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

[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 aeriation 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