Station	2%	6%	40%	45%	5%	0%
Compost Facility	5%	10%	40%	30%	15%	0%
Scalehouse	0%	5%	45%	50%	0%	0%
Admin/Educational Center	0%	5%	30%	55%	10%	0%
RRC/HHW	5%	10%	30%	50%	5%	0%
Maintenance Shop	0%	5%	30%	55%	10%	0%
Citizen Drop-Off	0%	5%	60%	30%	5%	0%

Travel Distances

WTE ash to Regional Landfill

Ash Trailers =	20	tons per load
One-way Distance =	115	miles
Average Speed =	65	mph
Ash Generation, Year 2038 =	106,141	tons ash
Calculated # Loads in Year 2038 =	5307	loads

TS Haul: Rejects & Non-Processed Waste to on-site Transfer Station.

TS Trailer Payload =	20	tons per load

One-way Distance =	115	miles	Need to go further out to find landfill(s) with capacity
Average Speed =	65	mph	
Transferred Waste, Year 2038 =	35,534	tons waste	
Calculated # Loads in Year 2038 =	1777	trailer loads	

Recovered Materials to Markets Assumptions:
1. Ferrous & Non-Ferrous Metals to local scrap dealers in Cedar Rapids, Iowa.
2. Compost to local markets.

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**SUMMARY**

SCENARIO 8
CRLCSWA WTE w/ REGIONAL LANDFILL OPTION
SUMMARY (2021$)

Facility	Minimum Land Required (Acres)	Land Purchase (Acres)	Liner / Pad Areas (Acres)	Building Size (SF)	Year 1, TPY	Year 50, TPY
WTE Facility	20	---	---	99,100	435,592	583,007
Transfer Station	10	---	---	6,200	35,534	54,144
Compost Facility	30	---	21	---	38,118	55,601
Scalehouse	10	---	---	600	---	---
Admin/Educational Center	2	---	---	5,500	---	---
RRC/HHW	4	---	---	18,300	4,045	5,943
Maintenance Shop	2	---	---	9,000	---	---
Citizen Drop-Off	2	---	0.4	---	1,173	1,711
TOTAL	**80**	**80**	**---**	**138,700**	**---**	**---**

	Year 1, TPY	Year 50, TPY
Diversion Tonnages		
Organics-YW/Misc. Food	38,118	55,601
Single Stream/OCC/Glass	4,045	5,943
Scrap Metal/White Goods	1,173	1,711
WTE - Ferrous Metals	8,491	11,292
WTE - NonFerrous Metals	1,061	1,412
Diversion Subtotal	**52,889**	**75,959**
WTE Volume Reduction	**308,869**	**410,751**
Landfill Tonnages	**163,457**	**227,068**
% Diversion/Reduction from LF	**69%**	**68%**

	Full Build-Out	Year 1 O&M$			Year 1 Revenues $		
Facility	Total Facilities Capital $	O&M $	O&M - Haul$	Disposal in Regional LF$	Other Revenues$	Energy/ Materials Revenues$	Other WTE Tip Fee Rev$
WTE Facility	$816,752,000	$29,549,100	---	---	$335,700	$26,303,300	$16,135,000
Transfer Station	$5,239,600	$473,300	$3,351,700	$5,383,700	$0	$0	$0
Compost Facility	$9,052,700	$1,171,200	---	---	$0	$1,091,100	$0
Scalehouse	$2,189,600	$293,900	---	---	$0	$0	$0
Admin/Educational Center	$2,878,100	$2,537,700	---	---	$0	$0	$0
RRC/HHW	$9,933,900	$1,407,400	---	---	$0	$647,900	$0
Maintenance Shop	$2,567,500	$385,800	---	---	$0	$0	$0
Citizen Drop-Off	$238,100	$6,500	---	---	$0	$0	$0
	$848,851,500	**$35,824,900**	**$3,351,700**	**$5,383,700**	**$335,700**	**$28,042,300**	**$16,135,000**

SCENARIO 8 CAMPUS	Quantity	Unit	Unit Price	Total	
Land Acquisition - Purchase	80	Acres	$25,000	$2,000,000	*3 Qtr Sections*
Land Acquisition - Legal/Support	25%	LS	$2,000,000	$500,000	*% Land Purchase*
Social Justice/Env Impact/Legal	2	RS	$7,000,000	$14,000,000	*Risk Factor*
SUBTOTAL				**$16,500,000**	
Facilities Capital				$658,960,100	
Contingency, Permitting, Eng/Construction Observation/CQA				$186,059,400	
Equipment/Mobile Equipment				$3,832,000	
SUBTOTAL				**$848,851,500**	
Estimated Financing Costs - All Other Facilities				$398,541,000	*20 yrs, 4% APR*
SUBTOTAL				**$398,541,000**	
TOTAL CAPITAL$				**$1,263,892,500**	

SCENARIO 8 TIPPING FEE ESTIMATE (2021$)

	Capital$[1]	Annual O&M$[2]	Annual Haul$[2]	Disposal in Regional LF$	Total - Gross
Total Costs - Facilities	$848,851,500	$35,824,900	$3,351,700	$5,383,700	

Total Costs - Financing	$398,541,000	---	---	---	
Total Costs-Land/Legal/Env Impact	$16,500,000	---	---	---	
CRLCSWA MSW & Transfer Tons	*13,076,000*	*215,100*	*215,100*	*215,100*	
$/Ton	**$96.66**	**$166.55**	**$15.58**	**$25.03**	**$278.79**

	Annual Other Revenues[3]	Annual Mat'l/ Energy Revenues[4]	Other Tip Fee Revenues[5]	Total - Revenues Before CRLCSWA
Revenues	$335,700	$28,042,300	$16,135,000	
CRLCSWA MSW & Transfer Tons	*215,100*	*215,100*	*215,100*	
	$1.56	**$130.37**	**$75.01**	**$206.94**

ESTIMATED NET TIP FEE	**$71.85**
Rounded ESTIMATED NET TIP FEE	**$72.00**

Notes:

1. Capital costs include full build out of facilities for 50-year period divided by projected processed & landfilles tons Year 2038-2087.
   Financing costs assume constant annual 4% interest rate on Facilities Capital plus Contingency, Permitting, Engineering & Construction Observation/CQA.
   Land acquisition costs including social justice, environmental impacts and legal.
2. Annual O&M costs include replacement reserves for equipment and rehab/rebuild of buildings over 50-year period. Divided by Year 2038 processed & landfilled tons.
3. Other Revenues obtained from CRLCSWA FY2022 budget including grants, investments, non-cash adjustments, other misc. revenues.
   Divided by Year 2038 processed & landfilled tons.
4. Annual Material/Energy Revenues includes recycled materials revenues through RRC (from FY2022 budget), composting tip fees at $24/ton, compost sales at $24/ton, WTE energy & recovered metals revenues. Divided by Year 2038 processed & landfilled tons.
5. WTE Tip Fee Revenues from non-CRLCSWA waste (i.e. MSW from other Iowa communities & RDF sources).

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**WTE Sizing**

SCENARIO 8
CRLCSWA WTE w/ REGIONAL LANDFILL OPTION
SIZING WTE FACILITY

Waste Flow (Tons)	**Year 1 FY2038**	**Year 25 FY2062**	**Year 50 FY2087**		
Waste thru WTE Facility					
CRLCSWA MSW	190,592	229,433	278,007		
Ames RDF	15,000	15,000	15,000		*Estimate to WTE*
Minnesota RDF	200,000	200,000	200,000		*Estimate to WTE*
MSW - Other Iowa Communities	30,000	60,000	90,000		*Assumed*
CRLC Industrial Customers	0	0	0		*Assumed*
Disaster Debris	0	0	0	0%	*Estimate to WTE*
C&D	0	0	0	0%	*Estimate to WTE*
Shingles	0	0	0	0%	*Estimate to WTE*
Incoming Waste to WTE, TPY	435,592	504,433	583,007		
Incoming Waste, TPD	1,472	1,704	1,970	296	*days/year*
Incoming Waste, TPH	164	189	219	9	*hours/day*
Initial Rejects	11,030	14,472	18,400	5%	*of CRLCSWA MSW & Iowa MSW Incoming*
Processed Waste, TPY	424,563	489,961	564,606		
Processed Waste, TPD	**1290**	**1490**	**1720**	329	*days/year, 90% WTE availability*
Processed Waste, TPH	54	62	72	24	*hours/day*
Ferrous Metals Recovery	8,491	9,799	11,292	2.0%	*of Processed Waste*
Non-Ferrous Metals Recovery	1,061	1,225	1,412	0.25%	*of Processed Waste*
Diversion - Metals, TPY	9,553	11,024	12,704		*Recovered from the ash*
WTE Ash Residue	106,141	122,490	141,152	25%	*of Processed Waste, remaining after metals recovery*
Waste to Transfer Station					
CRLCSWA Direct to Transfer Station:					
Disaster Debris	2,723	3,278	3,972		*From hauler*
C&D Waste	19,059	22,943	27,801		*From hauler*
Shingles	2,723	3,278	3,972		*From hauler*
From WTE Facility:					
Initial Rejects	11,030	14,472	18,400		
Transfer Station Waste, TPY	35,534	43,970	54,144		
Transfer Station Waste, TPD	**130**	**150**	**190**	296	*days/year*
Transfer Station Waste, TPH	14	17	21	9	*hours/day*
Waste to Landfill					
Direct to Regional Landfill:					
Special Waste	21,782	26,423	31,772		*Hauled to LF directly by hauler*
From Ash Management Bldg:	106,141	122,490	141,152		*Load ash into trailers at Ash Management Bldg*
From Transfer Station:	35,534	43,970	54,144		*Transfer haul*
Landfilled Waste	163,457	192,884	227,068		
% of Scenario 1 Landfilled	69.0%		65.7%		

Bldg Sizing	**Year 1 FY2038**	**Year 25 FY2062**	**Year 50 FY2087**	
Sizing Assumptions				
Unloading Bays - MSW	10	13	16	*Avg 3 tons/veh, peak factor 2.0, 10 min unload*

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**WTE Sizing**

Unloading Bays - RDF	2	2	2		*Avg 20 tons/veh, peak factor 2.0, 10 min unload*
Minimum Width (ft)	240	300	360		*20 ft per unloading bay*
Interior Maneuvering (ft)	100	100	100		*maneuvering & unloading*
Waste Storage in Pit (CY)	28,687	33,105	38,149	500	*lbs/CY and 5 day waste*
WTE Combustion/APC Units	1.8	2.1	2.5		*at 700 TPD units*
WTE Constrution Size (TPD)	1,400	1,400	1,400		
Estimated Square Feet					
Tipping Floor	24,000	30,000	36,000		*Maneuvering + unloading area*
Waste Storage Pit	19,400	22,300	25,800		*40 ft deep*
WTE Combustion/APC Units	30,000	30,000	45,000	2	*units at 15,000 SF per unit, 3 units Year 50*
Turbine Generator Room	12,000	12,000	12,000		*Estimate 200' x 60'*
WTE SF	**85,400**	**94,300**	**118,800**		
Ash Management Building	4,800	4,800	4,800		*Estimate 80'x60' size for Scenario 8*
Estimate WTE Land Requirements (Acres)					
Buildings	2.1	2.3	2.8		
Surrounding Area	16.2	16.6	17.6	300	*ft buffer area*
Entrance Area	0.0	0.0	0.0		*Included w/ scalehouse*
Land (Acres)	18.3	18.9	20.5		

Energy Production	**Year 1 FY2038**	**Year 25 FY2062**	**Year 50 FY2087**		
Net kWh Generation	275,965,829	318,474,834	366,994,161	650	*kWh/ton net for larger units*
Parasitic Load (kW)	3770	4350	5013	70	*kWh/ton net*

WTE Transfer Station Sizing	**Year 1 FY2038**	**Year 25 FY2062**	**Year 50 FY2088**		
Sizing Assumptions					
Unloading Bays	3	3	4		*Avg 3 tons/veh, peak factor 2.0, 15 min unload*
Minimum Width (ft)	60	60	80		*20 ft per unloading bay*
Waste Storage on Tip Floor (CY)	480	594	732	500	*lbs/CY and 1 day waste*
Estimated Square Feet					
Tipping Floor	4,620	5,010	6,470		*Waste piled avg 8' high + unloading area*
Transfer Loadout Area	1,200	1,200	1,200		*60' x 1 trailer load-out lane*
WTE TS Building (SF)	**5,820**	**6,210**	**7,670**		
Estimate WTE TS Land Requirements (Acres)					
Buildings	0.1	0.1	0.2		
Surrounding Area	10.4	10.4	10.7	300	*ft buffer area*
Entrance Area	0.0	0.0	0.0		*Included w/ scalehouse*
Land (Acres)	10.5	10.6	10.9		

Tonnage Projections-Total Processed or Transferred/Landfilled

Year	CRLCSWA Projections		Annual % Increase
2020	-	tons	0.46%
2030	221,763	tons	0.83%
2040	240,816	tons	0.77%
2050	260,043	tons	

YR	Calculate Annual Tonnage Processed/Transferred	Tons per Year	TPD	*CRLCSWA Only TPY*

Project:	CRLCSWA Infrastructure Options
Date:	2/28/2022
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**WTE Sizing**

1	2038	460,097	1554	215,097
2	2039	461,877	1560	216,877
3	2040	463,672	1566	218,672
4	2041	465,359	1572	220,359
5	2042	467,058	1578	222,058
6	2043	468,770	1584	223,770
7	2044	470,496	1590	225,496
8	2045	472,234	1595	227,234
9	2046	473,986	1601	228,986
10	2047	475,752	1607	230,752
11	2048	477,532	1613	232,532
12	2049	479,325	1619	234,325
13	2050	481,131	1625	236,131
14	2051	482,952	1632	237,952
15	2052	484,787	1638	239,787
16	2053	486,636	1644	241,636
17	2054	488,499	1650	243,499
18	2055	490,377	1657	245,377
19	2056	492,269	1663	247,269
20	2057	494,176	1670	249,176
21	2058	496,097	1676	251,097
22	2059	498,033	1683	253,033
23	2060	499,984	1689	254,984
24	2061	501,951	1696	256,951
25	2062	533,932	1804	258,931
26	2063	535,929	1811	260,928
27	2064	537,941	1817	262,940
28	2065	539,968	1824	264,968
29	2066	542,011	1831	267,011
30	2067	544,070	1838	269,070
31	2068	546,145	1845	271,144
32	2069	548,236	1852	273,235
33	2070	550,343	1859	275,342
34	2071	552,466	1866	277,465
35	2072	554,605	1874	279,605
36	2073	556,761	1881	281,761
37	2074	558,934	1888	283,933
38	2075	561,123	1896	286,123
39	2076	563,330	1903	288,329
40	2077	565,553	1911	290,552
41	2078	567,793	1918	292,793
42	2079	570,051	1926	295,051
43	2080	572,326	1934	297,326
44	2081	574,619	1941	299,618
45	2082	576,929	1949	301,929
46	2083	579,257	1957	304,257
47	2084	581,604	1965	306,603
48	2085	583,968	1973	308,967
49	2086	586,350	1981	311,350
50	2087	618,751	2090	313,750
	2088			
TOTAL ESTIMATED FOR POTENTIAL PROCESSED/LF		**26,136,046**	**tons**	**13,076,033**

Project:	CRLCSWA Infrastructure Options			
Date:	2/9/2022			
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design			
Costs:	2021$	WTE Size:	1400 TPD	
Location:	Linn County, Iowa	Required Land:	20 Acres	
Worksheet:	**WTE Capital Cost**	**TOTAL CAP$**		**$816,752,000**

SCENARIO 8
CRLCSWA WTE w/ REGIONAL LANDFILL OPTION
WTE CAPITAL COST ESTIMATE SUMMARY (1)(2)

MWP-RDF Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
WTE Facility	1,400	TPD	$ 350,000	$ 490,000,000	*Includes sitework, utilities, equipment*
Market Variability Factor	30%	Capital $	$ 490,000,000	$ 147,000,000	*Vertical construction*
SUBTOTAL WTE CONSTRUCTION				**$ 637,000,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	LS	$ 637,000,000	$ 127,400,000	
Eng., Design, Constr. Mgmt, Commissioning	0%	LS	$ 637,000,000	$ -	*Vendor's Cost, Included in WTE facility*
Permitting (Local & IDNR)	3%	LS	$ 637,000,000	$ 19,110,000	*Owner's Costs*
Procurement, Review & Construction Monitoring	5%	LS	$ 637,000,000	$ 31,850,000	*Owner's Costs*
SUBTOTAL WTE SOFT COSTS				**$ 178,360,000**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Loader	3	EA	$ 400,000	$ 1,200,000	
Skid Loader	1	EA	$ 50,000	$ 50,000	
Roll-Off Truck	1	EA	$ 110,000	$ 110,000	
Roll-Off Containers	4	EA	$ 8,000	$ 32,000	*Rejects & Metals Recovery*
Dump Truck	0	EA	$ 200,000	$ -	*Scenario 8 ash loaded into transfer trailers*
Forklift	0	EA	$ 50,000	$ -	
Yard Tractor	0	EA	$ 100,000	$ -	
Pick-up Truck	0	EA	$ 40,000	$ -	*Existing*
SUBTOTAL				**$ 1,392,000**	

ASSUMPTIONS:

1. No sales tax is included. Assumed facility is tax exempt.
2. Costs rounded to nearest thousand.
3. Does not include financing costs.
4. Assumed project to be competitively bid under one general contract.
5. Assumed construction to be during normal working hours.
6. The construction costs are used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Project:	CRLCSWA Infrastructure Options		
Date:	2/28/2022	**TIP FEE REV$**	**$16,135,000**
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design	**ENERGY REV$**	**$8,279,000**
Costs:	2021$ WTE Size: 1400 TPD	**MAT'L REV$**	**$1,889,300**
Location:	Linn County, Iowa	**OTHER REVENUES$**	**$335,700**
Worksheet:	**WTE O&M Costs**	**ANNUAL WTE O&M$**	**$29,549,100**

SCENARIO 8
CRLCSWA WTE w/ REGIONAL LANDFILL OPTION
WTE OPERATIONS COST ESTIMATE SUMMARY [1]

WTE Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 3,484,000	*FY2021 fully-burdened salary, escalated*
Scalehouse	0	FTE	$ 82,000	$ -		*Included w/ Scalehouse operations*
Loader Operator	3	FTE	$ 103,800	$ 311,400		*Tipping Floor, 6 days/wk*
Crane Operator	6	FTE	$ 103,800	$ 622,800		*1.5 per shift x 3 shifts/day x 7 days/wk*
Power Block Personnel	16	FTE	$ 114,400	$ 1,830,400		*4 per shift x 3 shifts/day x 7 days/wk*
Ash Management	2	FTE	$ 100,200	$ 200,400		*1 per shift x 2 shifts/day x 5 days/wk*
Maintenance/Mechanics	5	FTE	$ 103,800	$ 519,000		*2 per shift x 2 shifts/day x 7 days/wk*
Transfer Drivers - See Haul Costs						*Included in haul costs per ton*
Utilities					$ 157,400	
Electricity	429,000	kWh	$ 0.15	$ 64,400		*13% parasitic load during downtimes*
Water & Sewer	1	LS	$ 30,000	$ 30,000		*Estimate*
Natural Gas	1	LS	$ 50,000	$ 50,000		*Estimate - start ups*
Phones	12	months	$ 1,080	$ 13,000		*Estimate based on FTE*
Maintenance and Repairs					$ 4,973,500	
Building	1%	Capital $	$ 98,000,000	$ 980,000		*Bldg capital 20% of construction capital*
Power Block Equipment	1%	Capital $	$ 392,000,000	$ 3,920,000		*Equip capital 80% of construction capital*
Mobile Equipment	4,900	hours	$ 15	$ 73,500		*Avg equip operating hours (loaders, ash dump truck); not include transfer*
Consumables	1	LS	$ 200,000	$ 200,000	$ 200,000	*Estimate*
Supplies	0	LS	$ -	$ -	$ -	*Included w/ Power Block Equipment Estimate*
Fuel	14,700	gallons	$ 3.50	$ 51,500	$ 51,500	*Assume 3 gallons per hour operating*
Professional Services & Eng	1	LS	$ 200,000	$ 200,000	$ 200,000	*Estimate*
WTE Insurance	0.1%	Capital $	$ 637,000,000	$ 637,000	$ 637,000	*Percentage of WTE total capital*
Administration - Agency Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL WTE DIRECT OPERATIONS					**$ 9,703,400**	

WTE Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Mobile Equipment Replacement					$ 207,700	
Loaders	3	EA	$ 57,143	$ 171,400		*Capital cost divided by 7-yr life*
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Roll-Off Truck	1	EA	$ 11,000	$ 11,000		*Capital cost divided by 10-yr life*
Roll-Off Containers	4	EA	$ 800	$ 3,200		*Capital cost divided by 10-yr life*
Dump Truck	0	EA	$ 20,000	$ -		*Capital cost divided by 10-yr life*
Forklift	0	EA	$ 5,000	$ -		*Capital cost divided by 10-yr life*
Yard Tractor	0	EA	$ 10,000	$ -		*Capital cost divided by 10-yr life*
Pickup Truck	3	EA	$ 5,714	$ 17,100		
WTE Rehab/Replacement	1	EA	$ 19,600,000	$ 19,600,000	$ 19,600,000	*Capital cost divided by 25-yr life*
Operating Cash Reserve	1	LS	$ 38,000	$ 38,000	$ 38,000	*CRLCSWA FY2021 Budget, rounded*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*Estimate from Agency, NA if compost w/ MWP*
SUBTOTAL CASH RESERVES					**$ 19,845,700**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Costs/Rev**	**Total**	
Grants/Investments/ Other	1	LS	$ 281,300	$ 281,300	$ 281,300	*CRLCSWA FY2022 Budget*
Non-Cash Adjustments	1	LS	$ 25,000	$ 25,000	$ 25,000	*CRLCSWA FY2022 Budget*
Other Misc. Revenue	1	LS	$ 29,400	$ 29,400	$ 29,400	*CRLCSWA FY2022 Budget*
RDF Tonnage Revenues	215,000	Tons	$ 65	$ 13,975,000	$ 13,975,000	*Tip Fee Revenues*
Iowa MSW Tonnage Revenue	30,000	Tons	$ 72	$ 2,160,000	$ 2,160,000	*Tip Fee Revenues*
Ferrous Revenues	8,491	Tons	$ 140	$ 1,188,776	$ 1,188,800	*Source: Price of Scrap Metals.com Iowa*
Non-Ferrous Revenues	1,061	Tons	$ 660	$ 700,529	$ 700,500	*Source: Price of Scrap Metals.com Iowa*
Energy Revenues	275,965,829	kWh	$ 0.03	$ 8,278,975	$ 8,279,000	*Approx. wholesale price*
SUBTOTAL OTHER REVENUES					**$ 26,639,000**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 365 days.
   No Shifts = 3 8 hours per shift
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options			
Date:	1/28/2022			
Facility:	SCENARIO 8: WTE Concept w/ Regional Landfill - No Design			
Costs:	2021$	TS Size:	150 TPD	
Location:	Linn County, Iowa	Required Land:	10 Acres	
Worksheet:	**WTE Transfer Station Capital Cost**	**TOTAL CAP$**		**$5,239,600**

SCENARIO 8
CRLCSWA WTE w/ REGIONAL LANDFILL OPTION
WTE TS CAPITAL COST ESTIMATE SUMMARY (1)(2)

Transfer Station Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Transfer Station Building	6,200	SF	$ 300	$ 1,860,000	*Bldg, foundations, floors, concrete walls, etc.*
Site Investigations	1	LS	$ 100,000	$ 100,000	*Geotech in area of TS*
Site Work					
Mobilization/Demob	1	LS	$ 100,000	$ 100,000	*Assume portion to TS*
Clear & Grub	5	Acres	$ 2,000	$ 10,000	*Assume no demolition; half of required land*
Bulk Excavation/Quantities	3,200	CY	$ 3	$ 9,600	*Adequate quantity & quality of soils on-site*
Structural Fill	3,200	CY	$ 10	$ 32,000	*Assume 100% of bulk excavation quantities*
Roadways	4,000	SY	$ 45	$ 180,000	*4" asphalt over 6" granular base, 1000LF*
Manuevering Pad	170	CY	$ 600	$ 102,000	*9" reinforced concrete slab on grade*
Stormwater Pond	-	LS	$ 200,000	$ -	*Assume included w/ WTE*
Site Drainage/Erosion Control	-	EA	$ 50,000	$ -	*Assume included w/ WTE*
Site Utilities					
Electrical - Service to Facility	1	LS	$ 100,000	$ 100,000	*Extended to TS*
Water Supply & Fire Protection	1	LS	$ 50,000	$ 50,000	*Extended to TS*
Sanitary Sewer	1	EA	$ 50,000	$ 50,000	*Extended to TS*
Natural Gas System	-	LS	$ -	$ -	*Assume included w/ WTE*
Surveying	1	EA	$ 25,000	$ 25,000	
Screening, Landscaping, Signage	1	EA	$ 60,000	$ 60,000	*Allowance*
Fencing	-	LF	$ 35	$ -	*Included in WTE*
Market Variability Factor	30%	Capital $	$ 2,678,600	$ 803,600	*Vertical construction*
SUBTOTAL TRANSFER STATION				**$ 3,482,200**	

Soft Costs	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	LS	$ 3,482,200	$ 696,400	
Eng., Design, Constr. Admin & CQA	16%	LS	$ 3,482,200	$ 557,000	*Percentage of TS total capital*
Permitting (Local & IDNR)	3%	LS	$ 3,482,200	$ 104,000	*Percentage of TS total capital*
SUBTOTAL TS SOFT COSTS				**$ 1,357,400**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Loader	1	EA	$ 400,000	$ 400,000	
Yard Tractor	0	EA	$ 100,000	$ -	
Transfer Trucks & Trailers - See Haul Costs					*Included in haul cost per ton*
SUBTOTAL				**$ 400,000**	

ASSUMPTIONS:

1. No sales tax is included. Assumed facility is tax exempt.
2. Costs rounded to nearest thousand.
3. Does not include financing costs.
4. Assumed project to be competitively bid under one general contract.
5. Assumed construction to be during normal working hours.
6. The construction costs are used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Project:	CRLCSWA Infrastructure Options		
Date:	1/28/2022		
Facility:	SCENARIO 8: WTE Concept w/ Regional Landfill - No Design		
Costs:	2021$ TS Size: 150 TPD		
Location:	Linn County, Iowa		
Worksheet:	**WTE Transfer Station O&M Costs**	**ANNUAL WTE TS O&M$**	**$473,300**

SCENARIO 8
CRLCSWA WTE w/ REGIONAL LF OPTION
WTE TS OPERATIONS COST ESTIMATE SUMMARY (1)

TS Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 207,600	*FY2021 fully-burdened salary, escalated*
Scalehouse	0	FTE	$ 82,000	$ -		*Included w/ Scalehouse operations*
TS Loader Operators	2	FTE	$ 103,800	$ 207,600		
TS Roll-off Operator /Misc. Equipment	0	FTE	$ 100,200	$ -		*Included in WTE costs*
TS Transfer Drivers - See Haul Costs						*See TS Haul$*
TS Utilities					$ 9,500	
Electricity	43,400	kWh	$ 0.15	$ 6,500		*7 kWh/SF estimate avg warehouse/office*
Water & Sewer	1	LS	$ 1,000	$ 1,000		*Estimate*
Heating Fuel	1	LS	$ 1,000	$ 1,000		*Estimate*
Phones	12	months	$ 80	$ 1,000		*Estimate*
Maintenance and Repairs					$ 76,800	
Building & Grounds	1%	Capital $	$ 3,482,200	$ 34,800		*Percentage of TS total capital*
Mobile Equipment	2,800	hours	$ 15	$ 42,000		*Avg equip operating hours, 6 days/wk, 9 hrs/day (1 loader); not include trucks, trailers*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	8,400	gallons	$ 3.50	$ 29,400	$ 29,400	*Assume 3 gallons per hour operating*
Professional Services & Eng.	1	LS	$ 10,000	$ 10,000	$ 10,000	*Estimate-inspection, permitting, legal*
TS Insurance	0.1%	Capital $	$ 3,482,200	$ 3,500	$ 3,500	*Percentage of TS total capital*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL TS DIRECT OPERATIONS					**$ 341,800**	

TS Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 57,100	
Loaders	1	EA	$ 57,100	$ 57,100		*Capital cost divided by 7-yr life*
Yard Tractor	0	EA	$ 10,000	$ -		*Capital cost divided by 10-yr life*
Trucks & Trailers - See Haul Costs						*Included in haul costs per ton*
TS Rehab/Replacement	1	EA	$ 74,400	$ 74,400	$ 74,400	*Capital cost divided by 25-yr life*
Operating Cash Reserve	0	LS	$ -	$ -	$ -	*Included in WTE costs*
Site #3 Other Developments	0	LS	$ -	$ -	$ -	*NA if no Site #3 composting*
SUBTOTAL TS CASH RESERVES					**$ 131,500**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.5 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options		
Date:	1/28/2022		
Facility:	SCENARIO 8: WTE Concept w/ Regional Landfill - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**LF DISPOSAL$**	**$5,383,700**
Worksheet:	**WTE Transfer Station Haul Costs**	**ANNUAL HAUL$**	**$3,351,700**

SCENARIO 8

CRLCSWA WTE w/ REGIONAL LF OPTION

WTE TS & ASH HAUL COST ESTIMATE SUMMARY

	30-Mile Radius	80-Mile Radius	115-Mile Radius	*Comments*
Number of Trailer Loads	7,084	7,084	7,084	*Assumes average 20 ton payload*
Tonnage (tpy):	**141,675**	**141,675**	**141,675**	*Year 1, TS Waste + Ash*
Load & Unload Time (minutes):	30	30	30	*Estimate*
One-Way Distance (miles)	**30**	**80**	**115**	
Average Speed (mph):	50	60	65	*From route mapping in area*
Average Trips/Year:	7,084	7,084	7,084	
Average Trips/Month:	591	591	591	
Average Trips/Week:	137	137	137	
Hours Per Trip	1.7	3.2	4.0	
Weekly Freight Hours:	233	434	553	
Wkly Prorated Veh Inspect/Breaks:	6.0	6.0	6.0	*1 hour per day*
Annual Freight Hours:	12,111	22,559	28,770	*Freight hours only for vehicle fuel, oil & grease cost*
Total Miles/Yr	425,040	1,133,440	1,629,320	

Annual Costs Assumptions:				
Driver Labor				
Drivers (based on total time)	6	11	14	
Driver annual salary	$60,400	$60,400	$60,400	*Bureau of Labor Statistics-CR, Iowa, heavy truck driver*
Fringe benefits (% of salary)	35%	35%	35%	*Included in annual salary*
Fuel, Oil & Grease				
Fuel Cost per Gallon	$3.50	$3.50	$3.50	*Diesel Fuel 2021-US EIA, Mid-West average*
Miles per Gallon	6.5	6.5	6.5	*North American Council for Freight Efficiency*
Oil & Grease ($/freight hour)	$0.50	$0.50	$0.50	*Estimate*
Tires				
New Tires Price	$425	$425	$425	*Estimate*
# New Tires Per 50,000 Miles	18	18	18	*6 tires on tractor & 12 tires on trailers*
Maintenance & Repairs				
Mechanic Labor annual salary	$78,700	$78,700	$78,700	*Bureau of Labor Statistics-CR, Iowa, heavy equip mech*
Mechanic Labor % per Truck	2%	2%	2%	
Parts, Repairs, Overhaul ($/mile)	$0.25	$0.25	$0.25	
Truck Amortization				
Number of Tractors	6	11	14	*Update based on loads/day*
Capital Cost - per semi-truck	$115,000	$115,000	$115,000	*New truck price based on historic vendor/project data*
Resale Value (% of truck $)	30%	30%	30%	*Used trucks good condition $25K to $40K*
Replacement Schedule (years)	7	7	7	
Interest Rate	4%	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	0.1666	
Trailer Amortization				
Number of Trailers	7	12	15	*Includes spares at 10%*
Capital Cost -- per trailer	$70,000	$70,000	$70,000	*Walking floor - new*
Resale Value (% of purchase $)	15%	15%	15%	*Used trailers good condition $7K to $10K*
Replacement Schedule (years)	7	7	7	
Interest Rate	4%	4%	4%	
Capital Recovery Factor (A/P,i,n)	0.1666	0.1666	0.1666	
Insurance, License & Taxes (per yr/truck) @ 2.5% $ Capital Cost	$2,900	$2,900	$2,900	*Estimate % of capital cost of truck*
Overhead & Profit - Contract Haul @ % of O&M	20%	20%	20%	*Contingency or OHP on contract haul*

Annual Haul Cost to Disposal:	**30-Mile Radius**	**80-Mile Radius**	**115-Mile Radius**	**Comments**
Driver Labor	$362,400	$664,400	$845,600	Time Based
Fuel, Oil & Grease	$234,900	$621,600	$891,700	Mileage & Time Based
Tires	$65,000	$173,400	$249,300	Mileage Based
Maintenance & Repairs	$115,700	$300,700	$429,400	Mileage & Time Based
Truck Amortization	$80,500	$147,500	$187,800	100% Utilized

Project:	CRLCSWA Infrastructure Options
Date:	1/28/2022
Facility:	SCENARIO 8: WTE Concept w/ Regional Landfill - No Design
Costs:	2021$

Location:	Linn County, Iowa		**LF DISPOSAL$**	**$5,383,700**
Worksheet:	**WTE Transfer Station Haul Costs**		**ANNUAL HAUL$**	**$3,351,700**

Trailer Amortization	$69,400	$119,000	$148,700	100% Utilized
Insurance, Licensing & Taxes	$17,400	$31,900	$40,600	No. trucks
Overhead & Profit	$189,100	$411,700	$558,600	
MSW Haul Cost to Landfill	**$1,134,400**	**$2,470,200**	**$3,351,700**	
Total Haul Cost/Ton	**$8.01**	**$17.44**	**$23.66**	

Transfer Trucks Capital Cost	$690,000	$1,265,000
Transfer Trailers Capital Cost	$490,000	$840,000
Total Truck/Trailers Capital	**$1,180,000**	**$2,105,000**

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
WINDROW COMPOST FACILITY SIZING

Compost Feedstock	***Initial Development, Year 2038***	***Long Term, Year 2087***	
Incoming Organics (tons)	38,118	55,601	*From SW Volumes Memo 6-10-2021*
% as Food Waste	10%	10%	*Food target percent for windrow ops*
Processing Days per Year	296	296	
Tons per Day	129	188	
Yard Waste Density (lb/cy)	650	650	
Yard Waste C:N Ratio	25	25	
Yard Waste Moisture Content	40%	40%	
Food Waste Density (lb/cy)	1,000	1,000	
Food Waste C:N Ratio	45	45	
Food Waste Moisture Content	60%	60%	
Target C:N Ratio	30 to 45	30 to 45	
Target Moisture Content	60%	60%	
Net Bulk Density at Arrival (lb/cy)	685	685	
Target Bulk Density (lb/cy)	850	850	
Net C:N Ratio	27	27	
Net Moisture Content	42%	42%	
Water to Add Initially (gal/yr)	**1,647,378**	**2,402,939**	
Annual Infeed Volume Processed (cy)	**111,295**	**162,340**	
Finished Compost Volume (cy)	61,212	89,287	
Density of Finished Compost (lb/cy)	800	800	
Finished Compost (tons)	**24,485**	**35,715**	
Composting Parameters			
Composting Period (days)	120	120	*6 months from incoming to screening*
Curing Period (days)	40	40	*Recommended*
Storage Period, Pre-Screening (days)	30	30	
Storage Period, Post-Screening (days)	30	30	*Total 60 days compost storage*
Initial Windrow Shrinkage Factor	10%	10%	
Compost Shrinkage Factor	30%	30%	
Curing Shrinkage Factor	5%	5%	
Unloading/Receiving Area			
Yard Waste Daily Pile Volume (cy)	357	520	
2x YW for Peak Day (cy)	713	1040	*Daily yard waste*
YW Pile Height (ft)	10	10	
YW Pile Area (sf)	*1,926*	*2,809*	
Wood & Leaves Pile Volumes (cy)	10,556	15,397	*Assume 10% of annual raw material*
Wood/Leaves Pile Height (ft)	10	10	*For raw material mixing ratios*
Wood/Leaves Pile Area (sf)	*28,501*	*41,573*	*Storage piles for wood chips & leaves*
Food Waste Pile Volume (cy)	26	38	
2x FW for Peak Day (cy)	52	75	*Daily food waste*
FW Pile Height (ft)	5	5	
FW Pile Area (sf)	*278*	*406*	

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

Hours per Day YW/FW Receipt	9	9	
Vehicles Peaking Factor	1.5	1.5	
Vehicles Payload (avg tons/vehicle)	2	2	*Assumption*
Unloading Time for Loads (minutes)	10	10	*Assumption*
No. Vehicles per Hour (vph)	11	16	
Total Number Unloading Bays	2	3	
Area per Unloading Bay (sf)	720	720	
Unloading Bay Space (sf)	*1,440*	*2,160*	
Maneuvering Space (sf)	*3,600*	*5,400*	
Total Unloading/Receiving Space (sf)	**35,745**	**52,347**	
Compost Pad			
Average Volume on Compost Pad (cy)	32,931	48,035	
Compost Windrow Length (ft)	200	200	
Compost Windrow Height (ft)	6	6	
Compost Windrow Width (ft)	14	14	
Volume per Row (cy)	373	373	
Number of Rows	89	129	
Spacing Between Windrows (ft)	8	8	
Total Compost Pad Area (sf)	**391,600**	**567,600**	
Compost Curing Pad			
Average Volume on Curing Pad (cy)	7,318	10,674	
Curing Windrow Length (ft)	100	100	
Curing Windrow Height (ft)	7	7	*New windrow turner to handle up to 7'x16'*
Curing Windrow Width (ft)	16	16	
Volume per Row (cy)	249	249	
Number of Rows	30	43	
Spacing Between Windrows (ft)	6	6	
Total Curing Pad Area (sf)	**66,000**	**94,600**	
Storage Pad1 - PreScreening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	
Total Storage Pad1 Area (sf)	**12,937**	**18,871**	
Finished Compost Screening Area			
Loading Traffic Area Width (ft)	50	50	
Loading Traffic Area Length (ft)	100	100	
Loading Traffic Area (sf)	*5,000*	*5,000*	
Mixing Bin/Screen w/ Stockpile Width (ft)	75	75	
Mixing Bin/Screen w/ Stockpile Length (ft)	100	100	
Mixing Bin/Screen w/ Stockpile Area (sf)	*7,500*	*7,500*	
Total Screening Area (sf)	**12,500**	**12,500**	
Storage Pad2 - Post-Screening			
Average Volume on Storage Pad (cy)	5,031	7,339	
Storage Windrow/Pile Height (ft)	15	15	
Total Storage Pad2 Area (sf)	**12,937**	**18,871**	

Project:	CRLCSWA Infrastructure Options
Date:	11/9/2021
Facility:	New Aerobic Organics Compost Site - Windrows - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Aerobic Organics Composting - Sizing**

Traffic Lanes for Operations			
Traffic Lane Width (ft)	20	20	
Cummulative Processing Area (sf)	531,719	764,789	
Square Root (ft)	729	875	
Traffic Lane Length =	2,917	3,498	
Total Operations Traffic Lanes Area (sf)	**58,335**	**69,962**	

Retention/Leachate Pond			
Area Contributing to Pond (sf)	590,054	834,751	*Total of Areas above*
100-Yr 24 hr Stor Event Rainfall Intensity I	0.310	0.310	PF Map: Contiguous US (noaa.gov)
Area A (acres)	13.5	19.2	
Run-off Factor C	0.60	0.60	
Flow Rate Q (cfs)	2.5	3.6	*using Rational Formula Q=CIA*
Time to Retain (hours)	24	24	
Volume of Water to Retain (cf)	217,394	307,547	
Depth of Pond (ft)	6	6	
Side Slopes of Pond #:1	4	4	
Pond Area at 1/2 Depth (sf)	36,232	51,258	*Volume divided by Depth*
Length & Width at 1/2 Depth (ft)	190	226	
Total Pond Area (sf)	**45,945**	**62,701**	*at grade*

SUMMARY OF COMPOST AREAS			
Unloading/Receiving Area	35,745	52,347	
Compost Pad	391,600	567,600	
Compost Curing Pad	66,000	94,600	
Storage Pad1 - Pre-Screening	12,937	18,871	
Finished Compost Screening Area	12,500	12,500	
Storage Pad2 - Post-Screening	12,937	18,871	
Traffic Lanes for Operations	58,335	69,962	
Retention/Leachate Pond	45,945	62,701	
TOTAL REQUIRED AREA (sf)	**635,999**	**897,452**	
TOTAL REQUIRED AREA (acres)	**14.60**	**20.60**	
Site - Composting & Buffer (acres)	**23**	**30**	*Assume 100' buffer*

Project:	CRLCSWA Infrastructure Options			
Date:	11/9/2021			
Facility:	New Aerobic Organics Compost Site - Windrows - No Design			
Costs:	2021$	Facility Size:	21 Acres	
Location:	Linn County, Iowa	Required Land:	30 Acres	
Worksheet:	**Composting Capital Costs**	**TOTAL COMPOST CAP$**		**$9,052,700**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
CAPITAL COST ESTIMATE SUMMARY [(1)(2)]

Compost Site Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Site Investigations	1	LS	$ 50,000	$ 50,000	*Assumption*
Site Work					
Mobilization/Demob	1	LS	$ 50,000	$ 50,000	
Clear & Grub	11	Acres	$ 2,000	$ 22,000	*Assume no demolition; half compost area*
Grading/Excavation	67,800	CY	$ 3	$ 203,400	*Assume 2' across compost area*
Structural Fill	20,300	CY	$ 10	$ 203,000	*Assume 30% of excavation quantities*
Roadways	9,100	SY	$ 45	$ 409,500	*4" asphalt over 6" granular base*
Site Utilities					
Stormwater Pond	-	LS	$ 200,000	$ -	*See Compost Leachate Lagoon*
Site Drainage/Erosion Control	1	EA	$ 25,000	$ 25,000	
Electrical - Service to Site	-	LS	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Water Supply & Fire Protection	1	LS	$ 100,000	$ 100,000	*Extend water supply to compost facility*
Sanitary Sewer	-	EA	$ -	$ -	*Included w/ LF, TS, AD, MWP or WTE*
Natural Gas System	-	LS	$ -	$ -	*NA*
Surveying	1	EA	$ 10,000	$ 10,000	*For composting area only*
Landscaping, Signage	1	EA	$ 20,000	$ 20,000	*For composting area only*
Fencing	4,600	LF	$ 35	$ 161,000	*Around composting area*
Pads & Leachate Collection					
Composting & Curing Pads	73,600	SY	$ 45	$ 3,312,000	*Asphalt Pad - Full Buildout*
Screening/Storage Areas	5,600	SY	$ 25	$ 140,000	*Compacted Gravel Pad - Full Buildout*
Compost Leachate Lagoon, Lined	1	LS	$ 500,000	$ 500,000	*Approximate 2 acres*
Market Variability Factor	15%	Capital $	$ 5,205,900	$ 781,000	*Sitework, horizontal construction*
SUBTOTAL COMPOST SITE CAPITAL				**$ 5,986,900**	

Engineering [(3)]	**Quantity**	**Unit**	**Unit Price**	**Total**
Contingency	20%	Capital $	$ 5,986,900	$ 1,197,400
Engineering & Design	4%	Capital $	$ 5,986,900	$ 239,500
Permitting (Local & IDNR)	2%	Capital $	$ 5,986,900	$ 119,700
Construction Observation/CQA	6%	Capital $	$ 5,986,900	$ 359,200
SUBTOTAL COMPOST SOFT COSTS				**$ 1,915,800**

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Windrow Turner	1	EA	$ 750,000	$ 750,000	*Replacement*
Loader (large)	1	EA	$ 400,000	$ 400,000	*Replacement*
Water Truck	0	EA	$ 200,000	$ -	*Existing*
Screen Compost Finish	0	EA	$ 300,000	$ -	*Existing*
Grinder/Shredder	0	EA	$ 600,000	$ -	*Existing*
Conveyors	0	EA	$ 75,000	$ -	*NA - included w/ screener or grinder*
SUBTOTAL				**$ 1,150,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed cell projects to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Contingency, design/engineering, permitting, and CQA services over life of facility with infrastructure.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	New Aerobic Organics Compost Site - Windrows - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**COMPOST REV$**	**$1,091,100**
Worksheet:	**Composting O&M Costs**	**TOTAL COMPOST O&M$**	**$1,171,200**

SCENARIOS 1-8
CRLCSWA AEROBIC ORGANICS COMPOSTING
OPERATIONS COST ESTIMATE SUMMARY (1)

Compost Direct Operations	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 511,800	*FY2021 fully-burdened salary, escalated*
Scalehouse	0	FTE	$ 82,000	$ -		*Included in LF, TS, MWP, AD or WTE*
Windrow Turner Operator	1	FTE	$ 103,800	$ 103,800		
Loader Operator	2	FTE	$ 103,800	$ 207,600		
Misc. Equip Operator	2	FTE	$ 100,200	$ 200,400		*Water truck, grinder, screen, turner, loader*
Utilities					$ 27,400	
Electricity	0	kWh	$ 0.15	$ -		*NA*
Water	1	LS	$ 25,000	$ 25,000		*130 gal/ton for composting, dust control*
Leachate	0	gallons	$ 0.15	$ -		*NA - Compost leachate NPDES Discharge*
Heating Fuel	0	LS	$ 2,500	$ -		*NA*
Phones	12	months	$ 200	$ 2,400		*Estimate based on # labor*
Maintenance and Repairs					$ 153,500	
Roadways, Pads Repair & Misc Maintenance	0.3%	Capital $	$ 5,986,900	$ 18,000		*Percentage of Compost capital*
Windrow Turner	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Loader	2,368	hours	$ 20	$ 47,400		*80% of personnel hours*
Truck/Screen Equipment	2,368	hours	$ 15	$ 35,500		*80% of personnel hours*
Grinder	208	hours	$ 25	$ 5,200		*Estimate 4 hours per week*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*Estimate*
Fuel	21,936	gallons	$ 3.50	$ 76,800	$ 76,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Insurance	0.1%	Capital $	$ 5,986,900	$ 6,000	$ 6,000	*Percentage of compost total capital*
Compost Lab Testing	1	LS	$ 5,000	$ 5,000	$ 5,000	*Portion from CRLCSWA FY2022 Budget*
Administration - Office, Training, Audits, etc.- See Admin/Educational Center O&M						
SUBTOTAL COMPOST DIRECT OPERATIONS					**$ 785,500**	

Compost Cash Reserves	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Equipment Replacement					$ 385,700	*Rounded*
Windrow Turner	1	EA	$ 150,000	$ 150,000		*Capital cost divided by 5-yr life*
Loader	1	EA	$ 57,143	$ 57,100		*Capital cost divided by 7-yr life*
Water Truck	1	EA	$ 28,600	$ 28,600		*Shared w/ TS for roads dust control*
Screen Compost Finish	1	EA	$ 30,000	$ 30,000		*Capital cost divided by 10-yr life*
Grinder/Shredder	1	EA	$ 120,000	$ 120,000		*Capital cost divided by 5-yr life*
Conveyors	0	EA	$ 7,500	$ -		*Included w/ screen or grinder*
Operating Cash Reserve	0	LS	$ 38,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
Site #3 Other Developments	0	LS	$ 250,000	$ -	$ -	*No Site #3 composting*
SUBTOTAL LF CASH RESERVES					**$ 385,700**	

Other Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Compost Sales	7,345	Ton	$ 24	$ 176,300	$ 176,300	*Assume 30% compost sales to businesses*
YW Tip Fees	38,118	Ton	$ 24	$ 914,800	$ 914,800	*Current CRLCSWA unit price*
Non-Cash Adjustments	0	LS	$ 25,000	$ -	$ -	*Included in LF, TS, MWP, AD or WTE*
SUBTOTAL OTHER REVENUES					**$ 1,091,100**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 296 days. Based on 5.8 days/week operation, less 6 holidays.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	10 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Scalehouse & Scales Capital Costs**	**TOTAL CAP$**		**$2,189,600**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
SCALEHOUSE CAPITAL COST ESTIMATE SUMMARY (1)(2)

Scalehouse Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scalehouse	600	SF	$ 250	$ 150,000	*Approx. current size*
Entrance & Queuing Roads	13,300	SY	$ 60	$ 798,000	*Concrete 4" over 6" granular base, 3000LF*
Road, Scale Approach, Parking	1,200	SY	$ 60	$ 72,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 15,000	$ 15,000	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,035,000	$ 310,500	*Vertical construction*
SUBTOTAL				**$ 1,345,500**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,345,500	$ 269,100	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,345,500	$ 161,500	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,345,500	$ 13,500	*Percentage of total capital*
SUBTOTAL				**$ 444,100**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Scales	3	EA	$ 125,000	$ 375,000	*New*
Software	1	EA	$ 25,000	$ 25,000	*Software used for LF, Compost, RRC, etc.*
SUBTOTAL				**$ 400,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	11/23/2021			
Facility:	Solid Waste Campus Support Facilities			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Admin/Educational Center Capital Cost**	**TOTAL CAP$**		**$2,878,100**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
ADMIN CAPITAL COST ESTIMATE SUMMARY (1)(2)

Administration & Educational Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Two-Story Building	5,500	SF	$ 250	$ 1,375,000	*Building footprint SF; same size as current*
Access Road & Parking	2,300	SY	$ 45	$ 103,500	*Asphalt 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 137,500	$ 137,500	*10% of building cost*
Market Variability Factor	30%	Capital $	$ 1,616,000	$ 484,800	*Vertical construction*
SUBTOTAL				**$ 2,100,800**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 2,100,800	$ 420,200	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 2,100,800	$ 336,100	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 2,100,800	$ 21,000	*Percentage of total capital*
SUBTOTAL				**$ 777,300**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**
None at Admin Center				
SUBTOTAL				**$ -**

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	11/9/2021		
Facility:	Solid Waste Campus Support Facilities		
Costs:	2021$	Land:	4 Acres
Location:	Linn County, Iowa		
Worksheet:	**Resource Recovery Center Capital Cost**	**TOTAL CAP$**	**$9,933,900**

ALL SCENARIOS
CRLCSWA SOLID WASTE CAMPUS FACILITIES
RRC CAPITAL COST ESTIMATE SUMMARY (1)(2)

RRC Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
HHM Canopy - Covered Drive	2,000	SF	$ 25	$ 50,000	*CRLCSWA current size*
HHM Facility	8,000	SF	$ 300	$ 2,400,000	*CRLCSWA current size*
RRC Bldg	6,700	SF	$ 250	$ 1,675,000	*Size for just recyclables transfer*
RRC Office/Breakroom/Restrooms	3,600	SF	$ 200	$ 720,000	*CRLCSWA current size*
Access Road, Parking & Maneuvering	5,600	SY	$ 60	$ 336,000	*Concrete 4" over 6" granular base*
Landscaping & Signage	1	LS	$ 239,750	$ 239,800	*5% of buildings cost*
Market Variability Factor	30%	Capital $	$ 5,420,800	$ 1,626,200	*Vertical construction*
SUBTOTAL				**$ 7,047,000**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 7,047,000	$ 1,409,400	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	14%	Capital $	$ 7,047,000	$ 986,600	*Percentage of total capital*
Permitting (Local & IDNR)	2%	Capital $	$ 7,047,000	$ 140,900	*Percentage of total capital*
SUBTOTAL				**$ 2,536,900**	

Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Baler	0	EA	$ 1,000,000	$ -	*Assumes RRC recyclabes transfer only*
Forklift	1	EA	$ 50,000	$ 50,000	*For HHM Facility*
Skid Loader	0	EA	$ 50,000	$ -	*Existing*
Mid-Size Loader	1	EA	$ 300,000	$ 300,000	*Share w/ Citizen Drop-Off and Bunkers*
Roll-off Containers	0	EA	$ 8,000	$ -	*Existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from Citizen Drop-Off*
Trailers	0	EA	$ 30,000	$ -	*Assume provided by end market*
Trucks	0	EA	$ 115,000	$ -	*Assume provided by end market*
SUBTOTAL				**$ 350,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

(3) Sizing for RRC Building

RRC Transfer Sizing	**Year 1**	**Year 50**	
Incoming Recyclables, TPY	4,045	5,943	*Single stream recyclables/drop box handled by CRLCSWA*
Incoming Recyclables, TPD	16	23	*5 days/week*
Incoming Recyclables, TPH	2	3	*8 hours/day*
Number of Unloading Bays	2	2	*Avg 3 tons/veh, 2x peak factor, 15 min unload + 1 extra*
Recyclables - Floor Storage (CY)	247	363	*126 lbs/CY, 1 day worth*
Recyclables - Trailer Payload	7	7	*tons/trailer* *126 lbs/CY*
Area Needed (SF):			
Tipping Floor	3,700	4,400	*Recyclables piled avg 4' high + unloading area*
Transfer Loadout Area Area	1,200	1,200	*60' x 1 trailer load-out lane*
Flex Area	1,000	1,100	*20% extra*
RRC Transfer Building (SF)	**5,900**	**6,700**	

Project:	CRLCSWA Infrastructure Options			
Date:	1/27/2022			
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Maintenance Shop Capital Cost**	**TOTAL CAP$**		**$2,567,500**

SCENARIO 8
CRLCSWA WTE w/ REGIONAL LANDFILL OPTION
MAINT SHOP CAPITAL COST ESTIMATE SUMMARY (1)(2)

Maintenance Facility Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Maintenance Facility	9,000	SF	$ 150	$ 1,350,000	*CRLCSWA current Site#3 compost*
Access Road & Maneuvering Area	1,200	SY	$ 45	$ 54,000	*Asphalt 4" over 6" granular base*
Market Variability Factor	30%	Capital $	$ 1,404,000	$ 421,200	*Vertical construction*
SUBTOTAL				**$ 1,825,200**	

Engineering	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 1,825,200	$ 365,000	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	12%	Capital $	$ 1,825,200	$ 219,000	*Percentage of total capital*
Permitting (Local)	1%	Capital $	$ 1,825,200	$ 18,300	*Percentage of total capital*
SUBTOTAL				**$ 602,300**	

Maintenance Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
5-ton Overhead Crane w/ Hoist	1	EA	$ 40,000	$ 40,000	*Crane vendors $35K w/ $5k installed*
Maint/Repair Equipment	1	EA	$ 100,000	$ 100,000	*Estimate*
SUBTOTAL				**$ 140,000**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options			
Date:	1/27/2022			
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design			
Costs:	2021$	Land:	2 Acres	
Location:	Linn County, Iowa			
Worksheet:	**Citizen Drop-Off Center Capital Cost**	**TOTAL CAP$**		**$238,100**

SCENARIO 8
CRLCSWA WTE w/ REGIONAL LANDFILL OPTION
DROP-OFF CAPITAL COST ESTIMATE SUMMARY [(1)(2)]

Citizen Drop-Off Center Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Materials Bunkers Area	1,700	SY	$ 60	$ 102,000	*Concrete for tires, white goods, scrap metal*
Concrete Bunker Walls	80	CY	$ 600	$ 48,000	*3 bunkers 60'x 35' each*
Bulk Excavation & Structural Fill	0	CY	$ 13	$ -	*Suitable on-site soils*
Waste Unloading Area	0	SY	$ 60	$ -	*None*
Roll-Off Area	0	SY	$ 60	$ -	*None*
Concrete Z-Wall	0	CY	$ 600	$ -	*None*
Market Variability Factor	15%	Capital $	$ 150,000	$ 22,500	*Sitework, horizontal construction*
SUBTOTAL				**$ 172,500**	

Soft Costs	**Quantity**	**Unit**	**Unit Price**	**Total**	
Contingency	20%	Capital $	$ 172,500	$ 34,500	*Percentage of total capital*
Eng., Design, Constr. Admin & CQA	16%	Capital $	$ 172,500	$ 27,600	*Percentage of total capital*
Permitting (Local)	2%	Capital $	$ 172,500	$ 3,500	*Percentage of total capital*
SUBTOTAL				**$ 65,600**	

Mobile Equipment Capital	**Quantity**	**Unit**	**Unit Price**	**Total**	
Roll-off Containers	0	EA	$ 8,000	$ -	*1 glass; existing*
Roll-off Truck	0	EA	$ 110,000	$ -	*Share from WTE*
Skid Loader	0	EA	$ 50,000	$ -	*Share from RRC*
Mid-Size Loader	0	EA	$ 300,000	$ -	*Share from RRC*
SUBTOTAL				**$ -**	

ASSUMPTIONS:

(1) No sales tax is included. Assumed facility is tax exempt.

(2) Costs rounded to nearest thousand. Construction costs used for budgeting and planning purposes only and shall not be used as an actual bid as given by a contractor to build the project.

Does not include financing costs.

Assumed project to be competitively bid under one general contract.

Assumed construction to be during normal working hours.

Project:	CRLCSWA Infrastructure Options		
Date:	1/27/2022		
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,631,300**

SCENARIO 8
CRLCSWA WTE w/ REGIONAL LANDFILL OPTION
OPERATIONS COST ESTIMATE SUMMARY (1)

Scalehouse Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 246,000	
Scalehouse Personnel	3	FTE	$ 82,000	$ 246,000		
Utilities					$ 4,300	
Electricity	6,000	kWh	$ 0.15	$ 900		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 1,000	$ 1,000		*Estimate - small building*
Heating Fuel	1	LS	$ 1,000	$ 1,000		*Estimate 1-2 Therms/SF/year*
Phones	12	months	$ 120	$ 1,400		*Estimate*
Maintenance and Repairs					$ 9,000	
Building	1%	Capital $	$ 150,000	$ 1,500		*Percentage of building capital*
Scales	2%	Capital $	$ 375,000	$ 7,500		*Percentage of scales capital*
Mobile Equipment	0	hours	$ 15	$ -		*None*
Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 525,000	$ 1,600	$ 1,600	*Percentage of building & scales total capital*
Cash Reserves Bldg/Equip Replacement					$ 31,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Scales	3	EA	$ 8,333	$ 25,000		*Capital divided by 15-yr life*
Scalehouse Building	1	EA	$ 6,000	$ 6,000		*Capital divided by 25-yr life*
SUBTOTAL SCALEHOUSE & SCALES					**$ 293,900**	

Administration & Educational Center Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Agency Labor:					$ 1,583,500	*Estimate 40% from CRLCSWA FY2022 Budget*
Executive Director	1	FTE				
Site Engineer	1	FTE				
Director of Education	1	FTE				
Hazardous Materials Manager	1	FTE				
Operations Foreman	1	FTE				
Admin Personnel	2	FTE				
Utilities					$ 47,500	
Electricity	110,000	kWh	$ 0.15	$ 16,500		*Office Bldg 10 kWh/SF*
Water & Sewer	1	LS	$ 5,000	$ 5,000		*Estimate - office building*
Natural Gas/Heating Fuel	1	LS	$ 8,000	$ 8,000		*Estimate 1 Therms/SF/year*
Phones	12	months	$ 1,500	$ 18,000		*Estimate*
Maintenance and Repairs					$ 34,500	
Building & Grounds	0.5%	Capital $	$ 2,100,800	$ 10,500		*Percentage of capital*
Mobile Equipment	936	hours	$ 5	$ 4,700		*Assume pick-up trucks maintenance*
Office Equipment	1	LS	$ 19,300	$ 19,300		*CRLCSWA FY2022 Budget*
Agency Purchased Services	1	LS	$ 511,700	$ 511,700	$ 511,700	*CRLCSWA FY2022 Budget*
Agency Supplies & Materials	1	LS	$ 20,900	$ 20,900	$ 20,900	*CRLCSWA FY2022 Budget*
Agency Other Costs	1	LS	$ 46,000	$ 46,000	$ 46,000	*CRLCSWA FY2022 Budget*
Other Operating Costs - Services					$ 222,500	
ECICOG	1	LS	$ 10,000	$ 10,000		*CRLCSWA FY2022 Budget*
Public Education	1	LS	$ 37,500	$ 37,500		*CRLCSWA FY2022 Budget*
Media Advertising	1	LS	$ 125,000	$ 125,000		*CRLCSWA FY2022 Budget*
Comprehensive Planning	1	LS	$ 50,000	$ 50,000		*Annual estimate over period*
Fuel	2,808	gallons	$ 3.50	$ 9,800	$ 9,800	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 2,100,800	$ 6,300	$ 6,300	*Percentage of capital*
Cash Reserves Bldg/Equip Replacement					$ 55,000	
Mobile Equipment	0	EA	$ -	$ -		*None*
Admin Building	1	EA	$ 55,000	$ 55,000		*Capital divided by 25 years*
SUBTOTAL ADMINISTRATION & EDUCATIONAL CENTER					**$ 2,537,700**	

Resource Recovery Center/HHW Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	

Project:	CRLCSWA Infrastructure Options
Date:	1/27/2022
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design
Costs:	2021$
Location:	Linn County, Iowa
Worksheet:	**Support Facilities O&M Costs**

MATERIAL REV$	**$647,900**
ANNUAL O&M$	**$4,631,300**

Labor					$ 486,300	
Hazardous Materials Manager						*Included w/ Agency Labor in Admin/Ed Center*
RRC Loader Operator	1.5	FTE	$ 103,800	$ 155,700		
HHW Facility Receiving	1.5	FTE	$ 82,000	$ 123,000		
HHW Facility Chemists	2.0	FTE	$ 103,800	$ 207,600		
Utilities					$ 59,600	
Electricity	274,500	kWh	$ 0.15	$ 41,200		*15 kWh/SF, mixed use*
Water & Sewer	1	LS	$ 3,000	$ 3,000		*Estimate*
Natural Gas/Heating Fuel	1	LS	$ 13,000	$ 13,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 200	$ 2,400		*Estimate*
Maintenance and Repairs					$ 43,000	
Building & Grounds	0.5%	Capital $	$ 7,047,000	$ 35,200		*Percentage of capital*
Mobile Equipment	520	hours	$ 15	$ 7,800		*Loader, assume 2 hrs per day*
Supplies	1	LS	$ 5,000	$ 5,000	$ 5,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	1,560	gallons	$ 3.50	$ 5,500	$ 5,500	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 7,047,000	$ 21,100	$ 21,100	*Percentage of building total capital*
Cash Reserves Bldg/Equip Replacement					$ 243,300	
Skid Loader	1	EA	$ 5,000	$ 5,000		*Capital cost divided by 10-yr life*
Loader	1	EA	$ 42,900	$ 42,900		*Capital cost divided by 7-yr life*
Roll-offs	2	EA	$ 800	$ 1,600		*Capital cost divided by 10-yr life*
RRC/HHW Buildings	1	EA	$ 193,800	$ 193,800		*Capital cost divided by 25-yr life*
Disposal/Management Services					$ 543,600	
HHW Disposal	1	LS	$ 90,000	$ 90,000		*CRLCSWA FY2022 Budget*
Electronics Disposal	1	LS	$ 67,700	$ 67,700		*CRLCSWA FY2022 Budget*
Batteries/Flourescents/Medical Waste	1	LS	$ 13,200	$ 13,200		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 24,900	$ 24,900		*CRLCSWA FY2022 Budget*
Tires	1	LS	$ 48,300	$ 48,300		*CRLCSWA FY2022 Budget*
Recycling Services	1	LS	$ 299,500	$ 299,500		*CRLCSWA FY2022 Budget*
SUBTOTAL RESOURCE RECOVERY CENTER					**$ 1,407,400**	

Maintenance Facility Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:					$ 207,600	
Mechanic/Maintenance	2	FTE	$ 103,800	$ 207,600		*Servicing all facilities' mobile equipment*
Utilities					$ 20,000	
Electricity	63,000	kWh	$ 0.15	$ 9,500		*Assume 7 kWh/SF repair shop*
Water & Sewer	1	LS	$ 2,500	$ 2,500		*Estimate*
Heating Fuel	1	LS	$ 7,000	$ 7,000		*Estimate 1 Therms/SF/year, $7/MMBTU*
Phones	12	months	$ 80	$ 1,000		*Estimate based on # labor*
Maintenance and Repairs					$ 16,100	
Building & Grounds	0.5%	Capital $	$ 1,825,200	$ 9,100		*Percentage of capital*
Crane/Equipment	5%	Capital $	$ 140,000	$ 7,000		*Percentage of equipment capital*
Mobile Equipment	0	hours	$ 15	$ -		*Included w/ LF, TS, MWP, AD or WTE*
Supplies	1	LS	$ 78,600	$ 78,600	$ 78,600	*FY2022 Budget, Tools & Equipment, Shop*
Fuel	0	gallons	$ 3.50	$ -	$ -	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 1,825,200	$ 5,500	$ 5,500	*Percentage of total capital*
Cash Reserves Bldg/Equip Replacement					$ 58,000	
Overhead Crane	1	EA	$ 4,000	$ 4,000		*Capital over 10-year life*
Maintenance Building	1	EA	$ 54,000	$ 54,000		*Capital over 25-year life*
SUBTOTAL MAINTENANCE FACILITY					**$ 385,800**	

Citizen Drop-Off Direct Expenses	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
Labor:	Included with Labor for LF, TS, MWP, AD or WTE					*Shared Labor*
Utilities					$ -	
Electricity	0	kWh	$ 0.15	$ -		*Outdoors*
Water & Sewer	0	LS	$ -	$ -		*NA*
Heating Fuel	0	LS	$ -	$ -		*NA*
Phones	0	months	$ -	$ -		*NA*
Maintenance and Repairs					$ 2,400	
Paving/Pad Repairs	1%	Capital $	$ 102,000	$ 1,000		*Percentage of capital*
Mobile Equipment	96	hours	$ 15	$ 1,400		*8 hours/month*

Project:	CRLCSWA Infrastructure Options		
Date:	1/27/2022		
Facility:	SCENARIO 8: WTE w/ Regional Landfill Concept - No Design		
Costs:	2021$		
Location:	Linn County, Iowa	**MATERIAL REV$**	**$647,900**
Worksheet:	**Support Facilities O&M Costs**	**ANNUAL O&M$**	**$4,631,300**

Supplies	1	LS	$ 2,000	$ 2,000	$ 2,000	*CRLCSWA FY2022 Budget, prorated*
Fuel	288	gallons	$ 3.50	$ 1,000	$ 1,000	*Assume 3 gallons per hour operating*
Consulting/Eng Services	0	LS	$ -	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
Insurance	0.3%	Capital $	$ 102,000	$ 300	$ 300	*Percentage of construction capital*
Cash Reserves Equipment Replacement						
Roll-off Containers	1	EA	$ 800	$ 800	$ 800	*Capital over 10-year life*
Roll-off Truck	0	EA	$ 11,000	$ -	$ -	*Capital over 10-year life*
SUBTOTAL CITIZEN DROP-OFF					**$ 6,500**	

Miscellaneous Revenues	**Quantity**	**Unit**	**Unit Price**	**Annual Costs**	**Total**	
RRC/HHW Materials					$ 647,900	
Scrap Metal	1	LS	$ 18,000	$ 18,000		*CRLCSWA FY2022 Budget*
White Goods	1	LS	$ 74,700	$ 74,700		*CRLCSWA FY2022 Budget*
Waste Tires	1	LS	$ 53,900	$ 53,900		*CRLCSWA FY2022 Budget*
Electronic Waste	1	LS	$ 114,300	$ 114,300		*CRLCSWA FY2022 Budget*
HHW	1	LS	$ 57,200	$ 57,200		*CRLCSWA FY2022 Budget*
Commingled Recycling	1	LS	$ 271,400	$ 271,400		*CRLCSWA FY2022 Budget*
Recycling Services Revenue Share	1	LS	$ 58,400	$ 58,400		*CRLCSWA FY2022 Budget*
Other Misc. Revenue	0	LS	$ 29,400	$ -	$ -	*Included w/ LF, TS, MWP, AD or WTE*
SUBTOTAL MISC REVENUES					**$ 647,900**	

ASSUMPTIONS:

1. Costs rounded to nearest hundred.
2. Operating days per year equals 306 days. Based on 6 days/week operation.
   Personnel operating hrs 10 hours per day.
3. Labor & admin annual escalaction = 3%

Table 4 - CRLCSWA Material Handling Projections (In Tons)

Material	FY2020	FY2030	FY2040	FY2050	FY2038	FY2087
			Fiscal Year			
Population	228,600	254,900	276,800	298,900		
Materials Landfilled						
MSW	160,086	178,430	193,760	209,230	190,592	278,007
Disaster Debris	0	2,549	2,768	2,989	2,723	3,972
Special Waste	16,612	20,392	22,144	23,912	21,782	31,772
C&D	25,960	17,843	19,376	20,923	19,059	27,801
Shingles	9,091	2,549	2,768	2,989	2,723	3,972
Subtotal Materials Landfilled	**211,749**	**221,763**	**240,816**	**260,043**	**236,879**	**345,523**
Materials Recycled						
Organics	29,710	35,686	38,752	41,846	38,118	55,601
Single Stream/Drop Box/City	11,872	12,745	13,840	14,945	13,614	19,858
Scrap Metal/White Goods	876	1,098	1,193	1,288	1,173	1,711
Subtotal Materials Recycled	**42,458**	**49,529**	**53,785**	**58,079**	**52,905**	**77,170**
Total Materials	254,207	271,292	294,601	318,122	289,784	422,693
Annual MSW Percent Increase		0.65%	0.83%	0.77%		0.77%

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2088	FY2090
		Fiscal Year (Tons)							
PAPER									
Compostable Paper	9.3%	14,888	16,594	17,735	18,020	19,458		26,054	
High Grade Office Paper	0.8%	1,281	1,427	1,526	1,550	1,674		2,241	
Magazines/Catalogs	1.1%	1,761	1,963	2,098	2,131	2,302		3,082	
Mixed Recyclable Paper	4.2%	6,724	7,494	8,009	8,138	8,788		11,766	
Newsprint	1.0%	1,601	1,784	1,907	1,938	2,092		2,802	
Non-Recyclable Paper	4.6%	7,364	8,208	8,772	8,913	9,625		12,887	
OCC and Kraft Paper	3.4%	5,443	6,067	6,484	6,588	7,114		9,525	
Aseptic/Gable Top Containers	0.1%	160	178	191	194	209		280	
Subtotal Paper	**24.5%**	**39,221**	**43,715**	**46,720**	**47,471**	**51,261**		**68,637**	
PLASTIC									
#1 PET IA Deposit Beverage Container	0.5%	800	892	953	969	1,046		1,401	
#1 PET Beverage Containter	1.2%	1,921	2,141	2,288	2,325	2,511		3,362	
#2 HDPE Containers Natural	0.5%	800	892	953	969	1,046		1,401	
#2 HDPE Containers Colored	0.6%	961	1,071	1,144	1,163	1,255		1,681	
Retail Shopping Bags	0.8%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Plastic Film	8.7%	13,927	15,523	16,590	16,857	18,203		24,373	
Other #1 PET Containers	0.3%	480	535	572	581	628		840	
Plastic Containers #3-#7	2.4%	3,842	4,282	4,577	4,650	5,022		6,724	
Other Plast Containers	0.3%	480	535	572	581	628		840	
Expanded Polystyrene	0.9%	1,441	1,606	1,716	1,744	1,883		2,521	
Other Plastic Products	2.9%	4,642	5,174	5,530	5,619	6,068		8,124	
Subtotal Plastic	**19.1%**	**30,576**	**34,080**	**36,423**	**37,008**	**39,963**		**53,509**	
METAL									
Aluminum Beverage Containers	0.1%	160	178	191	194	209		280	
Aluminum IA Deposit Beverage Containers	0.3%	496	553	591	601	649		868	
Ferrous Food & Beverage Containers	0.8%	1,281	1,427	1,526	1,550	1,674		2,241	
Other Aluminum Containers	0.3%	496	553	591	601	649		868	
Other Ferrous Scrap Metals	1.2%	1,921	2,141	2,288	2,325	2,511		3,362	
Other Non-Ferrous Scrap Metals	0.7%	1,121	1,249	1,335	1,356	1,465		1,961	
Subtotal Metal	**3.4%**	**5,475**	**6,102**	**6,522**	**6,627**	**7,156**		**9,581**	
GLASS									
Blue Glass	0.0%	32	36	38	39	42		56	
Brown Glass	0.0%	48	54	57	58	63		84	
Clear Glass	0.9%	1,425	1,588	1,697	1,724	1,862		2,493	
Glass IA Deposit Containers	0.6%	928	1,035	1,106	1,124	1,214		1,625	
Green Glass	0.0%	32	36	38	39	42		56	
Other Mixed Cullet	0.6%	928	1,035	1,106	1,124	1,214		1,625	
Subtotal Glass	**2.1%**	**3,394**	**3,783**	**4,043**	**4,108**	**4,436**		**5,939**	
ORGANICS									
Yard Waste	1.0%	1,601	1,784	1,907	1,938	2,092		2,802	
Food Waste - Loose	15.3%	24,525	27,335	29,214	29,684	32,054		42,919	
Food Waste - Packaged	6.8%	10,918	12,169	13,005	13,214	14,269		19,106	
Textiles and Leather	2.9%	4,675	5,210	5,568	5,658	6,110		8,180	
Diapers	2.9%	4,675	5,210	5,568	5,658	6,110		8,180	
Rubber	2.4%	3,874	4,318	4,615	4,689	5,063		6,780	
Subtotal Organics	**31.4%**	**50,267**	**56,027**	**59,878**	**60,841**	**65,698**		**87,967**	
DURABLE									
Cell Phones & Chargers	0.1%	80	89	95	97	105		140	
Central Processing Units / Peripherals	0.3%	448	500	534	543	586		784	
Computer Monitors / TVs	0.2%	320	357	381	388	418		560	
Electrical and Household Appliances	0.9%	1,441	1,606	1,716	1,744	1,883		2,521	
Subtotal Durable	**1.4%**	**2,289**	**2,552**	**2,727**	**2,771**	**2,992**		**4,006**	
CONSTRUCTION & DEMOLITION									
Wood - Untreated	0.3%	480	535	572	581	628		840	

Table - CRLCSWA Waste Composition

Material	2017 Sort Data (%)	FY2020	FY2030	FY2038	FY2040	FY2050	FY2080	FY2088	FY2090
		Fiscal Year (Tons)							
Wood - Treated	5.5%	8,805	9,814	10,488	10,657	11,508		15,408	
Asphalt Pavement, Brick, Rock, & Concrete	0.0%	64	71	76	78	84		112	
Asphalt Roofing	0.0%	48	54	57	58	63		84	
Drywall/Gypsum Board	0.0%	64	71	76	78	84		112	
Carpet & Carpet Padding	1.3%	2,081	2,320	2,479	2,519	2,720		3,642	
Subtotal C&D	**7.2%**	**11,542**	**12,865**	**13,749**	**13,970**	**15,085**		**20,199**	
HOUSEHOLD HAZARDOUS MATERIALS (HHM)									
Chemicals	0.5%	800	892	953	969	1,046		1,401	
Lead-Acid Batteries	0.1%	80	89	95	97	105		140	
Mercury Containing Products	0.0%	64	71	76	78	84		112	
Lithium Batteries	0.1%	160	178	191	194	209		280	
Other Batteries	0.1%	80	89	95	97	105		140	
Sharps	0.0%	64	71	76	78	84		112	
Prescription Medications	0.0%	64	71	76	78	84		112	
Subtotal HHM	**0.8%**	**1,313**	**1,463**	**1,564**	**1,589**	**1,716**		**2,297**	
OTHER									
Other Organics	4.4%	7,044	7,851	8,391	8,525	9,206		12,327	
Other Inorganics	1.2%	1,921	2,141	2,288	2,325	2,511		3,362	
Other C&D	1.1%	1,761	1,963	2,098	2,131	2,302		3,082	
Other Durables	1.3%	2,081	2,320	2,479	2,519	2,720		3,642	
Other HHM	0.1%	160	178	191	194	209		280	
Fines	1.6%	2,561	2,855	3,051	3,100	3,348		4,482	
Other	0.3%	480	535	572	581	628		840	
Subtotal Other	**10.0%**	**16,009**	**17,843**	**19,069**	**19,376**	**20,923**		**28,015**	
TOTALS - MSW	**100.0%**	**160,086**	**178,430**	**190,694**	**193,760**	**209,230**	**263,453**	**280,150**	**284,488**
						0.77%			
		160,086	178,430	190,694	193,760	209,230	Check	280,150	

CRLCSWA SCENARIO 1 ASSUMPTIONS

SCENARIO 1	NEW LANDFILL (CRLCSWA OWNED)

Overall SW Campus	• Total site = 320 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	    o Facilities/Buildings, 20 years bond at annual 4% interest rate
	    o Compost Facility, 20 years bond at annual 4% interest rate
	    o Landfill with 9 cells/phases of development, 7 years bond for each phase at annual 4% interest rate (overlap of bond payments)
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

New Landfill	• Total area = 220 acres w/ 500' buffer
	• Landfill size = 100 acres
	• Number of landfill cells/phases = 9; first cell will be largest
	• All tonnages currently going to landfill assumed to continue to landfill
	• Permitted by = Year 2035
	• Assume start waste receipt = Year 2038
	• Provide capacity for = 50 years (i.e. Year 2087)
	• Tonnage projections from Table 4 of SW Volumes Memo escalated to Year 2087 at same rate
	• Same Public Days/Hours operation
	    o Monday – Friday: 7am – 4pm
	    o Saturday, by appointment only: 7am – 2pm
	• Work Hours: 6:30 am-4:30/5pm M-F, 6:30am-2:30pm Sat
	• Leachate managed on-site with evaporation pond and leachate recirculation, new leachate tanker truck
	• Water truck shared with composting operation
	• Utilities connections assumed 1 mile from site

Aerobic Organics Composting	• Total area = 30 acres w/ 100' buffer
	• Composting area = 21 acres by Year 2087
	• Move to SW Campus (Alternate of Site #3 retained)
	• Tonnage projections from Table 4, escalated to Year 2087
	• Windrow composting w/ compost turner
	• Windrow size 6'H x 14'W on compost pad & 7'H x 16'W on curing pad
	• Composting pads = asphalt
	• Screening & storage pads = compacted soil w/ gravel
	• Weighed Loads – Incoming raw materials and outgoing compost
	• Public Days/Hours Operation at SW Campus
	    o Monday – Friday: 7am – 4pm (same as LF)
	    o Saturday: 8am – 12pm (existing hours)
	• 6 months for composting process before screening
	• Compost screened prior to availability to customers
	• 30% compost tons produced annually sold to businesses

Resource Recovery Center	• Total area = 4 acres
	• Building Size = 10,300 SF, resized for recyclables transfer station, includes office, breakroom & restroom facilities
	• No sorting of mixed recyclables – transfer only
	• No baler
	• Mixed recyclables transferred to MRF by contract hauler
	• Public Days/Hours Operation
	  o Monday – Friday: 7am – 4pm
	  o Saturday, by appointment only: 7am-4pm
	• Tipping floor for citizens, curbside recycling trucks and roll-off
	• Recommend Open-Top Loading into transfer trailers vs. current Lift and Load operation

HHM Facility	• Total area = included in RRC total
	• Building Size = 8000 SF
	• Drive-Thru Canopy = 2000 SF
	• HHM received, sorted, and prepared for shipment
	• Public Days/Hours Operation
	  o Monday – Friday: 7am-4pm (current to 4:30)
	  o Saturday, by appointment only: 7am-4pm (current to 4:30)
	• Separate building/room(s) connected to the RRC building

Scalehouse & Scales	• Total area = 10 acres • Building Size = 600 SF • 3 scales (2 inbound, 1 outbound) • Main entrance and queuing roads included in total area • Roadways = 3000 LF
Administration & Environmental Education Center	• Total area = 2 acres • Building Size = 5500 SF • Same size as current; Two story w/ Education Center • Parking, access, landscaping, green space included in total area
Maintenance Facility	• Total area = 2 acres • Building Size = 17,200 SF • Same size as combined Site #2 landfill and Site #3 compost operations to service LF & composting equipment, HHW/RRC equipment and roll-offs • Equipment parking, access, road - asphalt • Heated • All facilities mobile equipment maintained here • 5-ton overhead crane
Citizen Drop-Off Center	• Total area = 4 acres • Size = 57,000 SF waste unloading + 15,000 SF for 3 bunkers & glass roll-off • Access roads = 170 FT each; In & Out • Current program materials (bunkers & roll-off) with contract haul to markets: o Appliances/White Goods

	- Tires - Scrap Metal - Glass - Garbage - Z-wall 7 unloading bays (same as current at Site #2 landfill) w/ roll-offs - Haul 2x / roll-off / day to landfill - Roll-off truck - Use RRC loader when needed

CRLCSWA SCENARIO 2 ASSUMPTIONS

SCENARIO 2	NEW TRANSFER STATION
TRANSER STATION CAMPUS 1	
Campus 1	• Total site = 15 acres • Revenue bonds assumed to finance development • Financing assumptions o Transfer Station & Scalehouse • Industrial zoned site • Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

Transfer Station	• Total area = 15 acres w/ 300' buffer
	• Sized for current disposed waste, although some material like Special Waste may need to be direct hauled to regional landfill
	  o Design Capacity = 900 TPD
	  o Building Size = 42,400 SF
	  o # Unloading Bays = #14, includes citizen self-haul
	  o # Load-out Hoppers = 2
	  o Expand after Year 25 to 1060 TPD with additional 6,100 SF
	• Permit by = Year 2036
	• Assume start waste receipt = Year 2038
	• Public Days/Hours Operation
	  o Monday – Friday: 7am – 4pm
	  o Saturday, by appointment only: 7am – 2pm
	• Work Hours: 6:30 am-4:30/5pm M-F, 6:30am-2:30pm Sat
	• TS purchase water truck shared with composting operation
	• Utilities connections assumed on-site

Scalehouse & Scales	• Total area = Included w/ Transfer Station area • Building Size = 600 SF • 2 scales (1 inbound/1 outbound) • Main entrance and queuing roads included in total area • Roadways = 1000 LF

Regional Landfill	• Haul waste from Transfer Station to non-CRLCSWA landfill in the region
	• 2 LFs within 30-miles; 5 LFs within 80-miles; 6 total LFs within 115-miles
	  o LFs within 80-miles not able or willing to take entire CRLCSWA transferred waste
	  o Haul costs for 115-miles one way shown in Summary
	• RFP/negotiations for long-term disposal capacity
	• Multi-year contract, assume minimum 10 years with option for renewal
	• Assumed landfill tip fee (2021$)
	  o MWA Metro Park East Landfill, $$38/ton
	  o Private landfill in Illinois

SOLID WASTE SERVICES CAMPUS 2	
Campus 2	• Total site = 50 acres • Revenue bonds assumed to finance development • Financing assumptions

	o Facilities/Buildings, 20 years bond at annual 4% interest rate o Compost Facility, 20 years bond at annual 4% interest rate • Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts
Aerobic Organics Composting	• Total area = 30 acres w/ 100' buffer • Composting area = 21 acres by Year 2087 • Move to SW Campus • Tonnage projections from Table 4, escalated to Year 2087 • Windrow composting w/ compost turner • Windrow size 6'H x 14'W on compost pad & 7'H x 16'W on curing pad • Composting pads = asphalt • Screening & storage pads = compacted soil w/ gravel • Weighed Loads – Incoming raw materials and outgoing compost • Public Days/Hours Operation at SW Campus o Monday – Friday: 7am – 4pm (same as LF) o Saturday: 8am – 12pm (existing hours) • 6 months for composting process before screening • Compost screened prior to availability to customers • 30% compost tons produced annually sold to businesses • Utilities connections to Campus 2 assumed 1 mile away
Resource Recovery Center	• Total area = 4 acres • Building Size = 10,300 SF, resized for recyclables transfer station, includes office, breakroom & restroom facilities • No sorting of mixed recyclables – transfer only • No baler • Mixed recyclables transferred to MRF by contract hauler • Public Days/Hours Operation o Monday – Friday: 7am – 4pm o Saturday, by appointment only: 7am-4pm • Tipping floor for citizens, curbside recycling trucks and roll-off • Recommend Open-Top Loading into transfer trailers vs. current Lift and Load operation
HHM Facility	• Total area = included in RRC total • Building Size = 8000 SF • Drive-Thru Canopy = 2000 SF • HHM received, sorted, and prepared for shipment • Public Days/Hours Operation o Monday – Friday: 7am-4pm (current to 4:30) o Saturday, by appointment only: 7am-4pm (current to 4:30) • Separate building/room(s) connected to the RRC building
Scalehouse & Scales	• Total area = 10 acres • Building Size = 600 SF • 1 scale for inbound/outbound; servicing compost facility & RRC/HHW & citizen drop-off of tires, scrap metal & white goods

	• Main entrance and queuing roads included in total area • Roadways = 3000 LF
Administration & Environmental Education Center	• Total area = 2 acres • Building Size = 5500 SF • Same size as current; Two story w/ Education Center • Parking, access, landscaping, green space included in total area
Maintenance Facility	• Total area = 2 acres • Building Size = 9000 SF • Approx. size as current at Site #3 compost operations to service composting equipment, HHW/RRC equipment and roll-offs as needed • Equipment parking, access, roads - asphalt • Heated • All facilities mobile equipment maintained here • 5-ton overhead crane

Citizen Drop-Off Center	• Total area = 2 acres
	• Size = 15,000 SF for 3 bunkers & glass roll-off
	• No Z-wall or garbage unloading – self-haul residents directed to TS
	• Access roads = 170 FT each; In & Out
	• Current program materials (bunkers & roll-off) with contract haul to markets:
	   o Appliances/White Goods
	   o Tires
	   o Scrap Metal
	   o Glass
	• Use RRC loader when needed

CRLCSWA SCENARIO 3 ASSUMPTIONS

<table>
<tr><th>SCENARIO 3</th><th>MWP-RDF w/ NEW LF (CRLCSWA OWNED)</th></tr>
<tr><td>Overall SW Campus</td><td>
Total site = 320 acres
Revenue bonds assumed to finance development
Financing assumptions
Facilities/Buildings, 20 years bond at annual 4% interest rate
Compost Facility, 20 years bond at annual 4% interest rate
Landfill with 5 cells/phases of development, 10 years bond for each phase at annual 4% interest rate

Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts
</td></tr>
<tr><td>Mixed Waste Processing/RDF</td><td>
Total area = 21 acres w/ 300' buffer
MSW directed to MWP-RDF facility, other wastes direct haul to landfill
Permit by = Year 2034
First waste receipt = Year 2038
Design Capacity = 211,000 TPY (Receipt 234,000 TPY)
690 TPD
2 Process Lines at each 35 to 40 TPH per shift
Building Size = 112,000 SF
Unloading Bays = 12, to include citizen self-haul
RDF storage = 1 week
Recovered materials storage = 1 week

Process equipment to include shredders, magnets, screens, eddy current, optical sorters, and AI/robotics to recover more and cleaner recyclables
Recovered Materials
Ferrous Metals = 1.0% of MSW
Non-Ferrous Metals = 0.4% of MSW
Plastics #1 = 0.2% of MSW
Plastics #2 = 0.1% of MSW
OCC = 1.0% of MSW
RDF = 70% of MSW

Haul RDF to markets within assumed 50-mile radius
Rejects & Process Residue/Fines to landfill
Rejects = 10% of MSW
Shrinkage = 1% of MSW
Process Residue/Fines = Remainder after recovered materials and RDF and shrinkage, typically > 5%

Public Days/Hours Operation (waste receipt)
Monday – Friday: 7am – 4pm
Saturday, by appointment only: 7am – 2pm

Work Hours:
Tipping Floor – M-F 6:30am-4:30pm, Sat 6:30am-2:30pm
Processing – one 8-hour shift Mon-Sat, initially
Increase shifts after Year 10

Utilities connections assumed 1 mile from site
</td></tr>
</table>

New Landfill	• Total area = 141 w/ 500' buffer
	• Landfill size = 50 acres
	• Number of landfill cells/phases = 5; first cell will be largest
	• Non-processible waste and WTE rejects and ash to new landfill
	• Permitted by = Year 2035
	• Assume start waste receipt = Year 2038
	• Provide capacity for = 50 years (i.e. Year 2087)
	• Tonnage projections from Table 4 of SW Volumes Memo escalated to Year 2087 at same rate
	• Same Public Days/Hours operation
	  o Monday – Friday: 7am – 4pm
	  o Saturday, by appointment only: 7am – 2pm
	• Work Hours: 6:30 am-4:30/5pm M-F, 6:30am-2:30pm Sat
	• Leachate managed on-site with evaporation pond and leachate recirculation
	• Water truck shared with composting operation

Aerobic Organics Composting	• Total area = 30 acres w/ 100' buffer
	• Composting area = 21 acres by Year 2087
	• Move to SW Campus
	• Tonnage projections from Table 4, escalated to Year 2087
	• Windrow composting w/ compost turner
	• Windrow size 6'H x 14'W on compost pad & 7'H x 16'W on curing pad
	• Composting pads = asphalt
	• Screening & storage pads = compacted soil w/ gravel
	• Weighed Loads – Incoming raw materials and outgoing compost
	• Public Days/Hours Operation at SW Campus
	  o Monday – Friday: 7am – 4pm (same as LF)
	  o Saturday: 8am – 12pm (existing hours)
	• 6 months for composting process before screening
	• Compost screened prior to availability to customers
	• 30% compost tons produced annually sold to businesses

Resource Recovery Center	• Total area = 4 acres
	• Building Size = 10,300 SF, resized for recyclables transfer station, includes office, breakroom & restroom facilities
	• No sorting of mixed recyclables – transfer only
	• No baler
	• Mixed recyclables transferred to MRF by contract hauler
	• Public Days/Hours Operation
	  o Monday – Friday: 7am – 4pm
	  o Saturday, by appointment only: 7am-4pm
	• Tipping floor for citizens, curbside recycling trucks and roll-off
	• Recommend Open-Top Loading into transfer trailers vs. current Lift and Load operation

HHM Facility	• Total area = included in RRC total • Building Size = 8000 SF

	• Drive-Thru Canopy = 2000 SF
	• HHM received, sorted, and prepared for shipment
	• Public Days/Hours Operation
	    o Monday – Friday: 7am-4pm (current to 4:30)
	    o Saturday, by appointment only: 7am-4pm (current to 4:30)
	• Separate building/room(s) connected to the RRC building

Scalehouse & Scales	• Total area = 10 acres • Building Size = 600 SF • 3 scales (2 inbound, 1 outbound) • Main entrance and queuing roads included in total area • Roadways = 3000 LF
Administration & Environmental Education Center	• Total area = 2 acres • Building Size = 5500 SF • Same size as current; Two story w/ Education Center • Parking, access, landscaping, green space included in total area
Maintenance Facility	• Total area = 2 acres • Building Size = 17,200 SF • Approx. size as combined from Site #2 landfill and Site #3 compost ops to service LF & composting equipment, HHW/RRC equipment and roll-offs • Equipment parking, access, roads - asphalt • Heated • All facilities mobile equipment maintained here • 5-ton overhead crane

Citizen Drop-Off Center	• Total area = 2 acres
	• Size = 15,000 SF for 3 bunkers & glass roll-off
	• No Z-wall or garbage unloading – self-haul residents directed to MWP-RDF Facility
	• Access roads = 170 FT each; In & Out
	• Current program materials (bunkers & roll-off) with contract haul to markets:
	    o Appliances/White Goods
	    o Tires
	    o Scrap Metal
	    o Glass
	• Use RRC loader when needed

CRLCSWA SCENARIO 4 ASSUMPTIONS

SCENARIO 4	**AD w/ NEW LF (CRLCSWA OWNED)**

Overall SW Campus	• Total site = 320 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	  o Facilities/Buildings, 20 years bond at annual 4% interest rate
	  o Compost Facility, 20 years bond at annual 4% interest rate
	  o Landfill with 8 cells/phases of development, 7 years bond for each phase at annual 4% interest rate (some overlap of bond payments)
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

Anaerobic Digestion (AD)	• Area = 15 acres w/ 300’ buffer
	• Organic rich loads directed to AD receiving facility
	  o Organics Stream = 28% of MSW
	  o AD Capture Rate = 50% of Organics Stream w/ mandatory program
	• Other wastes direct haul to landfill
	• Permit by = Year 2035
	• First waste receipt = Year 2038
	• AD Design Capacity = 31,000 TPY processed waste
	  o 84 TPD at Year 25
	  o # Unloading Bays = 2
	  o AD Receiving Building Size = 16,000 SF
	  o Preliminary Assumes Wet AD System:
	    ▪ # Digesters = 5 to 10 (depends on unit sizes)
	    ▪ # Effluent Tanks = 3, 20K gallon
	  o Overall costs similar between Wet AD and Dry AD systems
	• Recovered Materials
	  o Biogas converted to electricity; Assume power output 750KW
	  o Digestate = 15% of processed waste (assumes post-digestion has 30% solids)
	• Rejects disposed in landfill
	  o Rejects = 5% of Select Organic Loads
	• Public Days/Hours Operation
	  o Monday – Friday: 7am – 4pm
	  o Saturday, by appointment only: 7am – 2pm
	• Work Hours: 1 shift/day, 306 days per year
	• Utilities connections assumed 1 mile from site

New Landfill	• Total area = 204 acres w/ 500’ buffer • Landfill size = 90 acres • Number of landfill cells/phases = 8; first cell will be largest • Non-Processed MSW, C&D, Special Waste and AD rejects to new landfill • Permitted by = Year 2035 • Assume start waste receipt = Year 2038

	• Provide capacity for = 50 years (i.e. Year 2087)
	• Tonnage projections from Table 4 of SW Volumes Memo escalated to Year 2087 at same rate
	• Same Public Days/Hours operation
	  o Monday – Friday: 7am – 4pm
	  o Saturday, by appointment only: 7am – 2pm
	• Work Hours: 6:30 am-4:30/5pm M-F, 6:30am-2:30pm Sat
	• Leachate managed on-site with evaporation pond and leachate recirculation, new leachate tanker truck
	• Water truck shared with composting operation

Aerobic Organics Composting	• Total area = 31 acres w/ 100’ buffer (larger to receive digestate)
	• Composting area = 22 acres by Year 2087
	• Move to SW Campus
	• Tonnages:
	  o Composting projections from Table 4, escalated to Year 2087
	  o Digestate from the AD facility
	• Windrow composting w/ compost turner
	• Windrow size 6’ H x 14’ W on compost pad & 7’ H x 16’ W on curing pad
	• Composting pads = asphalt
	• Screening & storage pads = compacted soil w/ gravel
	• Weighed Loads – Incoming raw materials and outgoing compost
	• Public Days/Hours Operation at SW Campus
	  o Monday – Friday: 7am – 4pm (same as LF)
	  o Saturday: 8am – 12pm (existing hours)
	• 6 months for composting process before screening
	• Compost screened prior to availability to customers
	• 30% compost tons produced annually sold to businesses

Resource Recovery Center	• Total area = 4 acres
	• RRC Building Size = 10,300 SF, resized for recyclables transfer station, includes office, breakroom & restroom facilities
	• No sorting of mixed recyclables – transfer only
	• No baler
	• Mixed recyclables transferred to MRF by contract hauler
	• Public Days/Hours Operation
	  o Monday – Friday: 7am – 4pm
	  o Saturday, by appointment only: 7am-4pm
	• Tipping floor for citizens, curbside recycling trucks and roll-off
	• Recommend Open-Top Loading into transfer trailers vs. current Lift and Load operation

HHM Facility	• Total area = included in RRC total • Building Size = 8000 SF • Drive-Thru Canopy = 2000 SF • HHM received, sorted, and prepared for shipment • Public Days/Hours Operation o Monday – Friday: 7am-4pm (current to 4:30)

	o Saturday, by appointment only: 7am-4pm (current to 4:30) • Separate building/separate room(s) connected to the RRC building
Scalehouse & Scales	• Total area = 10 acres • Building Size = 600 SF • 3 scales (2 inbound, 1 outbound) • Main entrance and queuing roads included in total area • Roadways = 3000 LF
Administration & Environmental Education Center	• Total area = 2 acre • Building Size = 5500 SF • Same size as current; Two story w/ Education Center • Parking, access, landscaping, green space included in total area
Maintenance Facility	• Total area = 2 acres • Building Size = 17,200 SF • Same size as combined from Site #2 landfill and Site #3 compost ops to service LF & composting equipment, HHW/RRC equipment and roll-offs • Equipment parking, access, roads – asphalt • Heated • All facilities mobile equipment maintained here • 5-ton overhead crane
Citizen Drop-Off Center	• Total area = 4 acres • Size = 57,000 SF waste unloading + 15,000 SF for 3 bunkers & glass roll-off • Access roads = 170 FT each; In & Out • Current program materials (bunkers & roll-off) with contract haul to markets: o Appliances/White Goods o Tires o Scrap Metal o Glass • Garbage o Z-wall o 7 unloading bays (same as current at Site #2 landfill) w/ roll-offs o Haul 2x / roll-off / day to landfill • Roll-off truck from AD • Use RRC loader when needed

CRLCSWA SCENARIO 5 ASSUMPTIONS

SCENARIO 5	WTE w/ NEW LF (CRLCSWA OWNED)

Overall SW Campus	• Total site = 320 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	  o Facilities/Buildings, 20 years bond at annual 4% interest rate
	  o Compost Facility, 20 years bond at annual 4% interest rate
	  o Landfill with 5 cells/phases of development, 10 years bond for each phase at annual 4% interest rate
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

WTE	• Total area = 18 acres w/ 300' buffer
	• MSW directed to WTE facility, other wastes direct haul to landfill
	• Permit by = Year 2034
	• First waste receipt = Year 2038
	• Design Capacity = 700 TPY
	  o 680 TPD at 90% availability, Year 25
	  o 2 Units at 350 TPD each
	  o WTE Building Size = 75,000 SF
	  o # Unloading Bays = 11
	  o Pit storage = 5 days
	  o Ash Management Building = 2400 SF
	• Recovered Materials
	  o Ferrous Metals = 2.0% of processed waste
	  o Non-Ferrous Metals = 0.25% of processed waste
	  o Net Energy = 600 kWh/ton processed waste
	• Rejects & ash disposed in landfill
	  o Rejects = 5% of MSW
	  o Ash = 25% of processed waste
	• Public Days/Hours Operation
	  o Monday – Friday: 7am – 4pm
	  o Saturday, by appointment only: 7am – 2pm
	• Work Hours: 24-hours/day, 365 days per year
	• Utilities connections assumed 1 mile from site

New Landfill	• Total area = 141 acres w/ 500' buffer • Landfill size = 50 acres • Number of landfill cells/phases = 5; first cell will be largest • Non-processible waste and WTE rejects and ash to new landfill • Permitted by = Year 2035 • Assume start waste receipt = Year 2038 • Provide capacity for = 50 years (i.e. Year 2087) • Tonnage projections from Table 4 of SW Volumes Memo escalated to Year 2087 at same rate • Same Public Days/Hours operation o Monday – Friday: 7am – 4pm

	o Saturday, by appointment only: 7am – 2pm • Work Hours: 6:30 am-4:30/5pm M-F, 6:30am-2:30pm Sat • Leachate managed on-site with evaporation pond and leachate recirculation, new leachate tanker truck • Water truck shared with composting operation
Aerobic Organics Composting	• Total area = 30 acres w/ 100' buffer • Composting area = 21 acres by Year 2087 • Move to SW Campus • Tonnage projections from Table 4, escalated to Year 2087 • Windrow composting w/ compost turner • Windrow size 6' H x 14' W on compost pad & 7' H x 16' W on curing pad • Composting pads = asphalt • Screening & storage pads = compacted soil w/ gravel • Weighed Loads – Incoming raw materials and outgoing compost • Public Days/Hours Operation at SW Campus o Monday – Friday: 7am – 4pm (same as LF) o Saturday: 8am – 12pm (existing hours) • 6 months for composting process before screening • Compost screened prior to availability to customers • 30% compost tons produced annually sold to businesses
Resource Recovery Center	• Total area = 4 acres • Building Size = 10,300 SF, resized for recyclables transfer station, includes office, breakroom & restroom facilities • No sorting of mixed recyclables – transfer only • No baler • Mixed recyclables transferred to MRF by contract hauler • Public Days/Hours Operation o Monday – Friday: 7am – 4pm o Saturday, by appointment only: 7am-4pm • Tipping floor for citizens, curbside recycling trucks and roll-off • Recommend Open-Top Loading into transfer trailers vs. current Lift and Load operation
HHM Facility	• Total area = included in RRC total • Building Size = 8000 SF • Drive-Thru Canopy = 2000 SF • HHM received, sorted, and prepared for shipment • Public Days/Hours Operation o Monday – Friday: 7am-4pm (current to 4:30) o Saturday, by appointment only: 7am-4pm (current to 4:30) • Separate building/separate room(s) connected to the RRC building
Scalehouse & Scales	• Total area = 10 acres • Building Size = 600 SF • 3 scales (2 inbound, 1 outbound) • Main entrance and queuing roads included in total area

	• Roadways = 3000 LF
Administration & Environmental Education Center	• Total area = 2 acres • Building Size = 5500 SF • Same size as current; Two story w/ Education Center • Parking, access, landscaping, green space included in total area
Maintenance Facility	• Total area = 2 acres • Building Size = 17,200 SF • Same size as combined from Site #2 landfill and Site #3 compost ops to service LF & composting equipment, HHW/RRC equipment and roll-offs • Equipment parking, access, roads – asphalt • Heated • All facilities mobile equipment maintained here • 5-ton overhead crane

Citizen Drop-Off Center	• Total area = 2 acres
	• Size = 15,000 SF for 3 bunkers & glass roll-off
	• No Z-wall or garbage unloading – self-haul residents directed to WTE
	• Access roads = 170 FT each; In & Out
	• Current program materials (bunkers & roll-off) with contract haul to markets:
	    o Appliances/White Goods
	    o Tires
	    o Scrap Metal
	    o Glass
	• Use RRC loader when needed

CRLCSWA SCENARIO 6 ASSUMPTIONS

SCENARIO 6	MWP-RDF w/ REGIONAL LF

Overall SW Campus	• Total site = 90 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	  o Facilities/Buildings, 20 years bond at annual 4% interest rate
	  o Compost Facility, 20 years bond at annual 4% interest rate
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

Mixed Waste Processing/RDF	• Total area = 22 acres w/ 300' buffer
	• MSW directed to MWP-RDF facility, other wastes direct haul to landfill
	• Permit by = Year 2034
	• First waste receipt = Year 2038
	• Design Capacity = 300,000 TPY (Receipt 330,000 TPY)
	  o 970 TPD
	  o 2 Process Lines each at 40-50 TPH per shift
	  o Building Size = 128,000 SF
	  o # Unloading Bays = 12, to include citizen self-haul
	  o RDF storage = 1 week
	  o Recovered materials storage = 1 week
	• Process equipment to include shredders, magnets, screens, eddy current, optical sorters, screens for organics fraction, and AI/robotics to recover more and cleaner recyclables
	• Recovered Materials
	  o Ferrous Metals = 1.0% of MSW
	  o Non-Ferrous Metals = 0.4% of MSW
	  o Plastics #1 = 0.2% of MSW
	  o Plastics #2 = 0.1% of MSW
	  o Papers = 0.7% of MSW
	  o OCC = 1.0% of MSW
	  o Organics Fines = 9.0% of MSW
	  o RDF = 70% of MSW
	• Haul RDF to markets within assumed 50-mile radius
	• Haul Organics Fines to landfills within assumed 30-mile radius for ADC use
	• Rejects & Process Residue/Fines to landfill
	  o Rejects = 10% of MSW
	  o Shrinkage = 1% of MSW
	  o Process Residue/Fines = Remainder after recovered materials, organics fines, RDF and shrinkage, typically > 5%
	• Public Days/Hours Operation (waste receipt)
	  o Monday – Friday: 7am – 4pm
	  o Saturday, by appointment only: 7am – 2pm
	• Work Hours:
	  o Tipping Floor – M-F 6:30am-4:30pm, Sat 6:30am-2:30pm
	  o Processing – one 8-hour shift Mon-Sat, initially
	  o Increase shifts as MSW received increases
	• Utilities connections assumed 1 mile from site

<table>
<tr><td></td><td>Tip Fee rate for non-CRLCSWA waste similar to rounded CRLCSWA tip fee</td></tr>
<tr><td>Transfer Station</td><td>Total area = 12 acres w/ 300’ buffer
Sized for current CRLCSWA disaster debris, C&D waste, shingles, rejects and process residue from MWP; although some material like Special Waste may need to be direct hauled to regional landfill
Design Capacity = 280 TPD
Building Size = 10,500 SF
Unloading Bays = 5
Load-out Hoppers = 1
Permit by = Year 2036
First waste receipt = Year 2038
Public Days/Hours Operation
Monday – Friday: 7am – 4pm
Saturday, by appointment only: 7am – 2pm
Work Hours: 6:30 am-4:30/5pm M-F, 6:30am-2:30pm Sat
Utilities connections extended from MWP-RDF facility</td></tr>
<tr><td>Regional Landfill</td><td>Haul waste from Transfer Station to non-CRLCSWA landfill in the region
2 LFs within 30-miles; 5 LFs within 80-miles; 6 total LFs within 115-miles
LFs within 80-miles not able or willing to take CRLCSWA transferred waste based on Regional Stakeholder discussion
Haul costs for 115-miles one way shown in Summary
RFP/negotiations for long-term disposal capacity
Multi-year contract, assume minimum 10 years with option for renewal
Assumed landfill tip fee (2021$)
MWA Metro Park East Landfill, $38/ton
Private landfill in Illinois</td></tr>
<tr><td>Aerobic Organics Composting</td><td>Total area = 30 acres w/ 100’ buffer
Composting area = 21 acres by Year 2087
Move to SW Campus
Tonnage projections from Table 4, escalated to Year 2087
Windrow composting w/ compost turner
Windrow size 6’H x 14’W on compost pad & 7’H x 16’W on curing pad
Composting pads = asphalt
Screening & storage pads = compacted soil
Weighed Loads – Incoming raw materials and outgoing compost
Public Days/Hours Operation at SW Campus
Monday – Friday: 7am – 4pm (same as LF)
Saturday: 8am – 12pm (existing hours)
6 months for composting process before screening
Compost screened prior to availability to customers
30% compost tons produced annually sold to businesses</td></tr>
<tr><td>Resource Recovery Center</td><td>Total area = 4 acres
Building Size = 10,300 SF, resized for recyclables transfer station, includes office, breakroom & restroom facilities
No sorting of mixed recyclables – transfer only
No baler</td></tr>
</table>

	• Mixed recyclables transferred to MRF by contract hauler
	• Public Days/Hours Operation
	    o Monday – Friday: 7am – 4pm
	    o Saturday, by appointment only: 7am-4pm
	• Tipping floor for citizens, curbside recycling trucks and roll-off
	• Recommend Open-Top Loading into transfer trailers vs. current Lift and Load operation

HHM Facility	• Total area = included in RRC total
	• Building Size = 8,000 SF
	• Drive-Thru Canopy = 2,000 SF
	• HHM received, sorted, and prepared for shipment
	• Public Days/Hours Operation
	    o Monday – Friday: 7am-4pm (current to 4:30)
	    o Saturday, by appointment only: 7am-4pm (current to 4:30)
	• Separate building/room(s) connected to the RRC building

Scalehouse & Scales	• Total area = 10 acres • Building Size = 600 SF • 3 scales (2 inbound, 1 outbound) • Main entrance and queuing roads included in total area • Roadways = 3,000 LF
Administration & Environmental Education Center	• Total area = 2 acres • Building Size = 5,500 SF • Same size as current; Two story w/ Education Center • Parking, access, landscaping, green space included in total area
Maintenance Facility	• Total area = 2 acres • Building Size = 17,200 SF, Heated • Approx. size as combined from Site #2 landfill and Site #3 compost ops to service LF & composting equipment, HHW/RRC equipment and roll-offs • Equipment parking, access, roads - asphalt • All facilities mobile equipment maintained here • 5-ton overhead crane

Citizen Drop-Off Center	• Total area = 2 acres
	• Size = 15,000 SF for 3 bunkers & glass roll-off
	• No Z-wall or garbage unloading – self-haul residents directed to MWP-RDF Facility
	• Access roads = 170 FT each; In & Out
	• Current program materials (bunkers & roll-off) with contract haul to markets:
	    o Appliances/White Goods
	    o Tires
	    o Scrap Metal
	    o Glass
	• Use RRC loader when needed

CRLCSWA SCENARIO 7 ASSUMPTIONS

<table>
<tr><th>SCENARIO 7</th><th>AD w/ REGIONAL COMPOSTING & REGIONAL LF</th></tr>
<tr><td>Overall SW Campus</td><td>
Total site = 80 acres
Revenue bonds assumed to finance development
Financing assumptions
Facilities/Buildings, 20 years bond at annual 4% interest rate
Compost Facility, 20 years bond at annual 4% interest rate
Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts
</td></tr>
<tr><td>Anaerobic Digestion (AD)</td><td>
Area = 15 acres w/ 300’ buffer
Packaged food waste rich loads directed to AD receiving facility
20% capture rate from CRLCSWA, Iowa City, Black Hawk County & Dubuque w/ voluntary program
Only 30% of Dubuque capture sent to regional facility
Industrial waste stream (from food manufacturing/food prep) redirected; initial 10,000 TPY
Permit by = Year 2035
First waste receipt = Year 2038
Initial AD Design Capacity = 20,000 TPY processed waste
AD Receiving Building Sized for Year 25 = 16,000 SF
Unloading Bays = 2
Pre-processing equipment to unpackage/debag food waste
Preliminary assumes Wet AD System
Add more digesters and effluent tanks as captured and redirected waste streams grow
Overall costs similar between Wet AD and Dry AD systems
May need to add combination wet and dry systems
Recovered Materials
Biogas converted to electricity; Assume power output 750KW
Digestate = 15% of processed waste (assumes post-digestion has 30% solids)
Rejects disposed in landfill
Rejects = 5% of MSW Food-rich Loads
Public Days/Hours Operation
Monday – Friday: 7am – 4pm
Saturday, by appointment only: 7am – 2pm
Work Hours: 1 shift/day, 306 days per year
Utilities connections assumed 1 mile from site
Tip Fee rate for non-CRLCSWA similar to rounded CRLCSWA tip fee
</td></tr>
<tr><td>Transfer Station</td><td>
Total area = 14 acres w/ 300’ buffer
Sized for current CRLCSWA disaster debris, C&D waste, shingles, rejects from AD, and remaining CRLCSWA MSW; although some material like Special Waste may need to be direct hauled to regional landfill
Design Capacity = 840 TPD
Building Size = 23,500 SF
</td></tr>
</table>

<table>
<tr><td></td><td><li style="list-style:none">
Unloading Bays = #12
Load-out Hoppers = 2
Permit by = Year 2036
First waste receipt = Year 2038
Public Days/Hours Operation
Monday – Friday: 7am – 4pm
Saturday, by appointment only: 7am – 2pm
Work Hours: 6:30 am-4:30/5pm M-F, 6:30am-2:30pm Sat
Utilities connections extended from AD facility</td></tr>
<tr><td>Regional Landfill</td><td>Haul waste from Transfer Station to non-CRLCSWA landfill in the region
2 LFs within 30-miles; 5 LFs within 80-miles; 6 total LFs within 115-miles
LFs within 80-miles not able or willing to take CRLCSWA transferred waste
Haul costs for 115-miles one way shown in Summary
RFP/negotiations for long-term disposal capacity
Multi-year contract, assume minimum 10 years with option for renewal
Assumed landfill tip fee (2021$)
MWA Metro Park East Landfill, $38/ton
Private landfill in Illinois</td></tr>
<tr><td>Regional Aerobic Organics Composting/ Aerated Static Pile (ASP)</td><td>Total area = 17 acres w/ 100’ buffer (smaller area needed for ASP system vs. windrows)
Composting area = 10 acres by Year 2087
Move to SW Campus
Tonnages: 230-330 TPD
Composting projections from Table 4, escalated to Year 2087
20% capture loose food waste, compostable papers & OCC/kraft paper from CRLCSWA, Iowa City, Black Hawk County & Dubuque
Only 30% of Dubuque capture sent to regional facility
Digestate from the AD facility
Enclosed receiving, raw materials storage, grinding and mixing area, building = 30,200 SF w/ 4 unloading bays
ASP System with aerated compost pad, air manifold & blowers, biofilter for odor control, aerated curing pad
Screening & storage pads = compacted soil
Weighed loads – Incoming raw materials and outgoing compost
Public Days/Hours Operation at SW Campus
Monday – Friday: 7am – 4pm (same as other SW facilities)
Saturday: 8am – 12pm (existing hours)
2-3 months for ASP composting process before screening
Compost screened prior to availability to customers
30% compost tons produced annually sold to businesses
Tip Fee rate for non-CRLCSWA food scraps/papers set at AD tip fee</td></tr>
<tr><td>Resource Recovery Center</td><td>Total area = 4 acres
RRC Building Size = 10,300 SF, resized for recyclables transfer station, includes office, breakroom & restroom facilities
No sorting of mixed recyclables – transfer only</td></tr>
</table>

	• No baler
	• Mixed recyclables transferred to MRF by contract hauler
	• Public Days/Hours Operation
	    o Monday – Friday: 7am – 4pm
	    o Saturday, by appointment only: 7am-4pm
	• Tipping floor for citizens, curbside recycling trucks and roll-off
	• Recommend Open-Top Loading into transfer trailers vs. current Lift and Load operation

HHM Facility	• Total area = included in RRC total
	• Building Size = 8000 SF
	• Drive-Thru Canopy = 2000 SF
	• HHM received, sorted, and prepared for shipment
	• Public Days/Hours Operation
	    o Monday – Friday: 7am-4pm (current to 4:30)
	    o Saturday, by appointment only: 7am-4pm (current to 4:30)
	• Separate building/separate room(s) connected to the RRC building

Scalehouse & Scales	• Total area = 10 acres • Building Size = 600 SF • 3 scales (2 inbound, 1 outbound) • Main entrance and queuing roads included in total area • Roadways = 3000 LF
Administration & Environmental Education Center	• Total area = 2 acre • Building Size = 5500 SF • Same size as current; Two story w/ Education Center • Parking, access, landscaping, green space included in total area
Maintenance Facility	• Total area = 2 acres • Building Size = 9,000 SF, Heated • Same size from Site #3 compost ops to service loaders, composting equipment, HHW/RRC equipment and roll-offs • Equipment parking, access, roads – asphalt • All facilities mobile equipment maintained here • 5-ton overhead crane

Citizen Drop-Off Center	• Total area = 4 acres
	• Size = 15,000 SF for 3 bunkers & glass roll-off
	• Access roads = 170 FT each; In & Out
	• Current program materials (bunkers, roll-off) w/ contract haul to markets:
	    o Appliances/White Goods
	    o Tires
	    o Scrap Metal
	    o Glass
	• Roll-off truck from AD
	• Use RRC loader when needed

CRLCSWA SCENARIO 8 ASSUMPTIONS

SCENARIO 8	WTE w/ Regional LF

Overall SW Campus	• Total site = 80 acres
	• Revenue bonds assumed to finance development
	• Financing assumptions
	   o Facilities/Buildings, 20 years bond at annual 4% interest rate
	   o Compost Facility, 20 years bond at annual 4% interest rate
	• Land acquisition purchase and legal support, plus risk factor costs for social justice, environmental impact, and legal efforts

WTE	• Total area = 20 acres w/ 300' buffer
	• CRLCSWA MSW directed to WTE facility, other CRLCSWA waste to Transfer Station
	• RDF/excess RDF from Ames, Iowa and Minnesota facilities; estimate 215,000 TPY of RDF feedstock
	• MSW from other Iowa communities starting at 30,000 TPY
	• Permit by = Year 2034
	• First waste receipt = Year 2038
	• Design Capacity = 490,000 TPY receipt
	   o 1400 TPD at 90% availability
	   o 2 Units at 700 TPD each; Expansion capable for another unit
	   o WTE Building Size = 94,300 SF
	   o # Unloading Bays = 15, includes citizen self-haul MSW & RDF transfer trailers
	   o Pit storage = 5 days
	   o Ash Management Building = 4800 SF
	• Recovered Materials
	   o Ferrous Metals = 2.0% of processed waste
	   o Non-Ferrous Metals = 0.25% of processed waste
	   o Net Energy = 650 kWh/ton processed waste
	• Rejects to on-site Transfer Station; Ash to Regional Landfill
	   o Rejects = 5% of CRLCSWA MSW + MSW from Iowa Communities
	   o Ash = 25% of processed waste
	• Public Days/Hours Operation
	   o Monday – Friday: 7am – 4pm
	   o Saturday, by appointment only: 7am – 2pm
	• Work Hours: 24-hours/day, 365 days per year
	• Utilities connections assumed 1 mile from site
	• Tip Fee rate for non-CRLCSWA waste same as rounded CRLCSWA tip fee. Tip Fee for RDF assumed set at lower rate for cleaner material.

Transfer Station	• Total area = 10 acres w/ approximately 300' buffer
	• Sized for current CRLCSWA disaster debris, C&D waste, shingles, and rejects from WTE, although some material like Special Waste may need to be direct hauled to regional landfill
	   o Design Capacity = 150 TPD
	   o Building Size = 6,200 SF, with expansion capability

	o # Unloading Bays = 3 o # Load-out Hoppers = 1 • Permit by = Year 2036 • First waste receipt = Year 2038 • Public Days/Hours Operation o Monday – Friday: 7am – 4pm o Saturday, by appointment only: 7am – 2pm • Work Hours: 6:30 am-4:30/5pm M-F, 6:30am-2:30pm Sat • Utilities connections extended from WTE
Regional Landfill	• Haul waste from Transfer Station to non-CRLCSWA landfill in the region • Haul ash in transfer trailers from WTE to non-CRLCSWA landfill in region • 2 LFs within 30-miles; 5 LFs within 80-miles; 6 total LFs within 115-miles o LFs within 80-miles not able or willing to take entire CRLCSWA transferred waste o Haul costs for 115-miles one way shown in Summary • RFP/negotiations for long-term disposal capacity • Multi-year contract, assume minimum 10 years with option for renewal • Assumed landfill tip fee (2021$) o MWA Metro Park East Landfill, $38/ton o Private landfill in Illinois
Aerobic Organics Composting	• Total area = 30 acres w/ 100’ buffer • Composting area = 21 acres by Year 2087 • Move to SW Campus • Tonnage projections from Memo Table 4, escalated to Year 2087 • Windrow composting w/ compost turner • Windrow size 6’ H x 14’ W on compost pad & 7’ H x 16’ W on curing pad • Composting pads = asphalt • Screening & storage pads = compacted soil • Weighed loads – Incoming raw materials and outgoing compost • Public Days/Hours Operation at SW Campus o Monday – Friday: 7am – 4pm (same as WTE) o Saturday: 8am – 12pm (existing hours) • 6 months for turned composting process before screening • Compost screened prior to availability to customers • 30% compost tons produced annually sold to businesses
Resource Recovery Center	• Total area = 4 acres • Building Size = 10,300 SF, resized for recyclables transfer station, includes office, breakroom & restroom facilities • No sorting of mixed recyclables – transfer only • No baler • Mixed recyclables transferred to local MRF by contract hauler • Public Days/Hours Operation o Monday – Friday: 7am – 4pm o Saturday, by appointment only: 7am-4pm • Tipping floor for citizens, curbside recycling trucks and roll-off

	• Recommend Open-Top Loading into transfer trailers vs. current Lift and Load operation

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Citizen Drop-Off Center	• Total area = 2 acres
	• Size = 15,000 SF for 3 bunkers & glass roll-off
	• No Z-wall or garbage unloading – self-haul residents directed to WTE
	• Access roads = 170 FT each; In & Out
	• Current program materials (bunkers & roll-off) with contract haul to markets:
	    o Appliances/White Goods
	    o Tires
	    o Scrap Metal
	    o Glass
	• Use RRC loader when needed

Cedar Rapids Linn County Board Workshop

June 21, 2022

Executive Summary

Cedar Rapids Linn County Solid Waste Agency (CRLCSWA) has been undergoing the Forward 2044 Waste Planning project. During the project process, CRLCSWA has evaluated eight scenarios for the future collection, management, and transfer of municipal solid waste, recycling, and other types of waste and materials generated by households, businesses, and industries within Linn County.

A Board Workshop was held on June 21, 2022, at the Mount Trashmore Recreational Facility in Cedar Rapids to review the findings of the Forward 2044 study, prioritize waste management alternatives, and discuss the next steps. The Board's directive and prioritization will be used to design Phase II of the Forward 2044 project.

Board Findings

The Board directives and prioritization are as follows:

1. Ensuring the health, safety, and welfare of the community through cost-effective and environmentally sound practices for the management of solid waste generated in Linn County.

2. The Agency is not considering siting a new landfill in Linn County and will pursue alternative and regional waste disposal options.

3. The Agency is aggressively pursuing near-term and long-term waste reduction strategies that would divert waste from final disposal in landfills.

4. The Agency is interested in pursuing public and/or public-private partnerships for integrated solid waste management.

5. The Agency is interested in:
    - Siting two or more transfer stations for receiving and sorting facilities in Linn County to collect, sort, process, and/or transfer recyclables, organics, and waste.
    - Continuing to evaluate waste processing technologies.
    - Pursuing a regional organics processing campus which could include anaerobic digestion and composting.
    - Having a waste management campus that continues to offer household hazardous waste, recyclables collection, and other key needed services.

6. The Agency will continue public education that allows for transparent communications of information on the Forward 2044 planning progress for access by the general public.

Forward 2044 Board Workshop: Agenda

Meeting Details

Tuesday, June 21, 2022
Time: 1:45 – 4:30 p.m.
Location: Mount Trashmore Recreational Building 948’
2250 A Street SW
Cedar Rapids, IA 52404

Agenda

1:45 – 1:55 p.m.: Introduction, Ground Rules and Meeting Goals

1:55 – 2:15 p.m.: Reviewing what we Know

2:15 – 2:30 p.m.: Learning what you Think

2:30 – 3:00 p.m.: Landfill Volume Reduction and Technology

3:00 – 3:30 p.m.: Final Disposal Siting

3:30 – 4:00 p.m.: Linn County vs Regional Partnership

4:00 – 4:20 p.m.: Next Steps

4:20 – 4:30 p.m.: Wrap Up

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CRLCSWA Strategic Planning Workshop

June 21, 2022

Forward WASTE PLANNING 2044

Ground Rules

- Everyone Speaks
- One Conversation
- Take a Stand
- Question First
- ELMO
- E-Manners

Forward WASTE PLANNING 2044

Ground Rules

Everyone Speaks
One Conversation
Take a Stand
Question First
ELMO
E-Manners

- Recharge
- Assume the Best
- Your Role/My Role
- Start/End Time
- Parking Lot
- Consensus

Forward WASTE PLANNING 2044

Today's Goals

- Uncover a path for next steps
- Learn Board's comfort level and concerns to funnel towards a long-term solution
- Gain support on landfill volume reduction – short-term diversion strategies to extend life of the current site

Forward WASTE PLANNING 2044

What we know

	New landfill (Solid Waste Agency owned)	Partner landfill	Waste transfer	Household hazardous materials	Resource Recovery Center	Aerobic organics composting	Anaerobic digestion (green waste/food)	Refused derived fuel (mixed waste) processing	Direct combustion (waste to energy)
1 New landfill	●			●	●	●			
2 Transfer to Landfill Not owned by CRLCSWA		●	●	●	●	●			
3 Mixed Waste Processing with New Landfill CRLCSWA Owned	●			●	●	●		●	
4 Anaerobic Digestion with New Landfill CRLCSWA Owned	●			●	●	●	●		
5 Direct Combustion with New Landfill CRLCSWA Owned	●			●	●	●			●
6 Mixed Waste Processing with Partnered Landfill		●	●	●	●	●		●	
7 AD/Organics with Partnered Landfill		●	●	●	●	●	●		
8 Direct Combustion with Partnered Landfill		●	●	●	●	●			●

Partner/regional approach

Capital Cost Summary

	Waste Campus Cost [a]	Technology Cost [a]	Total Capital Cost [b]	Net Tipping Fee
Scenario 1 New Landfill	$30,363,700	$103,069,800	$180,536,500	$43
Scenario 2 Transfer Station w/ Partner Landfill	$33,467,900	$30,049,300	$95,975,200	$95
Scenario 3 MWP with New Landfill	$28,986,500	$205,806,200	$348,954,700	$92
Scenario 4 AD with New Landfill	$30,585,800	$126,554,100	$220,184,900	$50
Scenario 5 WTE with New Landfill	$27,923,200	$573,669,300	$896,079,500	$153
Scenario 6 MWP with Partner Landfill	$26,859,900	$177,682,300	$309,190,700	$93
Scenario 7 AD with Partner Landfill	$42,386,700	$64,372,900	$164,363,600	$58
Scenario 8 WTE with Partner Landfill	$26,859,900	$821,991,600	$848,851,500	$72

What is Airspace?

Airspace is the volume available within the permitted landfill envelope for waste placement.

\- - -

Permitted Top-of-Waste grades

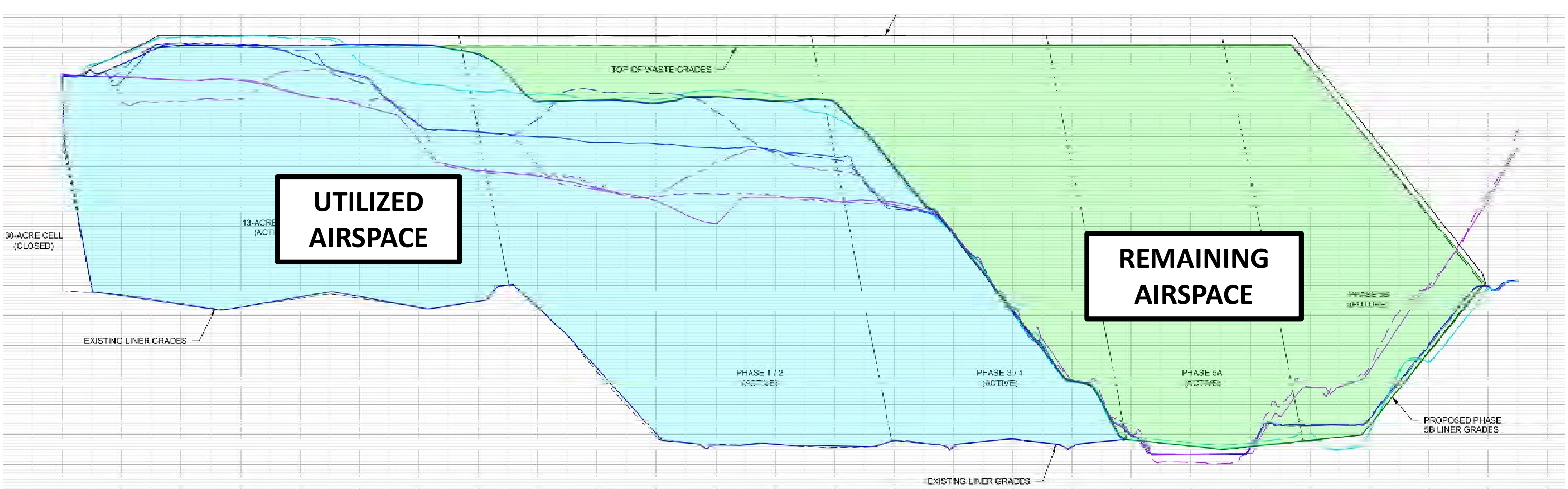
vs.

Permitted Base grades

=> Available Volume

\- - -

Airspace = Revenue



Utilized Airspace

Remaining Airspace

Landfill Airspace

Section View

Airspace as of 15-APR-2022

How does airspace translate to site life?

- Waste density is a comparison of annual volume consumed to annual tonnage.
- Waste density is applied to future projected waste receipts to estimate site life.

$$Waste\ Density\ \left(\frac{tons}{cy}\right) = \frac{Tonnage}{Volume\ consumed}$$

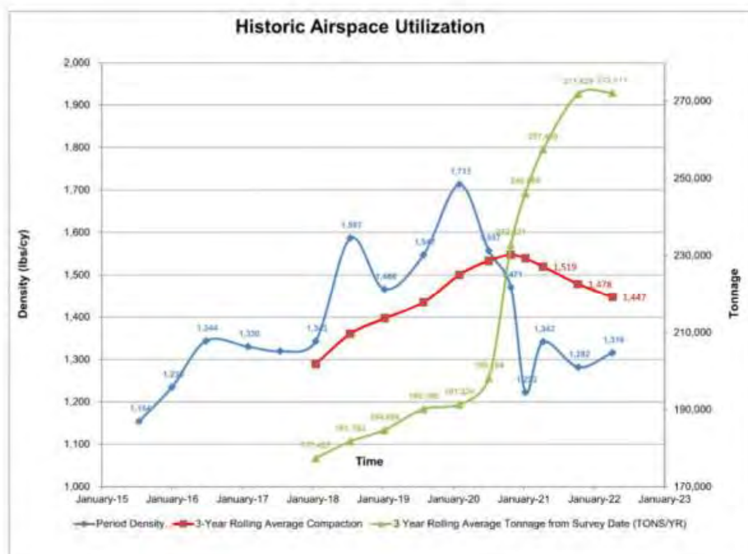
What factors cause the density to change?

- Changes in waste receipts (210,000 tons/year used for Planning)
- Changes in soil use (soil use has trended down recently)
- Changes in waste density, settlement (density increases with the height of the waste column)

Forward WASTE PLANNING 2044

Airspace as of 15-APR-2022

HDR

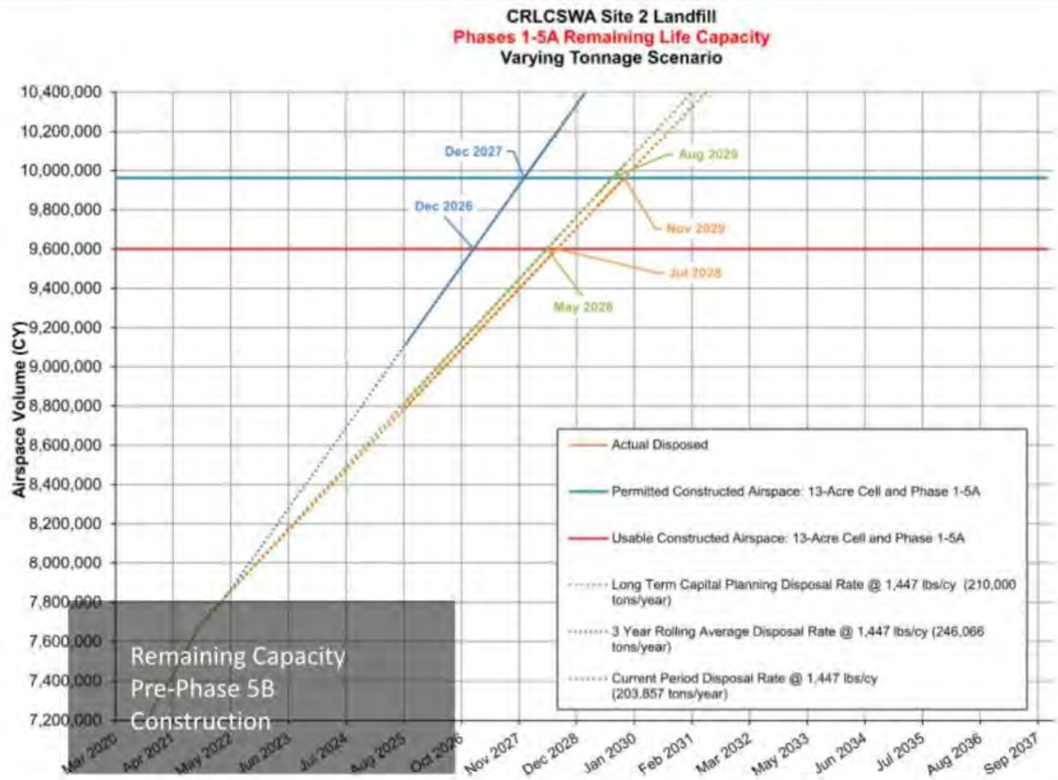


REMAINING CAPACITY 13-ACRE CELL AND PHASES 1 THROUGH 5B		
TOTAL REMAINING VOLUME (CY)	TOTAL REMAINING TONNAGE (TONS) [A]	REMAINING LIFE [B]
4,371,665	3,162,900	15 YEARS

(A) REMAINING TONNAGE BASED ON 3-YEAR ROLLING AVERAGE DENSITY OF 1,447 LBS/CY
(B) REMAINING LIFE ASSUMES A CONSUMPTION RATE OF 210,000 TONS PER YEAR

Forward WASTE PLANNING 2044

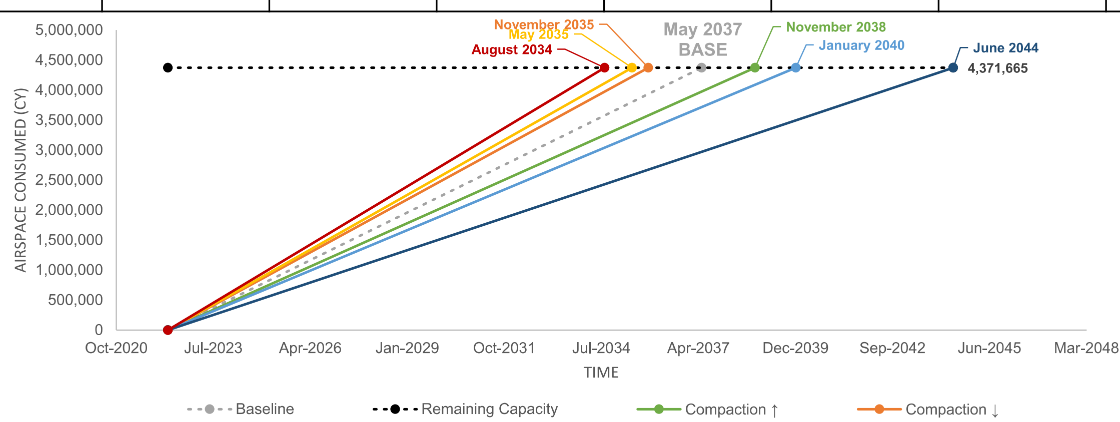
HDR



Airspace as of 15-APR-2022

Site 2 – Remaining Airspace Scenarios

	Baseline	Compaction ↑	Compaction ↓	Tonnage ↑	Tonnage ↓	Compaction ↑ Tonnage ↓	Compaction ↓ Tonnage ↑
	Tonnage (Tons/YR)	Tonnage Change (%)	Tonnage Change (%)	Tonnage Change (%)	Tonnage Change (%)	Tonnage Change (%)	Tonnage Change (%)
	210,000	**0%**	**0%**	**15%**	**-15%**	**-20.0%**	**10%**
	Compaction (LBS/CY)	Compaction Change (%)	Compaction Change (%)	Compaction Change (%)	Compaction Change (%)	Compaction Change (%)	Compaction Change (%)
	1,447	**10.0%**	**-10%**	**0%**	**0%**	**17.7%**	**-10%**
WASTE DISPOSAL RATE (TONS/YR)	210,000	210,000	210,000	241,500	178,500	168,000	231,000
ESTIMATED DATE OF LIFT COMPLETION	May 2037	November 2038	November 2035	May 2035	January 2040	June 2044	August 2034



Airspace as of 15-APR-2022

What we know

Forward WASTE PLANNING 2044

What we know

2007

Forward WASTE PLANNING 2044

What we know

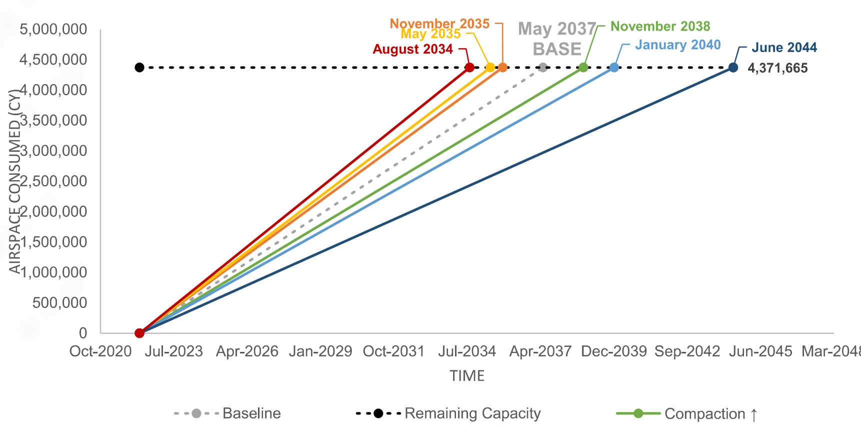
2007 + 15 Years = 2022

Forward
WASTE PLANNING
2044

What we know

2007 + 15 Years = 2022

2022 + 15 Years = 2037



Forward
WASTE PLANNING
2044

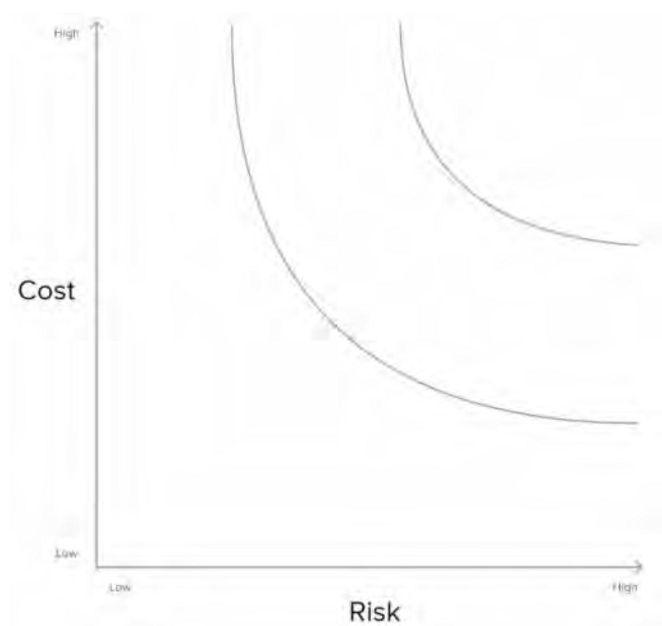
Learning what you think

	New landfill (Solid Waste Agency owned)	Partner landfill	Waste transfer	Household hazardous materials	Resource Recovery Center	Aerobic organics composting	Anaerobic digestion (green waste/food)	Refused derived fuel (mixed waste) processing	Direct combustion (waste to energy)
1 New landfill	●			●	●	●			
2 Transfer to Landfill Not owned by CRLCSWA		●	●	●	●	●			
3 Mixed Waste Processing with New Landfill CRLCSWA Owned	●			●	●	●		●	
4 Anaerobic Digestion with New Landfill CRLCSWA Owned	●			●	●	●	●		
5 Direct Combustion with New Landfill CRLCSWA Owned	●			●	●	●			●
6 Mixed Waste Processing with Partnered Landfill		●	●	●	●	●		●	
7 AD/Organics with Partnered Landfill		●	●	●	●	●	●		
8 Direct Combustion with Partnered Landfill		●	●	●	●	●			●

Partner/regional approach

Forward WASTE PLANNING 2044

Landfill Volume Reduction Technology



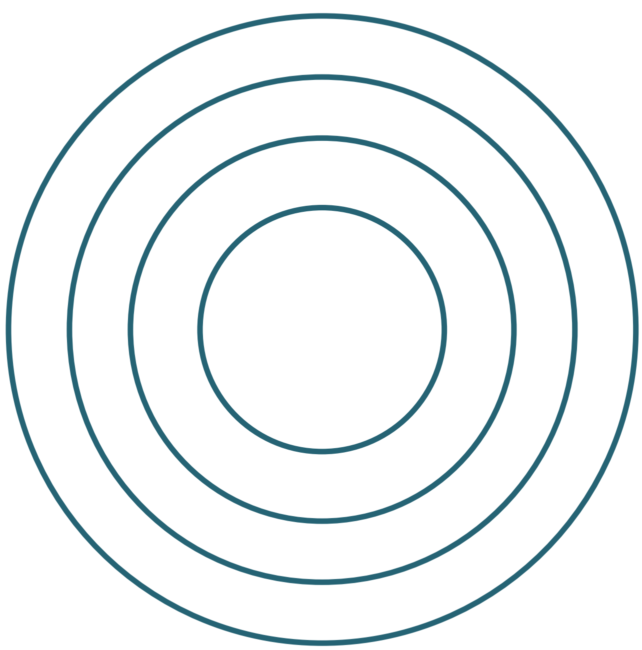
Forward WASTE PLANNING 2044

Final Disposal Siting

Landfill vs Transfer Station(s) to Landfill(s)

Forward WASTE PLANNING 2044

Linn County vs Regional Partnership



Forward WASTE PLANNING 2044

Next Steps – Original Goals

- Reduce amount of waste landfilled
- Ensure landfill space is available in case of high-volume event (i.e., derecho)
- Provide competitive rates
- Provide end markets where possible
- Provide public education
- Conserve environmental resources
- Manage risk associated with waste disposal
- Minimize impact on surrounding community (i.e., odor)

Forward WASTE PLANNING 2044

Next Steps – Phase 2 Goals

- Technology
- Transfer (or not)
- Regional Partnership (or not)

Forward WASTE PLANNING 2044

Wrap-up!

Forward
WASTE PLANNING
2044

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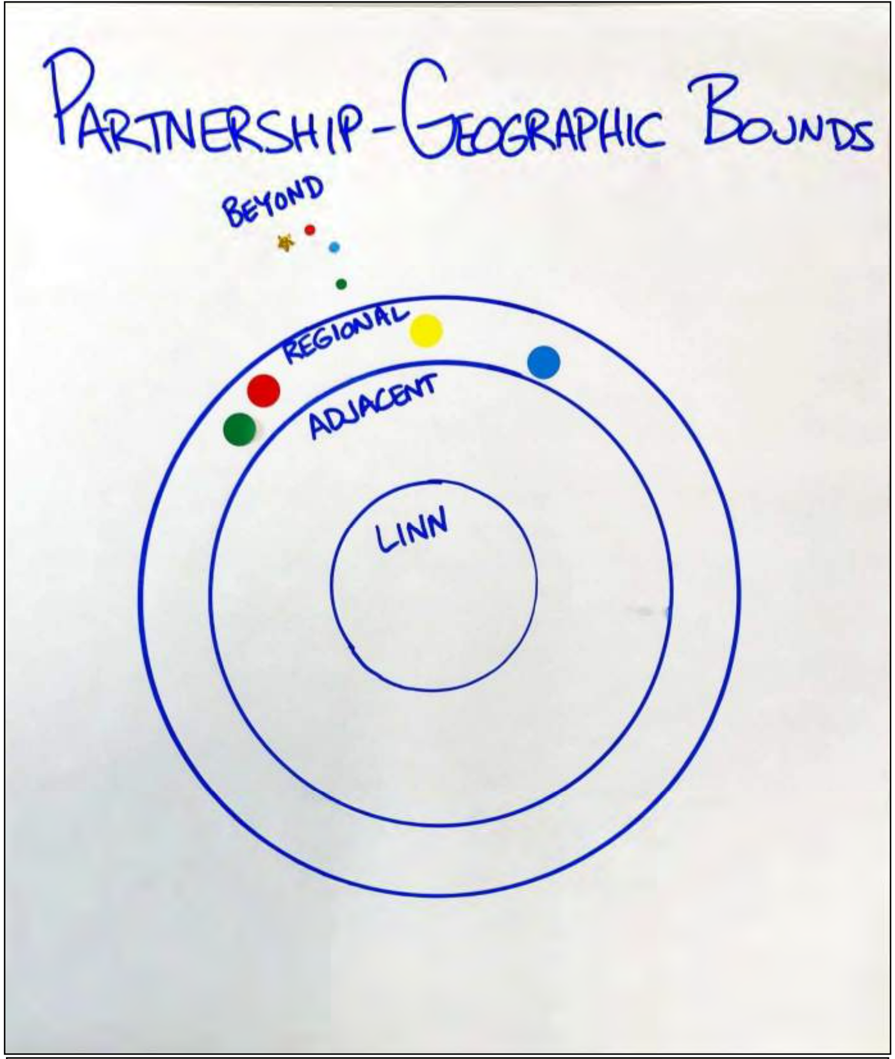
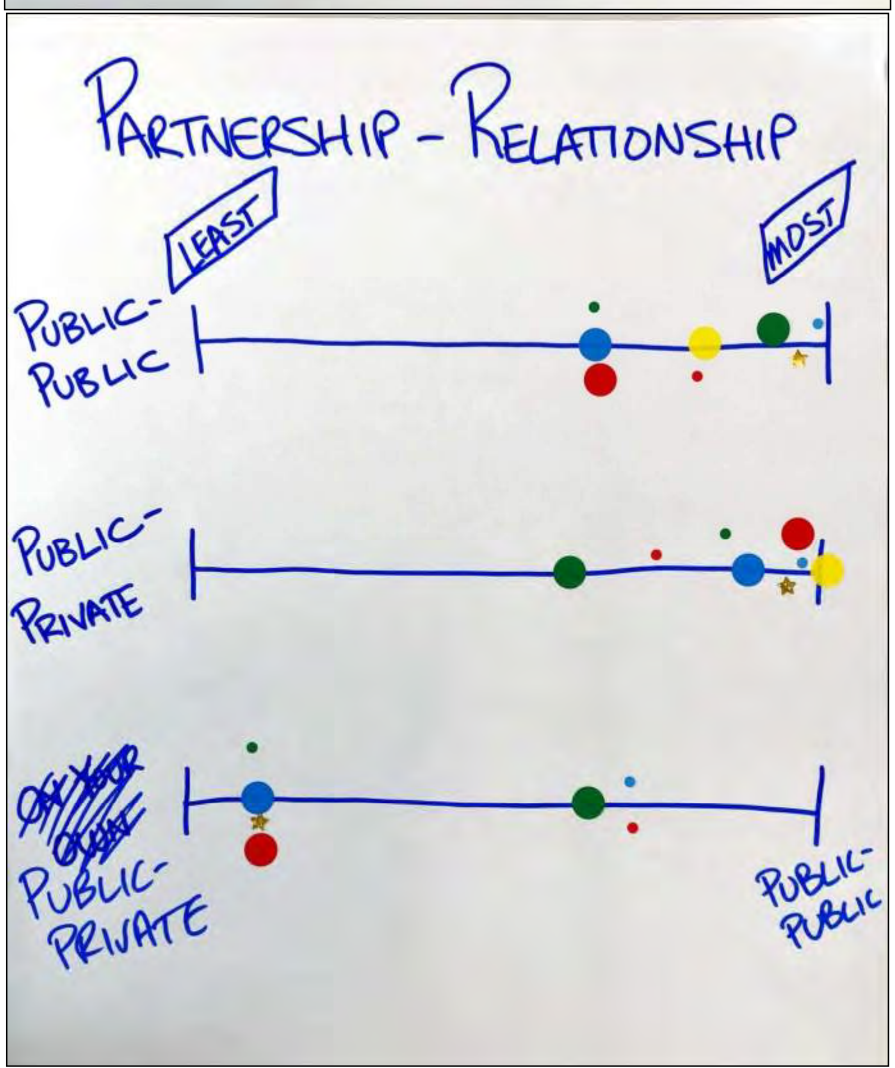

PARTNERSHIP - GEOGRAPHIC BOUNDS
BEYOND
REGIONAL
ADJACENT
LINN


PARTNERSHIP - RELATIONSHIP
LEAST
MOST
PUBLIC-
PUBLIC
PUBLIC-
PRIVATE
PUBLIC-
PRIVATE
PUBLIC-
PUBLIC

FINAL DISPOSAL SITING . 2

- DO WE OWN A TNSFR STA?
  - IT'S A REVENUE STREAM. GOOD IDEA
  - ALSO LIABILITY... NOT HAVING LIABILITY IS ATTRACTIVE
  - OWN STATION, BUT NOT THE HAULERS
- OUR LANDFILL FUNDS OUR PROGRAMS.. WHAT HAPPENS WHEN DOESN'T FUND? NEED TO HAVE A DIFF. $ STRUCTURE
- CAN BE A TEMP SOLUTION, NOT ENDGAME
  ALLOWS FLEX TO KEEP EYE ON EMERGING TECH
- TRANSFER CAN BE DIVERSION TO HELP GET TO 2044
  COMMUNICATION IS KEY

FINAL DISPOSAL SITING

~~LANDFILL~~ TRANSFER TO LANDFILL(S)

- TRANSFER WON'T GO TO WITHIN IOWA
- MORE OPEN TO REGIONAL ORGANICS
- BENTON IS NOT INTERESTED
- ENVIRONMENTAL CONCERNS DUE TO VEH. TRAFFIC
- AT LEAST 2 TRANSFER STATIONS (RURAL/URBAN)
- INFRASTRUCTURE TO SERVE INDUSTRIAL WASTE BEING MET IN THE MARKET
- RISK OF PRICING YOURSELF OUT OF INDUSTRY MARKET - KEEP AN EYE ON TIPPING FEES
  - INDUSTRY ALSO HAVE ZERO WASTE PLANS
  - OPPORTUNITIES ON BOTH SIDES
  - DOES AD GET THOSE BENEFITS? NOT IN LINN COUNTY - WOULD NEED TO ~~[illegible]~~ CO-LOCATE W/ ORGANICS

NEXT STEPS / GOALS

- SUMMARIZE + THINK ABOUT LOGICAL
  NEXT STEPS FOR
  - SHORT TERM - DIVERSION, WASTE CHARACTERIZATION STUDY
  - LONG TERM
- WHAT ENDS THE PROCESS?
  TARGET LOW HANGING FRUIT TO HELP
  ACHIEVE BIG PICTURE
  ALSO LOOKING AT PARTNERSHIPS, ETC TO IDENTIFY
  PATH FORWARD
- TIMELINES REQUIRE DECISIONS FOR NOW
  + TO BUILD TO 203x →
- SCOPE

NEXT STEPS / GOALS. 2

- TRY TO BUY MORE TIME, EVEN IN
  OUR OWN LANDFILL... REMOVE / TRANSFER
  STUFF THAT DOESN'T COMPACT
- IDENTIFY WHAT CAN GO
  - BRING ALONG THE REGION
  - REACH OUT AGAIN TO OTHER COUNTIES

SHORT TERM - (CONCURRENT PATHS) - LONG TERM

TO GET US TO 6/30/44   > 7/1/44

TEST WATERS NOW IF
WE WANT

MARION + U OF IA
POSSIBILITIES

FUTURE REGS INCL PFAS

NOW WE ADDRESS FUTURE RISK MITIGATION
ID FUTURE OPPS

LANDFILL VOLUME REDUCTION .2

RISK VS COST COMPARISON HEAVILY
IMPACTED BY COST ESTIMATES

INVESTMENT RISK IS LARGE

UNKNOWN FUTURES ARE A RISK (E.G. CHINA RECYCLEABE MARKET)

→ MANY EXTRA VARIABLES

TECH OF WTE NOT AVAILABLE YET

ALWAYS NEW TECH COMING BUT TOO LATE BECAUSE OF PLANNING END

CAN'T KEEP WAITING

PARALLEL TO SOLAR (INCLUDING SUBSIDIES PARALLEL)

THINK OF WASTE AS ~~PARA~~SEGMENTS OF WASTE GOING TO KEY LOCATIONS TO BE ON CUTTING EDGE

GOALS

- MAKE PRACTICAL STEPS TOWARDS FUTURE OPPORTUNITIES
  - NOT RIGID IF SOMETHING NEW ARISES

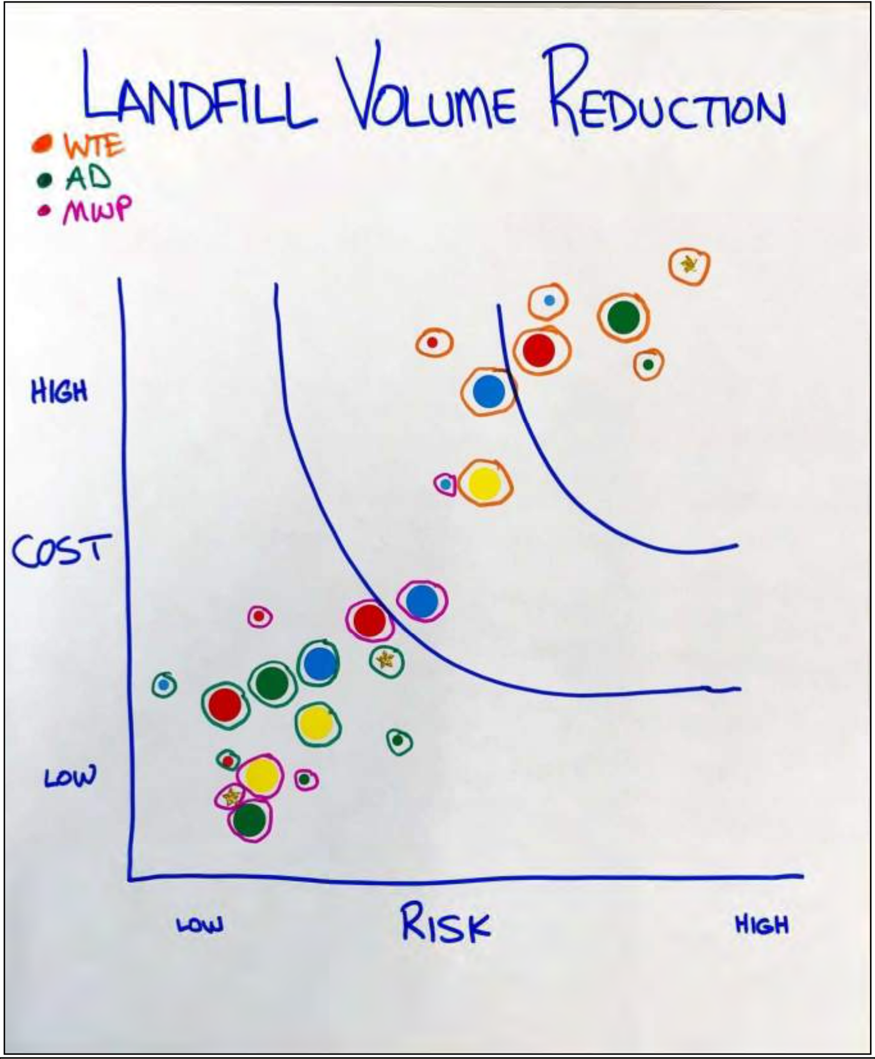
LANDFILL VOLUME REDUCTION

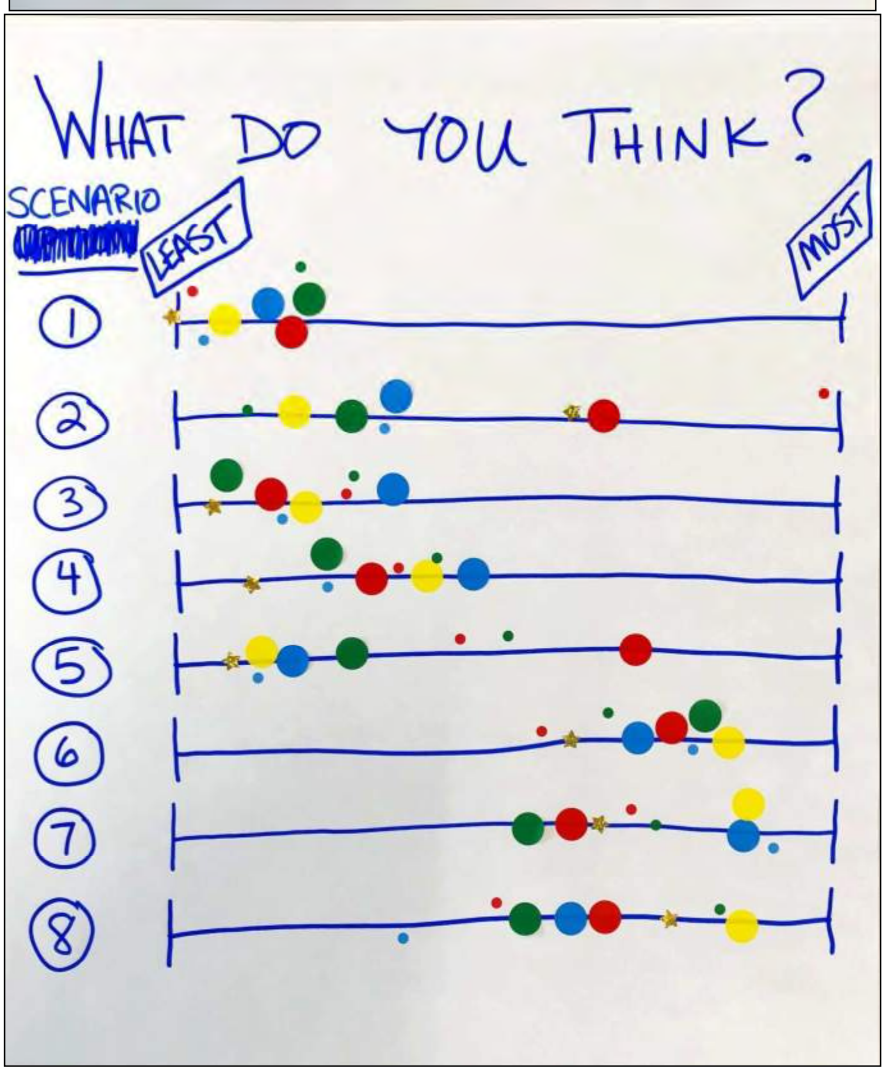
- WTE CONCERNS ABOUT ENV + ACCEPTANCE
  - KATE → REGULATED HEAVILY
    DO HAVE CONCERNS INCL. E.J.
    E.G OF CONCERNS IN FL, MN → RENEWABLE ENERGY
- WHO REGULATES
  - IDNR – AIR PERMITS
- DO WE WANT TO MAKE FUEL MORE ECONOMICALLY VIABLE

ALSO IN AMES

A/D ALSO RENEWABLE

WTE IN IA
NOT WORKING 80% OF TIME


LANDFILL VOLUME REDUCTION
WTE
AD
MWP
HIGH
COST
LOW
LOW
RISK
HIGH


WHAT DO YOU THINK?
SCENARIO
LEAST
MOST
1
2
3
4
5
6
7
8