Barnstable County

MSW Diversion Options For Recyclable, Reusable and Hard to Dispose Waste Materials

Summary Report: Cost Avoidance and Long-Term Future Plan

209-4203746
November 11, 2021

TETRA TECH

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NOVEMBER 11, 2021
PROJECT NUMBER: 209-4203746

PRESENTED TO

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EXECUTIVE SUMMARY

Historically, landfilling and waste-to-energy have been the long-term, cost-certain, and environmentally compliant solutions for the management of waste. The regulatory climate moving forward has demonstrated an increasing reluctance to permit new landfill capacity in the Massachusetts region. In addition, waste-to-energy facilities are continuing to be under scrutiny from air permitting and greenhouse gas emission perspectives. Moreover, it is increasingly likely that future state regulations and planning efforts will mandate additional portions of the waste stream, in both quantity and quality, be diverted from disposal.

As a result, it is likely that over the longer-term planning horizon that Cape and Island communities will have fewer final disposal options that will be conveniently located and accessible, and it will become increasingly uncertain if the region will have access to recycling or waste diversion infrastructure sufficient to meet (what is likely to be) ever increasingly stringent diversion mandates. This would result in increasingly higher disposal and transportation costs and challenges in meeting state diversion mandates.

Barnstable County is in a position to advance longer term, comprehensive municipal waste management by aligning its member municipalities, including the towns on Martha's Vineyard and Nantucket, towards regional resiliency.

This report is a technical summary comprised of the five technical memos previously submitted as supporting information. Tetra Tech conducted a high-level analysis of traditional and innovative options to reduce, reuse, re-purpose and market identified waste material streams.

Cape and Islands Towns Waste Material Streams

From 2017 to 2020, the year-round population on Cape Cod increased by 1.02% from 214,107 in 2017 to 216,294 in 2020 *(2020 Cape Cod Commission).* With the influx of summer residents and tourists, the population density increases to more than 500,000 during peak tourist periods.

To begin the process of benchmarking the magnitude of seasonal variations in the waste material stream, monthly tonnage data was requested from the town transfer stations within Barnstable County and included two towns on Martha's Vineyard *(Oak Bluffs and Tisbury)* in Dukes County. Some, but not all, municipalities provided data.

The most reported material stream was for municipal solid waste (MSW), with thirteen of the fifteen Barnstable County town transfer stations reporting monthly data.

Figure 1: MSW Generation Per Month (in Tons)

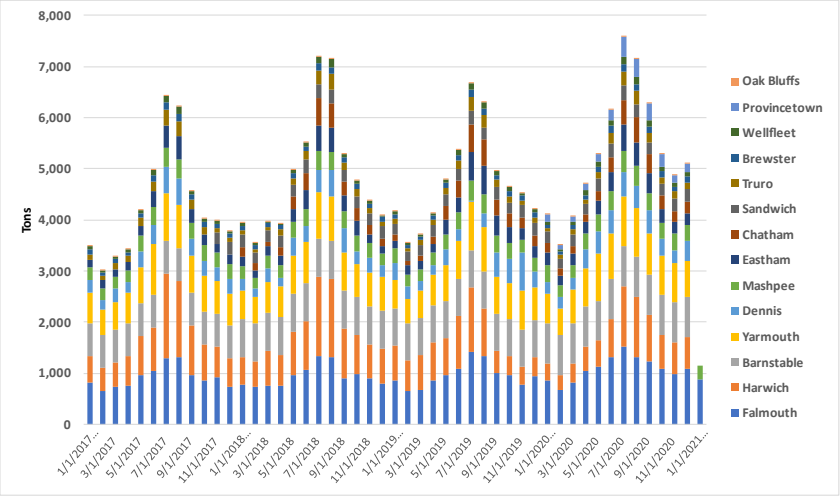

Figure 1 shows the results for the MSW monthly tonnages from municipal programs with the obvious seasonal fluctuations between the summer and winter seasons. In most cases, the waste stream doubles in tonnage between May through September. These material volumes are not inclusive of municipal or private waste hauler subscription service pick-up at the curb.

- The estimated total generation of MSW was ± 64,500 tons per year collected at the fifteen town transfer stations within Barnstable County.
- The estimated total generation of Construction and Demolition materials (C&D) was ± 30,150 tons per year collected at the fifteen town transfer stations within Barnstable County.
- The estimated total generation of Recycling was ± 20,500 tons per year collected at the fifteen town transfer stations within Barnstable County.
- The estimated total generation of Yard Debris was ± 19,300 tons per year collected at the fifteen town transfer stations within Barnstable County.

Industry and Regulatory Shifts

Paradigm shifts in solid waste management have occurred over time. While we continue to have landfilling and waste-to-energy as waste solutions, the paradigm for materials management continues to evolve as markets shift and new technologies become available allowing us to realize a larger fraction of value from resources that are discarded, bringing us to a more circular infrastructure and economy.

The Massachusetts Department of Environmental Protection (MassDEP) will continue to set aggressive waste reduction goals and strive towards a zero-waste future in Massachusetts. Moreover, solid waste disposal options and capacity in Massachusetts and throughout the region are increasingly limited, which will result in progressively higher disposal and transportation costs.

The County is in a position to provide guidance and insights to assist Cape Cod towns and Islands towns in their collaborative planning to divert valuable materials through organics processing, reuse, and recycling programs and incorporate regional sustainability goals.

This report is intended as a starting point for the County to build consensus and focus on future solid waste management.

For the longer-term planning horizon, Tetra Tech recommends that it is in the best interest of Barnstable County to engage the Joint Base Cape Cod (JBCC) to seek land use instruments for parcels of land at the JBCC most suited for future development of waste material processing/waste diversion infrastructure. Having use over suitable land at the JBCC (or other suitable available land) would provide the communities with a measure of certainty over their solid waste management responsibilities that they do not currently possess. This unique opportunity presents the following advantages and flexibility to the County.

- Future solid waste infrastructure projects can be cooperatively considered and pursued among the County and member communities to build consensus regarding specific goals and mechanisms for development.

- Successful infrastructure implementation at the JBCC will increase capacity of local government, communities and other stakeholders to adopt and implement sustainable materials management policies, practices and incentives for decades to come.

- Identifying land to locate potential future technologies will place the Cape and Islands in the best position to take advantage of regional waste management opportunities and potential funding sources.

- The markets are dynamic with current levels of waste generation and market prices fluctuating. The current trend of mergers and acquisitions in the solid waste industry and impacts of COVID-19 make it even more challenging for communities to manage their municipal solid waste stream cost effectively and to plan for the future.

- Climate mitigation and greenhouse gas emissions will be an integral element in infrastructure. Reuse and recyclable content could be a priority in infrastructure projects to help meet environmental, sustainability and climate goals.

The solid waste management dynamic is challenging as there are no current solutions in waste conversion technologies that are acceptable to the Massachusetts Department of Environmental Protection (MassDEP). The MassDEP has revised the State Solid Waste Master Plan 2030 (the Plan) and revisions to regulations *310 CMR 16.00 Site Assignment for Solid Waste Facilities and 310 CMR 19.00 Solid Waste Management*. The Plan is revised in ten-year increments. As such, now is the opportunity for the County to start the process on how to organize the towns on the Cape and Islands to prepare for the implementation of MassDEP future policy mandates.

Combined or collaborative approach is the direction that municipalities and counties across the country are moving toward. Working together to keep costs down through regional planning for a sustainable materials management infrastructure will ensure the Cape and Islands are more resilient to markets and support a growing population.

Barnstable County has an opportunity to work with the towns of the Cape and Islands to supplement a significant portion of their solid waste management into a system that will maximize resource reuse and align with long-term necessities for a more circular paradigm of resource management.

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AD	Anaerobic Digestion
ADS	Advanced Drainage Systems Recycling
ASP	Aerated Static Pile
CASP	Covered Aerated Static Pile
CCC	Cape Cod Commission
C&D	Construction and Demolition
ECA	Education Center and Administration
FCSWMD	Franklin County Solid Waste Management District
FOG	Fats, Oils and Grease
JBCC	Joint Base Cape Cod
MassDEP	Massachusetts Department of Environmental Protection
MBA	Massachusetts Beverage Association
MFA	Massachusetts Food Association
MRF	Materials Recovery Facility
MRWMD	Monterey Regional Waste Management District
MSW	Municipal Solid Waste
R&E	Ramsey/Washington Counties Recycling and Energy, Minnesota
RDF	Refuse Derived Fuel
RFPs	Request For Proposals
RNG	Renewable Natural Gas
SSRC	South Shore Recycling Cooperative
SSO	Source Separated Organics
SWMP	Solid Waste Master Plan
TS	Total Solids
UCRTS	Upper Cape Regional Transfer Station
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

Barnstable County retained Tetra Tech to conduct a high-level analysis of the County's municipal solid waste (MSW) diversion options for recyclable, reusable and hard to dispose waste materials. The study focused on identified materials collected at the Cape and Island towns transfer stations. Through this study, certain strategies and considerations were identified to assist in mitigating future solid waste management costs in the County and to foster stronger relationships and system resiliency on Cape Cod and the Islands.

- Barnstable County is positioned to advance longer term, comprehensive leadership by aligning its fifteen member municipalities, including Nantucket and Martha's Vineyard, towards regional resiliency. The Barnstable County Home Rule Act (1988) established a legislative body with the power to enact ordinances and certain rights of home rule, and increased citizen participation in County government.

- The Cape Cod Commission Act (1990) formed a regional planning department for the County with regulatory power.

The leadership role toward collaboration for solid waste management aligns with the County's regional focus for services and programs. The County has a procurement department that currently provides support for group contract and purchasing which would naturally be of use to support solid waste procurement efforts. Moreover, the County provides many services and programs that the towns of the Cape may not otherwise afford to provide for themselves. These services are beneficial especially for these towns that experience large influx of population during the summer months. Since Barnstable County already has a regional government structure in place, the County is the logical entity to assist the Cape and Islands towns to prepare for a more resilient, future sustainable materials management system.

The regulatory climate is very challenging to permit new or expanded landfill capacity in Massachusetts. Moreover, waste-to-energy facilities are under increasing scrutiny due to air pollution concerns and directives to reduce greenhouse gas emissions. As a result, there will likely be fewer and fewer disposal options that are accessible to the Cape and Islands communities, which will result in increasingly higher disposal and transportation costs.

The County and member communities could build consensus regarding specific goals and mechanisms for development toward future solid waste infrastructure projects to be cooperatively considered and pursued. The County is in a position to provide guidance and insights to assist Cape Cod and Islands towns in their collaborative planning to divert valuable materials through organics processing, materials reuse, and recycling programs and incorporate regional sustainability goals with a focus on zero-waste.

This MSW Diversion report is just the beginning to build consensus and focus on the Cape and Islands' future solid waste management. The report is also an opportunity to provide information in a broad sense for local, regional and state policy makers.

1.1 OBJECTIVES

Tetra Tech conducted research to look historically and plan forward to determine reuse, recycling, pre-processing and beneficial end-use markets for the components of the waste materials stream. This report brings together the research and findings to identify cost avoidance and recommendations including regional and sub-regional facility options for processing the portion of the MSW stream that is collected at the Cape and Island towns transfer stations.

- Present options for public/public, public/military, and public/private collaborations to achieve goals.
- Cost avoidance analysis for the recommended options and municipal design/build/operate opportunities.

This report is a technical summary comprised of the five technical memos previously submitted as supporting information. It aims to provide a high-level analysis to indicate how the County could proceed to assist the towns of the Cape and Islands in a long-term planning strategy looking out five to fifteen years, or more; specifically, for reserving acreage for materials management facilities and innovation. This report presents information and hypothetical options that can be used by the towns to plan for future municipal solid waste management. The theoretical options are presented for consideration purposes and not intended to present a preconceived plan.

1.2 BARNSTABLE COUNTY MUNICIPAL SOLID WASTE STREAM

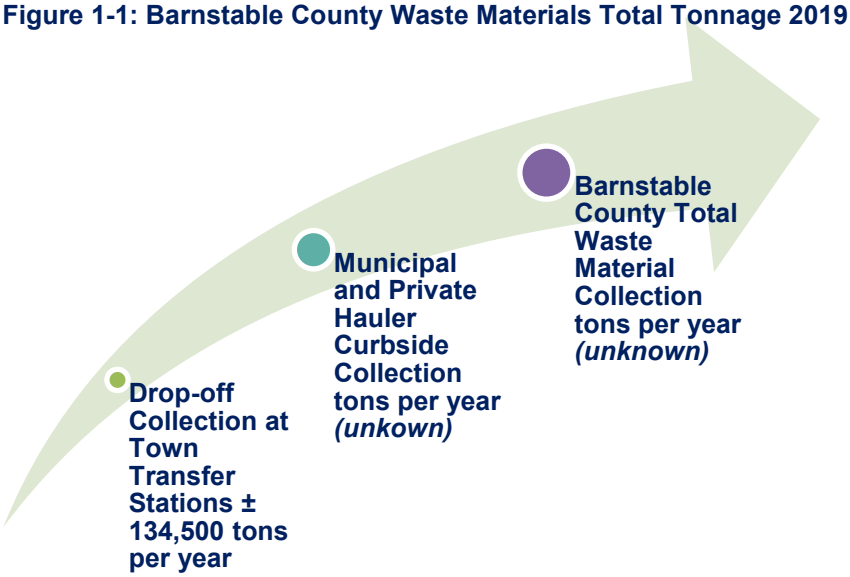
This section of the report provides an overview of the portion of the waste stream that is collected at the Cape and Island towns transfer stations. To get a sense of the seasonal variations in the waste stream, monthly tonnage data was requested from the transfer stations within Barnstable County and included two towns on Martha's Vineyard (Oak Bluffs and Tisbury) in Dukes County. Some, but not all municipalities provided data.

This study focused on the MSW and recycling materials coming through the town Transfer Stations whether by drop-off or curbside service by a private hauler. This study does not include residential MSW, and recycling picked up by a private hauler subscription service, business disposal or commercial generated tonnage unless those private haulers pay a tip fee at the Transfer Stations. Some Transfer Stations do allow for private haulers to tip for a fee. This analysis is based on the information provided by the Transfer Stations.

Figure 1-1 shows the known quantity of waste materials collected at the town transfer stations estimated at 134,500 tons per year in 2019.

The most reported material stream by the town transfer stations was for MSW, with thirteen of the fifteen Barnstable County town transfer stations reporting monthly data. Recyclable materials were also well reported with eleven town transfer stations reporting monthly tonnages as well as data from the Oak Bluffs transfer station.

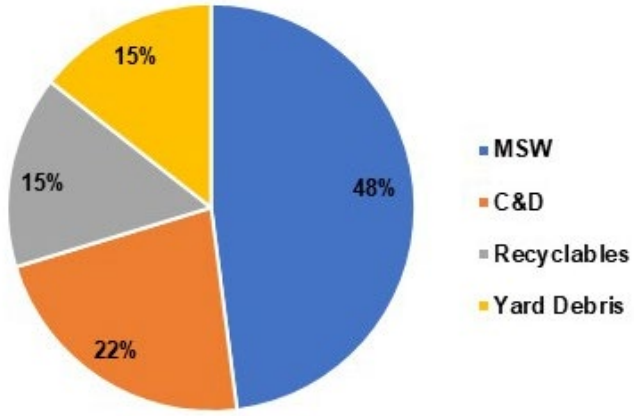
Figure 1-1: Barnstable County Waste Materials Total Tonnage 2019



The final two major quantity material component streams collected at the town transfer stations were construction and demolition (C&D) and yard debris. There was less information available on food waste collection at the town transfer stations, as residential food waste collection is relatively new with nine municipalities providing a drop-off location for collection within Barnstable County.

Figure 1-2 shows the percentages of the four major material components of the waste stream.

Figure 1-2: Largest Material Components



The Cape and Islands towns transfer station facilities developed organically over the course of decades to serve as small, convenient drop-off locations for businesses and residents to deliver their solid waste. Over time, these facilities also incorporated small volume recycling/drop-off opportunities into their already limited facility footprints. None of the facilities were planned, located, or intended to serve as County-wide infrastructure for either waste consolidation or recycling processing and diversion. Moreover, residential encroachment renders a great deal of these existing facilities poor candidates on which to expand larger volume, comprehensive solid waste processing operations.

Barnstable County should consider the entire waste stream and not just the fraction that is collected at the town transfer stations. This includes private hauler and commercial collection services. A recommendation is for the County to look at this missing municipal solid waste (MSW) data as there is more waste stream data available to incorporate for aggregated volume cost effectiveness.

1.2.1 Zero Waste Future and Climate Mitigation

The Massachusetts DEP (MassDEP) envisions a zero-waste future that would require Massachusetts to move toward policies requiring reusable, recyclable and compostable materials to be diverted from disposal at an extremely high rate while eliminating the use of products/packaging that are not reusable, recyclable, or compostable. These changes to material handling will require significant policy actions, societal change and infrastructure at a local and regional level.

The material markets are dynamic, with current levels of waste generation and market prices fluctuating. Moreover, the current trend of mergers and acquisitions in the solid waste industry, and impacts of COVID-19 make it even more challenging for communities to manage their municipal solid waste stream cost effectively and to plan for the future. Reuse and recyclable content will also be a priority in infrastructure projects to help meet State solid waste goals, but also environmental, sustainability and climate mitigation goals.

2.0 DEVELOPMENT SCENARIO FOR SHARED RESOURCES

To help the towns develop a shared vision the County should develop:

- Stepped, phase-in approach
- Vision and strategy for future/ongoing infrastructure planning

For the Longer-Term Future Plan, it is in the best interest of Barnstable County to engage the Joint Base Cape Cod (JBCC) to seek land use instruments for land at the JBCC most suited for future development as waste processing/waste diversion infrastructure. This unique opportunity presents the following advantages and flexibility to the County:

1. **There is limited space and opportunity to develop larger volume, County-wide solid waste processing infrastructure at existing transfer station facilities.** Developing larger scale solid waste processing infrastructure at a new location within the County is challenging due to lack of available land and to avoid locations proximate to development and sensitive receptors. The JBCC presents the opportunity to set aside large potential development areas further removed from existing development than is available anywhere else in the County.

2. **The regulatory climate moving forward is increasingly reluctant to permit new landfill capacity in the Massachusetts region.** Moreover, waste-to-energy facilities are under increasing scrutiny from air permitting and greenhouse gas emission perspectives. As a result, it is likely that over the longer-term planning horizon that fewer and fewer final disposal options will be conveniently located and accessible to Cape and Islands communities, which will result in increasingly higher disposal and transportation costs. Having control over suitable land at the JBCC would provide the communities with a measure of control over their solid waste management that they do not currently possess.

3. **A historical landfill development is already on property controlled by the Joint Base Cape Cod (JBCC), in addition to other potential parcels that could be of interest.** Moreover, development of disposal facilities or waste processing infrastructure has successful precedent at other divested military installations. As an example, former U.S. Army Base Fort Devens in central Massachusetts closed in 1996. The base was redeveloped into a sustainable and mixed-use community including the Devens Eco-Efficiency Center, and the Devens Recycling Center which is a full-service C&D recycling facility (90,000 square feet) on 11-acres. Devens Recycling Center recently merged operations with Republic Services.

   Another example is the Joint Base Elmendorf-Richardson (JBER) in Anchorage, Alaska that is currently in discussions with the Municipality of Anchorage, Solid Waste Services Department (SWS) about several potential alternatives which would transfer lands adjacent to the current Anchorage Regional Landfill property to SWS for future landfill development and potential organics management infrastructure. As such, development of land at JBCC into a regional solid waste processing infrastructure represents a likely compatible use.

4. **Development of solid waste processing or diversion infrastructure on the JBCC can be pursued in parallel with continuing operations at the existing municipal transfer station facilities**. This would be a longer-term strategic solution that can be pursued without interruption to the existing services provided by the towns to residents, visitors and businesses.

5. **The JBCC parcels do not require specific planning or programming at the time of the County engaging base officials regarding potential use over the parcels.** Future solid waste infrastructure projects can be cooperatively considered and pursued among the County and member communities to build consensus regarding specific goals and mechanisms for development.

6. **In the event Barnstable County or another entity obtains the authority to develop waste management infrastructure at JBCC and has organized multi-community agreements that can contractually direct waste to a facility, towns would be in a collectively empowered position to issue Request For Proposals (RFPs) to waste management companies and technology providers to propose privately funded solutions to the County's requests.** This mechanism would allow the County or member communities to maintain direction over the operation and capitalize or operate more progressive waste/recycling solution alternatives with the private sector.

7. **JBCC parcels can also potentially serve as a County-wide hub for the emergency storage, processing and transport of disaster generated debris and waste.** This would enhance the elasticity of the area network of waste transfer infrastructure to respond to these infrequent, but profoundly high volume "black swan" waste generation events.

8. **Successful infrastructure implementation at the JBCC will increase the capacity of local government, communities, and other stakeholders to adopt and implement sustainable materials management policies, practices, and incentives for decades to come.** Identifying land to locate potential future technologies will place the Cape and Islands in the best position to take advantage of regional waste management opportunities and explore innovation including alternative/renewable energy.

Moreover, it could position Cape Cod as a regional leader in Massachusetts, and in the Northeast, to advance awareness between recycling materials and climate change to achieve Barnstable County's goals.

Barnstable County Goals

- **Reduce waste generated.**
- **Maximize the value of materials recovered.**
- **Maximize the amount of material reused, repurposed and recycled.**
- **Do all of these for the lowest cost possible.**
- **Solid waste aggregation - lower disposal fees.**
- **Better position with recycling markets.**
- **Organics management or other means of disposal to be financially and environmentally viable.**
- **Development of debris management under emergency circumstances.**

2.1 DIVERSION COOPERATIVE IDEOLOGY

The County can bring together its member towns to share resources, develop consistent programs, establish policies, and identify best practices. With the seasonal fluctuations of municipal solid waste tonnage between the summer and winter seasons, the County can consider the development of a more formal solid waste management strategy and infrastructure to manage these waste flow peaks and variations.

There is significant value for the towns of the Cape and Islands to consider the idea of a Diversion Cooperative infrastructure. With the County's over-arching legislative body and procurement department, the towns are well-positioned to advance the area's sustainable materials management ahead of impending regulatory waste management changes. There are several potential steps the County could take to begin the process of a Diversion Cooperative, taking a phased or stepped approach toward longer-term planning.

1. **Goals and Strategic Approach**
   Develop a common set of goals and strategic plan for the Diversion Cooperative. The goals and plan will help define interim steps and the role of the towns. Moreover, the County and Islands towns should commence a process of understanding and articulating the value placed on lowest cost of service versus materials diverted or recycled to help inform longer term future decision-making.
2. **Economies of Scale for Materials Management**
   Aggregating solid waste volumes should enable a better position for negotiation of disposal contracts with larger solid waste volumes being collected for lower disposal fees, along with all recyclable materials including organics (yard debris and food materials) collected within the County. Together, the waste generated from multi-community agreements enables the potential for facilities such as a County-wide organics management facility to be more financially and environmentally viable.
3. **Government Structure**
   Cooperatives or refuse districts will require a cooperative agreement as a group and establish common goals and potentially funding mechanisms. A cooperative agreement could be a government structure in which each municipality has representation. This collaborative approach can be a model for the County to leverage best practices for resource sharing, to create potential innovation opportunities for better market position and pricing, consolidating with the largest volume for recycling end markets and consistent programming across the Cape and Islands.
4. **Request For Proposal (RFP) Process**
   The County currently has a procurement department to provide support for group contracts and aggregated purchasing. The County could further explore entering intermunicipal agreements with the Cape and Islands towns concerning resource sharing and collaboration. The towns would be in a collectively empowered position to issue Request For Proposals (RFPs) to waste management companies and technology providers to propose privately funded solutions to the County's requests. This mechanism would not require the County or member communities to capitalize or operate these more progressive waste/recycling solution alternatives.

The four potential steps or phased approach outlined above toward longer-term future planning are a set of tools that includes the tracking, measuring, and aggregating material volumes that position the towns to initiate Request For Proposals (RFPs) to the achieve best market prices and costs.

Figure 2-1 presents a solid waste management flow diagram. The three columns of **Source, Collection and Transfer** are the activities currently conducted by the town transfer stations. The two columns of **Processing and End-Markets** present the potential shared resources of the Diversion Cooperative and technology ideas of the Eco-Park vision.

Figure 2-1: Solid Waste Management Flow Diagram

2.2 COOPERATIVES IN OTHER JURISDICTIONS

The County can leverage best management practices and lessons learned from other jurisdictions including the Greater New Bedford Regional Refuse Management District, Franklin County Solid Waste Management District, the South Shore Recycling Cooperative, and Zero Waste Sonoma County Regional Solid Waste.

2.2.1 Greater New Bedford Regional Refuse Solid Waste District, Massachusetts

The Greater New Bedford Regional Refuse Solid Waste District is an example of regional cooperation providing a needed municipal service for solid waste disposal and a wide range of recycling programs. The District was formed through an Inter-Municipal Agreement in 1979 to develop a solid waste landfill for the member communities Acushnet, Dartmouth and Fairhaven with the City of New Bedford. *(Acushnet and Fairhaven dropped out.)*

The initial cost sharing formula was based on the member communities' population. Since the opening of the landfill, the assessment is based on the percentage of MSW tonnage delivered by the member communities. The Town of Dartmouth had land available for a landfill. The Town of New Bedford paid for up to 80% of the design, engineering and construction costs to start the 70-acre Crapo Hill Landfill that opened in January 1995. The District is governed by a District Committee, with three members from New Bedford and three members from Dartmouth.

2.2.2 Franklin County Solid Waste Management District, Massachusetts

Franklin County Solid Waste Management District (FCSWMD) in Western Massachusetts represents 21 member towns. Each town pays an annual administrative assessment to cover 65% of the District's administrative operating expenses, and 35% of the budgeted common expenses are paid through a fee for service and by grants.

Located within the District is the Springfield Materials Recovery Facility (MRF) at 84 Birnie Avenue in Springfield. The MRF is a public facility that services 62 towns, and the Western Massachusetts Regional Recycling Program is currently operated by Waste Management (WM) under contract with the MassDEP through a Public/Private Partnership.

The original plan that the MassDEP put forth in the 1980's was to develop five or six state-owned regional MRFs across Massachusetts. The Springfield MRF was the first, and to date the only MRF, built by the State and completed in 1989. However, soon after the Springfield MRF was constructed, private sector waste collection companies commenced development of MRF facilities in Massachusetts and the balance of the envisioned state-owned MRF's were never developed. The state-owned Springfield MRF is overseen by the Springfield MassDEP office. To balance operating continuity and cost competitiveness, MassDEP solicits bids on behalf of the member communities every ten years for facility operating services.

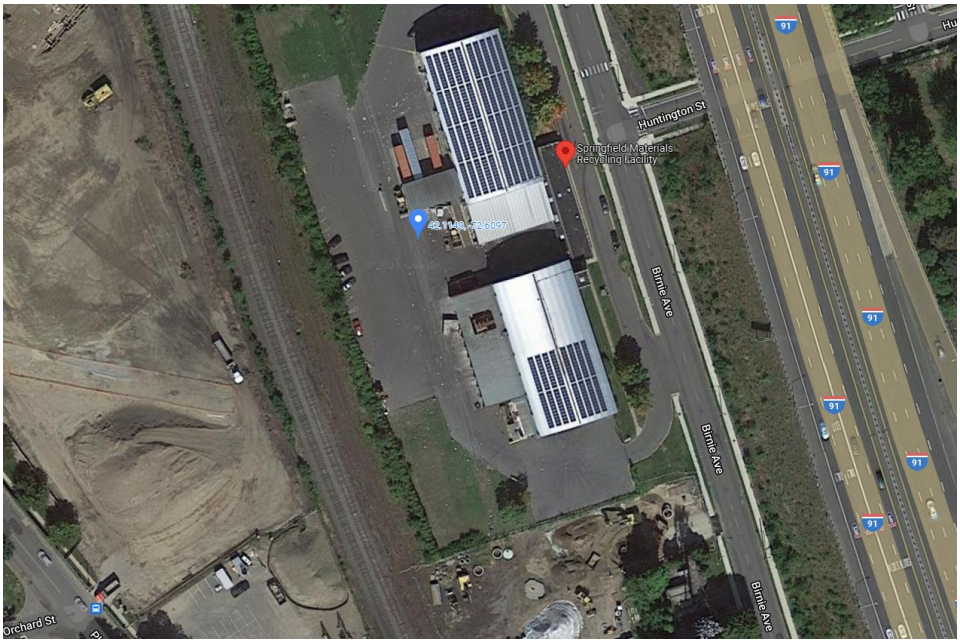
Nearly all of the FCSWMD member towns have been part of the state contracts since the 1990s. As such, it is challenging to benchmark pre-MRF versus post-MRF costs. However, the towns have benefitted from the contracts that are long term and at a favorable rate compared to alternatives. The dual-stream MRF has a relatively low contamination rate of around 5-6%. As such, the FCSWMD has been receiving more favorable commodity pricing when compared to many single stream recycling operations.

The Springfield MRF is designed for ± 48,000 tons per year capacity and now processes ± 20,000 tons per year on average. At the height of the dual-stream MRF operations pre-2008 the facility was processing around 40,000 to 50,000 tons per year. About a decade ago several larger communities started moving to curbside single stream recycling, which the Birnie Avenue MRF was not designed to process.

Figure 2-2 shows the dual-stream Springfield Materials Recovery Facility, which is located near major transportation corridors. The 1989 construction cost was estimated at $3.2 million (excluding land acquisition costs) and has provided area communities significant value. The size of the facility is 400 feet x 130 feet, or 52,000 square feet. The facility has two processing buildings, one is for paper processing and one for containers and includes administration offices.

The land use at the time was an abandoned potato processing factory located within an industrially blighted area. Today, the surrounding neighborhood has been redeveloped into medical business properties, and land values in areas proximate to the facility have continued to appreciate. There is some correlation between towns serviced by the Springfield MRF and the Cape and Islands. Both areas include a group of relatively small towns with transfer stations that provide drop-off collection that promote residents' behavior at the source of material separation to produce a higher quality material stream.

Figure 2-2: Springfield Materials Recovery Facility in Springfield, Massachusetts



2.2.3 South Shore Recycling Cooperative, Massachusetts

The South Shore Recycling Cooperative (SSRC) was established in 1988, and is a voluntary, regional government entity constituting 18 members towns that collaborate to reduce the costs to residents for solid waste management and recycling programs. The towns work cooperatively to reduce costs, improve recycling, and maximize their purchasing power by joining together for regional procurement.

SSRC Member Towns	
Abington	Kingston
Braintree	Middleboro
Cohasset	Norwell
Duxbury	Pembroke
East Bridgewater	Plymouth
Hanover	Rockland
Hanson	Scituate
Hingham	Weymouth
Hull	Whitman

2.2.4 Sonoma County Solid Waste District, California

California cities and counties are mandated by state law to make significant inroads on diverting organic waste under Senate Bill 1383, a 2016 law that went into effect January 1, 2021. Sonoma County, California has a population of 500,000 that experiences heavy seasonal population fluctuations due to the widely popular wine country tourism. Zero Waste Sonoma (ZWS) is the local waste management agency representing unincorporated areas and the county's nine cities. The ZWS secured sufficient organic waste material volumes from neighboring

counties along with Sonoma County residents' curbside organics weekly collection volumes to support a regional organics management facility.

ZWS was negotiating a Private/Public Partnership for a new organics processing and compost facility with the City of Santa Rosa on city-owned property located adjacent to the City's Laguna Wastewater Treatment Plant. Despite diligently pursuing multiple development scenarios, the technology vendor was unable to secure sufficient investment financing to move the project forward. As a result, 100,000 tons of organic waste will continue to be hauled out of the county for the foreseeable future, at extra cost to area citizens.

The existing composting system managed 100,000 tons per year of organic feedstock, resulting in 50,000 tons of finished compost that routinely sold out. As a result, the County decided it would require either access to, or the development of, an organics management facility with a design capacity of 120,000 tons per year. With the Private/Public venture facility on hold, the County is currently in "wait and see" mode as a private company is in their final stage of completing their California Environmental Quality Act (CEQA) environmental impact report (EIR) for a proposed compost facility nearby that could be available to conveniently service Sonoma County.

2.2.5 Ramsey and Washington Counties, Minnesota

Ramsey and Washington Counties in Minnesota have partnered since the early 1980's to manage waste jointly through Ramsey/Washington Recycling & Energy (R&E). R&E serves a large metro area with ± 800,000 residents and 70,000 businesses. The counties aim to meet the state's 75% recycling goal by viewing the waste as a resource stream. R&E is governed by a board composed of commissioners from the two counties.

In 2016, the counties purchased the Recycling & Energy Center (R&E Center) in Newport, Minnesota. All MSW generated in the two counties (±450,000 tons) is delivered to the R&E Center, where it is processed to recover recyclable metals and make refuse derived fuel (RDF) for electricity production. In 2018, R&E Center diverted over 90% of their incoming waste stream from landfill disposal.

2.3 SHORT TO MID-TERM PLAN

Working Together To Reduce Solid Waste on The Cape and Islands

In the short-term Barnstable County should engage and cooperate with the Town of Yarmouth to support Yarmouth's development plan. The Town of Yarmouth transfer station and composting operation presents as the largest, best situated facility for the potential to incorporate waste diversion infrastructure on the Cape in the short to mid-term. The Town of Yarmouth is unilaterally pursuing its goals for managing waste and energy development and may provide an outlet for food material and biosolids processing needs on and off Cape.

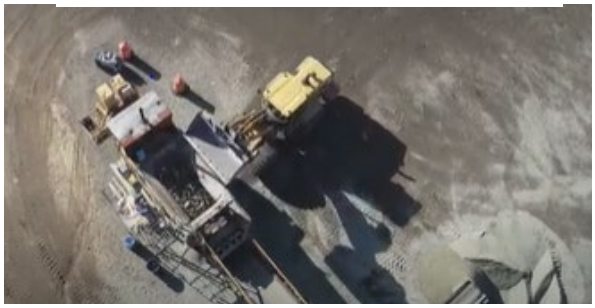
It is recommended that an initial step is collaboration with the Town of Yarmouth in the sourcing of organics and potential biosolids to assist Yarmouth with their proposed Cape Cod Energy Park and anaerobic digester pro forma. To this end, Barnstable County should continue regular dialog with Yarmouth to formulate how food material and biosolids sourced from on and off Cape may assist Yarmouth in their development of this short to mid-term infrastructure.

As discussed earlier in this report, it is likely that climate mitigation and greenhouse gas emissions will be a driver for the State Solid Waste Master Plan as implementation efforts move forward. Reduce and reuse initiatives will become a priority to lessen the burden on infrastructure projects and to meet State solid waste goals. Reduce and reuse initiatives will help reduce the amount of material that the towns will need to manage. These efforts

should include increased recycling of commodities, C&D materials, mattresses, textiles, glass, and organics processing,

As an example, the Town of Dennis started a glass recycling program in 2019 and collected ±352 tons of glass at their town transfer station in the first year of the program. Other towns can participate in the glass program at $60 per ton.

Town of Dennis Glass Recycling



The towns of Harwich, Wellfleet and Barnstable currently participate in this program, and more recently the towns of Mashpee and Brewster started to send their source separated glass to Dennis. More municipalities should also participate in this initiative. Many of the towns transport their glass off-Cape at significant cost, and this program offers a collaborative and cost-saving approach.

The Town of Dennis recently came to an arrangement with Robert B. Our, a local construction company, to use processed glass aggregate (PGA) as a substrate in underground sewer installations in the Towns of Orleans and Barnstable. This local glass reuse initiative helps to reduce the amount of material that local governments will need to manage. Shared recycling and reuse programs are an option that more and more communities are focusing on to avoid infrastructure costs.

The following are interim steps the County should consider initiating as part of the Short to Mid-Term Plan while working toward the Longer-Term Plan.

1. **Collaborate with the Town of Yarmouth**. The County can assist, with the cooperation of the member towns, to organize and track organics and C&D materials for aggregation at Yarmouth; and pursue grants for equipment or other needs. Encourage organics collection at all town transfer stations. Food scraps-filled toters can be transported to Yarmouth as feedstock for the digestor. Provide education support to increase awareness of organics diversion programs and reduce contamination.

2. **Support the Town of Yarmouth's plan to potentially develop a wet anaerobic digestion facility at their existing town transfer station while the County develops its plans to supplement Yarmouth's efforts.** A larger-scale organics infrastructure including dry anaerobic digestion and composting at the JBCC *(Longer-Term Future Plan) that does not compete with Yarmouth's investments and expected operations*. Support the Town of Yarmouth to meet their goals and provide examples for other member towns to host regional and subregional opportunities.

3. **Coordinate with the Massachusetts Food Association (MFA) and Massachusetts Beverage Association (MBA) on commercial food waste collection**. For food waste that does not meet donation standards, commercial food waste should be transported directly to Yarmouth for depackaging and processing. Yarmouth is working toward deploying a food waste depackaging facility that could be operational in 2022.

4. **Aggregate C&D materials from the Lower and Outer Cape transfer stations at Yarmouth.** There is potential space available for a 40-yard trailer for the collected C&D material. C&D contamination is typically mattresses and bulky plastics. Yarmouth could pre-process the C&D to remove the contamination, and aggregate mattresses and bulky plastics for New England Recycling (NER) to pick up. NER could continue to process C&D materials, and transport mattresses to Ace Mattress Recycling in Rhode Island via their

Taunton facility. NER can also take all bulky plastic items to be chipped at their Taunton facility for recycling markets.

5. **State Solid Waste Master Plan 2030 Targeted Diversion Materials.** The State Solid Waste Master Plan 2030 aims at improving management of residential waste streams and reduce disposal of typical recyclables (commodity recovered materials), organics (food materials), textiles, mattresses, and bulky materials. The County can assist the towns to contractually aggregate these materials. Together the towns can aggregate material volumes to negotiate for collection and recycling at the most favorable rate attainable with vendors including New England Recycling (NER). This collaborative function can serve as a foundation and organizational effort as the towns collaborate toward the Longer-Term Future Plan including regional infrastructure.

2.4 LONGER-TERM FUTURE PLAN

In the State Solid Waste Master Plan 2030, the MassDEP targets waste reduction goals with significant additional diversion potential on a per ton basis. MassDEP identified priority material categories of recyclables, food material, textiles, mattresses, and bulky materials as opportunities for local market development, and potential use of existing underutilized waste transfer capacity should be considered to manage these materials locally or regionally. This will include phasing out single use disposable products and packaging, while developing local market opportunities through reuse and donation.

2.5 OPTIONS FOR INFRASTRUCTURE

The Longer-Term Future Plan for Barnstable County and the Islands should be to secure appropriate land assets for an Eco-Park development at the Joint Base Cape Cod (JBCC), and work toward the County's vision for the towns to collaborate on reduce, reuse and recycling efforts, resiliency, and cooperate to mitigate climate change through sustainable materials management. There is existing underutilized waste transfer capacity potential at several parcels located on the JBCC property.

The County has the resources and existing infrastructure to develop short and long-term planning. As an example, in July 2021 the Cape Cod Commission (CCC) approved the region's first climate action plan. The Cape Cod Climate Action Plan sets actionable goals for Cape Cod to address climate change in measurable ways. This is an example of the type of framework that the County should reference when working toward building a consensus around solid waste management and connecting materials management and recycling with climate change.

Working with towns and partners, the Cape Cod Commission (CCC) developed a Cape Cod Climate Action Plan that includes a Greenhous Gas Inventory and establishes goals, strategies, actions and steps to improve climate resiliency. The idea of an Eco-Park fully aligns with the CCC's efforts in organizing the towns to mitigate the region's contribution to greenhouse gas emissions.

- The County should consider becoming more actively positioned to respond to the evolving issue of disposal capacity moratoriums, diversion mandates, and their effects on waste collection and processing costs as towns will be individually at a disadvantage to comprehensively address these challenges.

- The County should work with Cape and Islands towns to gauge their interest in the potential development of a Waste Diversion Cooperative infrastructure to service all residents, seasonal population, visitors and commercial businesses and entities.

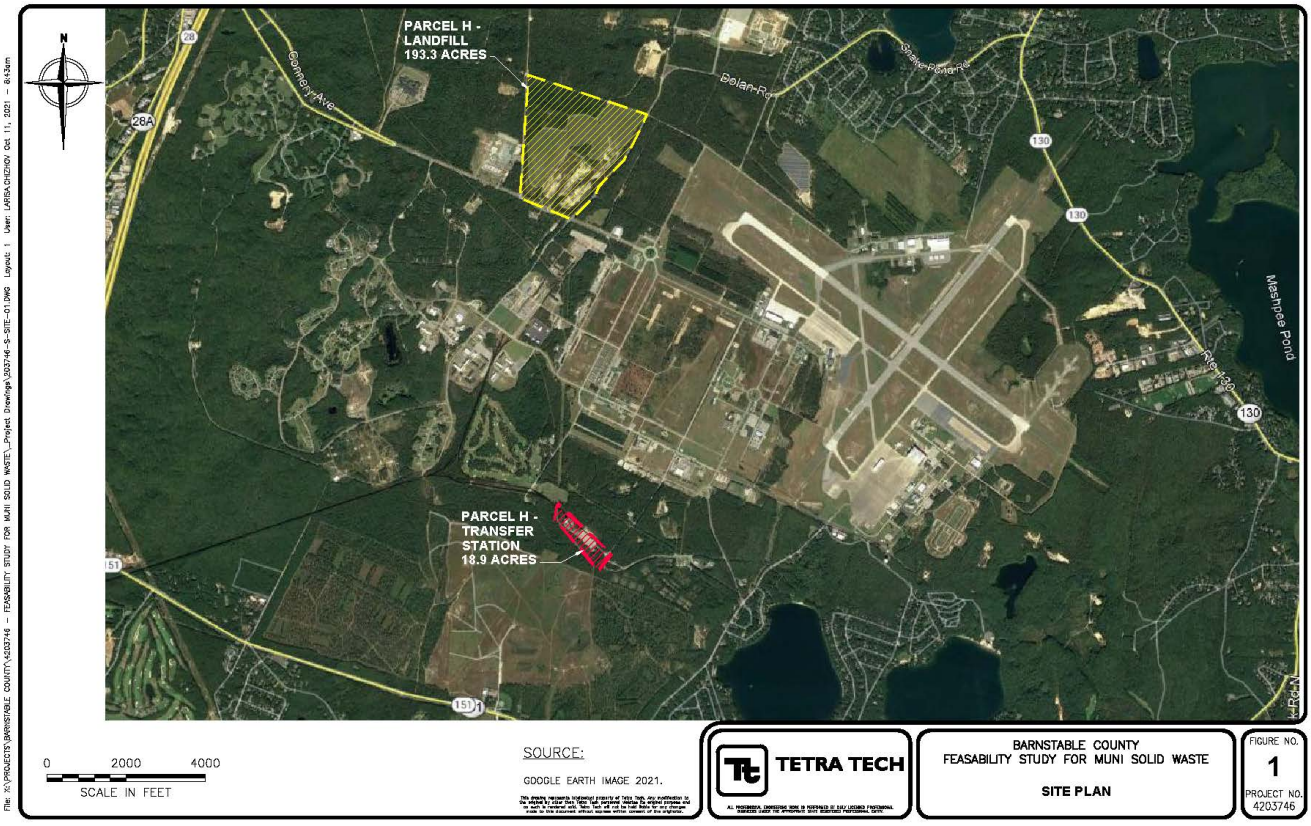
An Eco-Park could coalesce municipal solid waste materials from all Cape and Islands towns to the extent they need. The JBCC presents the opportunity to set aside large potential development areas that are suitably zoned for solid waste management activities and further removed from residential development than is available anywhere else in the County.

The key objective is to maintain a cooperative approach through a cohesive municipal transfer station network that is currently in place, and utilize the JBCC as an Eco-Park to serve as the coalescing point for system-wide waste and recycling processing needs. The Eco-Park would also serve as a place for proven and emerging technologies for waste management and diversion to meet the County's definition of beneficial reuse and recycling, including alternative energy production.

Recognizing the hypothetical potential of the JBCC, at least two parcels have been identified that are already utilized (or were previously utilized) as solid waste facilities. Moreover, the JBCC is located conveniently to service the towns, and located near the major roads and with a rail head. This makes it feasible to consider the JBCC sites as hypothetical options to allow for future solid waste management needs.

The Project Team identified two areas of interest on the JBCC Map shown in **Figure 2-3** below. It shows the locations of the two parcels. Parcel H Landfill 193.3ac is outlined with a yellow hyphenated boundary; this parcel contains a closed landfill. Parcel H Transfer Station 18.9ac is outlined with a red hyphenated boundary; this parcel is currently used as a C&D transfer facility. These two areas of interest were identified because of their proximity to established solid waste facilities, access to suitable roadway and rail networks, and thus present a high probability of compatible use. There could be other potential properties on the Cape to be identified that could also service the towns as solid waste facilities options. However for this report, the JBCC is identified for hypothetical planning purposes. Based on the fact the two parcels are already (or were previously) used as solid waste facilities, that the capability already exists is an important aspect of the parcels.

Figure 2-3: Two Potential Areas of Interest at the Joint Base Cape Cod



2.5.1.1 Parcel H – Landfill 193.3ac

Although the landfill parcel (Parcel H 193.3ac) is within the base security fence and located just beyond the guard gatehouse, the parcel has a history of solid waste management use. Therefore, Parcel H or a similarly sized land parcel could be utilized.

The existing landfill located at the JBCC is on state-owned land but is regulated through the United States Environmental Protection Agency (USEPA). The MassDEP reported the state has the lease with the military and stated that it is unknown if a site assignment exists as there are no records available.

Potential use for the landfill area could be as a dedicated organics management facility site with anaerobic digestion (dry, high solids) to manage all types of organic materials including yard debris, woody material, seaweed, and food scraps, fish and cranberry processing waste. Alternative energy in the form of biogas and potential co-generation of heat and power could be the end-products resulting from the anaerobic digestion operation. A composting facility would be co-located to manage the digestate from the anaerobic digestion process.

The landfill site is currently a waste site cleanup as plumes of PFAS and 1.4, Dioxin have been detected. This has compromised areas of the public water supply. For the County's future planning purposes, it is recommended for the County to conduct a Fatal Flaw Analysis to understand what development would be feasible and compatible at this landfill site, and how to potentially co-manage the landfill site with the state-level government.

2.5.1.2 Parcel H – Transfer Station 18.9ac

The Upper Cape Regional Transfer Station (UCRTS) Board of Managers is the body that oversees all operations for the municipally managed regional solid waste transfer station located on Joint Base Cape Cod (JBCC). The site currently includes a transfer station tipping building with tipping floor and office space, a rail spur, a truck scale, and utilities. The UCRTS is located on an approximate 19-acre parcel of land on the JBCC. It would be in the interest for the County to expand the transfer station area for the Eco-Park development and services.

Four towns manage the transfer station and rail head property. The County could assist in coordinating with Board members.

Upper Cape Regional Transfer Station Board of Managers

Town/Entity	Contact
Bourne	Dan Barrett, Phil Goddard (Alt.)
Mashpee	Catherine Laurent
Falmouth	Ray Jack
Sandwich	Paul Tilton
JBCC	Chris Segura

2.6 ECO-PARK VISION AND INFRASTRUCTURE

The Project Team conducted calls with MassDEP, and they have expressed a favorable attitude toward multi-community collaborative agreements to enhance contract leverage. MassDEP is also favorable to the idea of the fifteen town transfer stations continuing to collect their materials, then aggregate at a system-wide central facility for processing and hauling for recycling and reuse end-markets. MassDEP stated that they can provide model contracts and is open to further discussions to support the County's future planning efforts.

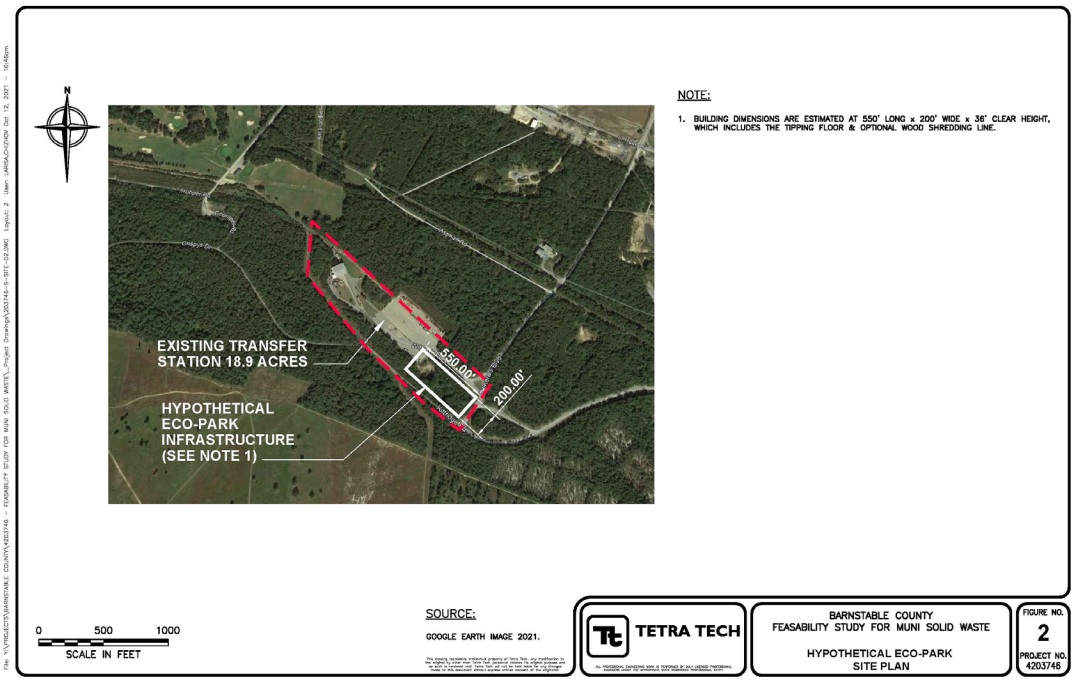
The state solid waste regulations that would be applicable are *310 CMR 16.00* Site Assignment for local rule for recycling and facility general permit for self-certification *310 CMR 16.03 and 16.04*. There is an exemption for towns *310 CMR 16.04* to establish a recycling center for all recycling, basic commodities, furniture, books, clothing, and more. For larger tonnages over the self-certification limit, then *310 CMR 16.05* requires a written permit from MassDEP for facilities planning to incorporate composting operations, anaerobic digestion, and material recovery facilities.

The concept of an Eco-Park addresses Barnstable County's interest in identifying options to most comprehensively manage the waste generated on-Cape and from the Islands, to supplement the existing transfer station network, share resources, and identify processing facilities for the waste stream components for beneficial reuse and recycling, including organics. For the Longer-Term Future Plan, this type of arrangement could be implemented to create a solid waste facility with the existing UCRTS transfer station and rail head and is an opportunity to strengthen military/municipal partnerships at JBCC.

Disaster debris management is of high importance to the Cape and Island towns. A recommendation would be to locate a disaster debris management area and the Eco-Park vision within the UCRTS area. The area of the UCRTS presents a favorable location as it has access to suitable roadways, has areas available for the staging and processing of materials and possesses existing rail access for moving large volumes of materials off Cape.

Figure 2-4 shows the existing UCRTS where an Eco-Park infrastructure is outlined in red on the current 18.9 acres. Included is a specific area outlined in white for potential solid waste facility (i.e., materials recovery facility)

Figure 2-4: Potential Infrastructure at Upper Cape Regional Transfer Station



Tetra Tech recommends that the Upper Cape Regional Transfer Station (UCRTS), with rail head and surrounding property should be incorporated and developed into an Eco-Park infrastructure. **Table 2-1** shows some of the potential technologies that could be sited at the Eco-Park, potential infrastructure and construction cost. The construction cost does not include cost for land use acquisition. The table identifies the potential facility needs including, but not limited, to acreage, access and utilities.

Table 2-1: Potential Eco-Park Infrastructure Needs

Facility Type	Technology	Waste Material Stream	End Product or Market	Acres[1]	Facility Size[2]	Costs[3, 4]
Organics Management Facility	Anaerobic Digestion, Dry (AD)	Yard and food waste; spent grain from local breweries, seaweed; food processing waste including fish waste, cranberries, other agricultural wastes, horse manure/bedding. storm debris (trees).	Alternative energy; biogas for power, heat, electricity and compression into CNG, and digestate	5 acres	30,000 to 60,000 tons per year	$25 M -$60 M
	Composting Operation, Covered Aerated Static Pile (CASP)	Digestate from AD, other food and organic materials including wood chips; certified compostable packaging.	Compost for local use for homes, public areas, and farms, MassDOT projects	10 acres	30,000 to 60,000 tons per year	$6 M - $12 M
	Equipment, access roads, storage, parking			10 acres		
Disaster Debris Management	Mitigation plan to provide towns with destination for stockpiling until materials can be transported. For staging and management of all debris materials after major events. Material sorting, storage and equipment, road access.		Prepare for end-markets	45 acres		
Eco-Park	Existing Transfer Station with scale, tipping area and rail	Aggregation of materials for moving materials to vendors and markets.		19 acres		
	Material Recovery Facility	Processing recyclable materials and baling; beverage cartons, plastic films, boat shrink-wrap and agriculture mulch films	vendors or end-markets; Kelly Green Products in CT and others	2 acre	30,000 to 100,000 tons per year	$20 M - $30 M
	Secondary Material Recovery Facility	Processing hard to recycle plastics	Processing hard to dispose waste materials; plastics to chemical recycling facility	2 acre	20,000 to 30,000 tons per year	$16 M - $20 M

			(i.e. Brightmark), ADS Recycling			
	Innovation Technology Center	Pilot Program including waste technologies	Technology providers; develop case studies	120 acres		
	Eco Swap, Reuse Shop and Fixit Clinic	Reuse, recycling and zero waste opportunities	Local markets, trades/arts culture and clothing shops involved with reuse fashion; donations	6 acres		$0.5 M - $3 M
	Education Center & Administration (ECA)	Tours and learning, offices	Education and stakeholder outreach			
	Equipment, access roads, storage, parking			10 acres		
Estimated Total Acres				**229 acres**		

2.7 TECHNOLOGY OPTIONS FOR CONSIDERATION

The Project Team conducted a high-level analysis on the feasibility of several material processing technologies for managing typical recyclables and organics materials. These technology options could be designed, sited, permitted and engineered to work together as an Eco-Park campus at the JBCC.

2.7.1 Construction and Demolition Materials Recovery Facility

Figure 2-5 shows a hypothetical building structure, in this example a C&D materials recovery facility (MRF) that could be sited at the existing UCRTS. For example purposes, the MRF building dimensions are depicted as 550 feet long x 200 feet wide with 36 feet clear height. This includes a tipping floor and an optional wood shredding line. This drawing is a general representation of a large C&D recycling facility with a processing capacity of 100 tons per hour.

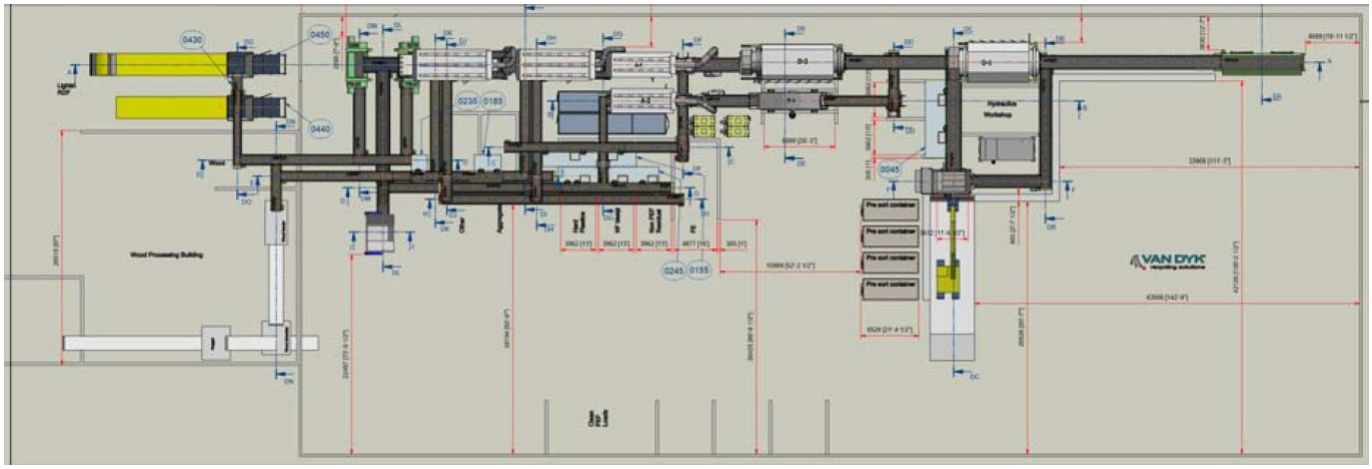
Construction costs are typically based on a warehouse-type building based on square footage. About five to 10 MRFs are built each year in the United States, with a typical fully equipped facility averaging $20 M to $30 M.[1]

While C&D recycling can be conducted utilizing relatively “low-tech” methods such as manual and tipping floor “kick-sorting” methods, these methods are usually not capable by themselves to achieve the desired levels of

[1] *Recyclingtoday.com*

material separation and sorting for the whole of the C&D debris waste stream. As such, some level of mechanization is usually employed to enhance material separation. For a typical C&D processing facility, the C&D processing equipment employed can be up to approximately one-half the cost of total MRF development. Installation/implementation costs of MRF equipment is typically around 15 percent of the retail equipment cost.

Figure 2-5: Construction and Demolition Material Recovery Facility



The potential costs for a small C&D facility could be from $350,000 to ± $2 million depending on the level of sorting desired, and use of artificial intelligence (AI) for automation would increase the equipment cost.

For the Cape and Islands towns, this type of C&D recycling facility could be designed to process 120 to 180 tons per day based on the estimated total generation of ± 30,000 tons per year of C&D materials collected at the fifteen town transfer stations within Barnstable County.

When considering the seasonality of the material from the Cape and Islands towns, facilities should be designed to manage the peak flow of materials. Peak flow of materials is estimated at ± 3500 tons per month. As a baseline scenario, **Table 2-2** shows the potential C&D recycling facility that could conceptually be designed to process 30,000 and 45,000 tons per year.

Table 2-2: Construction and Demolition Facility Size for the Cape

Facility Size	Tons Per Hour Processing	Per Month Processing
30,000 tons per year	15 tons per hour	2500 tons per month
45,000 tons per year	22.5 tons per hour	3750 tons per month

2.7.2 Recyclables Materials Recovery Facility

The estimated total generation of recycling was ± 20,500 tons per year collected at the fifteen town transfer stations within Barnstable County. For the Cape and Islands towns, a small-scale materials recovery facility (MRF) for recyclables collected at the town transfer stations could be considered. An approximately 12,000 to 15,000 square foot processing building could be designed to process 80 tons per day and could be situated to allow the potential to scale-up facility processing volume over time.

Photo courtesy: The Authority New Jersey

This type of new "mini-MRF" recently started operations in Cumberland County, New Jersey. This localized materials recovery facility is designed to sort and bale valuable local recyclables, including paper, plastic, glass, and metals.

The facility operates through a public/private partnership. The capital expense is estimated at $2.2 million. (The Authority New Jersey)

2.7.3 Organics Management

The town transfer stations collect mostly yard debris and are expected to receive increasing volumes of food waste as the MassDEP lowers the threshold for commercial organics diversion ban to generators of a half-ton or more per year in November 2022, with all organics mandated to be banned by 2030.

2.7.3.1 Organics Management on Cape Cod

Residential food waste collection at Cape Cod and Islands town transfer stations is a relatively new program with nine Barnstable County municipalities providing a drop-off location for collection within the County. These towns are Barnstable, Brewster, Chatham, Dennis, Falmouth, Mashpee, Truro, Wellfleet, and Yarmouth.

The organics stream includes all food waste, leaf and yard waste, and food-soiled compostable papers. Approximately 19,376 tons of yard waste and 205 tons of food waste were collected at the municipal transfer stations in 2019, for a total of 19,581 tons of organics. There are several viable options that the County could pursue for processing the collected organics, including composting and anaerobic digestion.

2.7.3.2 Organics Management on the Islands

Like Barnstable County, Martha's Vineyard (Dukes County) also experiences significant seasonal population fluctuation. Martha's Vineyard has 16,000 year-round residents and the population increases to over 200,000 during the summer months. On Martha's Vineyard, the Island Grown Initiative (IGI) operates a farm and an in-vessel composting system. In 2019, IGI collected 360 tons of food waste from 40 organizations from the six towns of Aquinnah, Chilmark, Edgartown, Oak Bluffs, Tisbury, and West Tisbury.

Nantucket operates an in-vessel composting operation in which co-mingled MSW, food waste and other compostable materials are screened and processed into a composted material. With the emerging concerns with PFAS in Massachusetts, the Town preemptively stopped offering the Composter Compost with biosolids to the public in August 2019. With MassDEP's permission, the Town plans to remove the biosolids portion from the composting process and is likely to transport the biosolids to the landfill as an interim method of disposal.

2.7.4 Dry Anaerobic Digestion

The Project Team conducted a high-level analysis for the feasibility of a dry anaerobic digester for managing organic waste from a variety of source separated organics (SSO), including yard debris and all food materials. The organic waste stream can include residential kitchen waste, and municipal and commercial yard and garden waste. These waste mixtures typically contain high proportions of solids and foreign matter, and this is where the advantages of dry anaerobic digestion enter.

Anaerobic digestion (AD) is the biological decomposition of organic materials in the absence of oxygen. The process is carried out by anaerobic micro-organisms that convert carbon-containing compounds to biogas, which consists primarily of methane (CH_4) and carbon dioxide (CO_2), with trace amounts of other gases. This methane-rich biogas can be used to generate electricity or can be cleaned and upgraded to be sold and transported as renewable natural gas (RNG).

Dry/high solids anaerobic digestion batch process is a recommended option to the seasonal fluctuation in organics management. The following provides a high-level analysis of two batch processes and includes a third option of a continuous feed process anaerobic digestion technologies.

2.7.4.1 BioFerm

BioFerm anaerobic digesters process high-solids (dry) organics including food materials, yard and garden waste. Although feedstocks may vary in solids contents, the system typically operates within the 25-35% total solids (TS) range. During this batch-style digestion process (which requires no internal moving parts or pumpable waste stream), organics remain stationary inside the individual, rectangular fermentation chambers. Modular design allows the system to be scaled according to the feedstock amount available.

Source: **BioFerm**

A minimum of 8,000 tons of organic waste per year is typically processed with this system and is considered ideal for municipalities, industries and institutions including, food processors and campuses.

2.7.4.2 Organic Waste Solutions (OWS) DRANCO System

The DRANCO dry anaerobic digestion process is a vertical design, uses high-solids concentration without mixing inside the digester, and provides an efficient way to digest solid and semisolid feedstocks. The biogas can be used for the production of electricity and/or heat, or after upgrading, as biomethane.

The system is compact with an insulated digester that requires minimal heating. The digester is designed as a vertical fermenter with inbound materials receiving at the top and extraction through a conical outlet at the bottom.

Source: ***OWS***

The process is a single-phase digestion with intensive recycling of the digestate and operates at thermophilic or mesophilic temperature.

2.7.4.3 Hitachi Zosen Inova

Hitachi Zosen INOVA (HZI)/Kompogas Dry Anaerobic Digestion technology is proven in cold climate environments in Europe. The first U.S. HZI/Kompogas system located in San Luis Obispo, California started operations in 2018. It is designed to process up to 36,500 tons of SSO, yard and garden waste and fats, oils, grease (FOG) from the county-wide residential collection program. The system is designed as a continuous dry (thermophilic temperature) anaerobic digestion facility for organic waste management and converts the material into renewable products.

Source: HZI

As an example, the HZI/Kompogas AD system in San Luis Obispo project cost is an estimate of ~$25M. The County could consider conducting a future cost benefit analysis to realize the potential opportunity for a dry anaerobic digestion system.

This analysis would be based on several factors including the potential end-product and markets as shown in **Tables 2-3 and 2-4.**

Table 2-3: Dry Anaerobic Digestion Process, Activity and Output

Anaerobic Digestion Process: Basic Steps	Activity and Output
Pre-treatment	Organic waste is shredded and cleaned of metals before being fed into the plug-flow digester
Material fed into the plug-flow digester	Thermophilic AD process ensures complete sanitation of the organic matter while its gas potential is fully exploited.
Biogas generation and collection	Biogas is utilized in an on-site combined heat and power (CHP) unit to produce renewable energy in the form of electricity that can be exported to the utility power grid.
Digestate (discharge) collection both solid and liquid fractions	Solid digestate is aerated in an indoor composting area and marketed as nutrient- rich compost and fertilizer to local the agriculture market and residents Liquid digestate can be marketed as nutrient- rich compost and fertilizer to local the agriculture market.

Table 2-4: Dry Anaerobic Digestion End-Products and Markets

Potential End-Products	Market Uses
Biogas	• Electricity feed into landfill-gas-to-energy (LFGTE) or direct to the grid • Can be cleaned/upgraded for use as RNG fuel
Compost	• Soil amendment for residential and local farms
Biochar	• Mixed with compost for soil amendment • Fuel
Hydrogen gas collection	• Renewable energy and fuel

2.7.5 Composting Operations

Composting is an aerobic biological decomposition process that reduces organic material (in the presence of oxygen) to produce a peat-like humus, typically used as a soil amendment. Composting processes can range from simple pile systems to process yard and garden waste to more complex self-contained systems that are capable of processing mixed organics, both yard waste and food waste.

Composting is utilized in many jurisdictions for processing yard and garden waste, food scraps, food-soiled paper, animal by-products, manure, and biosolids. Composting generates heat that is used to deactivate pathogens within the compost pile (i.e., heat is generated and then used to reduce pathogen levels in the compost) if a certain duration and temperature is maintained. This process to reduce pathogen levels is referred to as Processes to Further Reduce Pathogens (PFRPs). Composting is also often used after anaerobic digestion (wet and dry methods) to produce a more stable and marketable nutrient rich compost. Composting technologies can range from a simple non-aerated static pile to aerated piles/windrows and to more complicated in-vessel (i.e., inside a building) systems.

When considering the seasonality of the material from the Cape and Islands towns, the County should consider aerated composting technologies to increase throughput and minimize odor issues.

Aerated Composting
An aerated composting approach should have the composting area built on an impermeable surface such as a concrete or asphalt pad with a 2 percent grade to allow for leachate collection. Each pile can be equipped with a concrete floor with imbedded aeration channels or piping, or perforated pipe is placed on the compost pad and compost piles are built over top. The aeration pipes are connected to a blower equipped with a control system to moderate temperature and oxygen content in the pile. The control system tracks operating conditions to determine aeration rates, usually based on temperature feedback. Condensate and leachate are collected in the trench with drainage to a sump.

Odor is managed by maintaining aerobic conditions in the pile and this can be accomplished by keeping piles small or injecting air into the composting pile (i.e., forced aeration). The composting time takes a minimum of three months plus some additional time for curing which can take 3 to 6 months depending on the feedstocks and climate.

Table 2-5 on the next page presents aerated static pile (ASP) composting benefits and considerations.

Table 2-5: Aerated Static Pile (ASP) Composting Benefits and Considerations[1]

Benefits	Considerations
▪ Can be suitable for composting food waste and biosolids. ▪ Forced aeration reduces land requirements and mixing. ▪ Can result in more rapid stabilization in the high-rate compost stage. ▪ Use of negative aeration with a biofilter can help control odors. ▪ Smaller surface area relative to windrows. ▪ Can have lower operating equipment requirements with less mixing/turning. ▪ Can achieve pathogen reduction temperatures.	▪ Slightly higher capital cost for forced aeration equipment. ▪ Moisture addition may be required if piles dry from over aeration. ▪ Feedstock pre-processing requires a higher degree of care; feedstocks must be well mixed and properly sized and moistened. ▪ More operator skills are required to manage aeration systems. ▪ Aeration systems generally require three phase electrical supply. ▪ Exposure to rain can be problematic if the pile becomes over saturated unless it is under cover.

[1] *Sourced from http://aep.alberta.ca/waste/reports-data/documents/LeafYardWasteDiversionStrategy-Aug2010.pdf*

2.7.5.1 Membrane-Covered Aerated Static Pile (CASP)

The covered aerated static pile composting area is typically constructed on an impermeable surface such as concrete or asphalt with a 2 percent grade to allow for leachate collection. The aeration system design uses an aeration channel built into the impermeable compost pad. Leachate is collected in the aeration channel and drains to a sump. Surface leachate is drained over the pad to a leachate pond or sump.

The GORE Cover System is a covered aerated static pile (CASP) that operates using positive aeration. The cover is made of a microporous membrane (PTFE) sandwiched between a bottom and top fabric. The cover is placed over the pile and secured to the ground or to support walls on the side of the pile. As air is injected into the pile, the breathable membrane expands like a balloon to create an in-vessel like environment. The sealed edges create a fully enclosed system. This membrane allows for the management and retention of moisture, temperature, and odor. Odors are reduced with efficient aeration, and with odor molecules being absorbed into the moisture film forming inside the cover. The control system monitors oxygen content and pile temperature. The control system uses oxygen feedback to activate the blowers to maintain oxygen levels.

Image: **GORE Covered Aerated Static Pile**

The composting process consists of the main active phase (4 weeks under GORE cover), second active phase (2 weeks under GORE cover) and curing phase (2 weeks without GORE cover). Between each phase, the composting material is mixed by moving the materials from one bunker to another. The residence time for this type of system is approximately 56 days. Further curing of the compost can be expected with a market ready compost produced in 6 to 9 months.

2.8 ECO-PARKS IN OTHER JURISDICTIONS

The Project Team recommends for the County to consider how other jurisdictions are transforming waste into resources. Below are two examples of Eco-Parks that incorporate reuse, recycling, and clean energy recovery technologies, and also include community services and educational programs.

2.8.1 Monterey Regional Waste Management District, California

The Monterey Regional Waste Management District (MRWMD) services a population of approximately 170,000 residents. The District's facilities are located on 475 acres that consists of a landfill (315 acres), buffer area (126 acres), resource recovery facilities (20 acres), and a community collection facility with administrative offices and maintenance buildings (12 acres). Services include MSW disposal, recycling, composting facility and household hazardous waste (HHW) collection.

The organics recycling is a primary driver to reduce MSW and greenhouse gas emission reductions as a means to comply with California's organics regulations. The Eco-Park includes a reuse and swap shop, and an artist in residence. An anaerobic digestion facility was operating but shut down and moved to another location.

2.8.2 Prince William County, Virginia

Prince William County (County) is solving environmental challenges through research, education, energy generation, & resource recovery. The County transformed its landfill into a community resource producing green energy, recovering valuable materials, and providing unique opportunities for education and research. The Eco-Park includes a state-of-the art landfill, 6.8-MW methane-to-energy facility and materials recovery/recycling facilities. Under development are food waste-to-energy conversion including biogas, vehicle fueling station, solar electricity generation, and greenhouses fueled by waste heat and biogas.

The Eco-Park includes 383-acres of forest buffer containing old growth trees and multiple streams. A variety of wildlife have been observed including white tailed deer, red foxes, wild turkeys, salamanders, and numerous woodland bird species.

The Eco-Park includes plans for an interpretive science-technology-engineering-math (STEM) Education Center that will empower students to solve today's environmental challenges through hands-on activities and onsite investigations. Collaborations with institutions and universities will advance energy generation and waste management research. Community members and visitors discover ways to reduce their impact on the environment and live a more sustainable life. **Table 2-6** shows the technologies and community benefits of the Prince William County's Eco-Park.

Table 2-6: Prince William County Eco-Park Technologies

Energy and Recovery Technologies	Community Benefits
6.8 MW Landfill Gas Collection	• Methane gas captured and converted to electricity and heat • Energy used to heat County facilities like fleet maintenance shop, school bus garage and animal shelter • Future teaching greenhouses* can be located onsite, utilizing the heat, electricity and CO2 from landfill gas.

Solar Energy Generation*	• Solar photovoltaic panels on capped sections generate electricity for on-site County facilities.
Recycling Facilities	• More than 52,000 tons of plastics, paper, electronics, metal, batteries, automotive fluids and household items kept out of the landfill in 2015.
Organics Management Facilities (Composting and Anaerobic Digestion)	• Almost 40,000 tons of yard waste converted into compost and mulch in 2015. • Food waste converted to energy in anaerobic digester

* Technologies are under development.

3.0 FUTURE REGULATORY DRIVERS

Through the Solid Waste Master Plan 2030, the MassDEP provides the overall framework, direction, and goals for solid waste reduction and management policy in Massachusetts.

The MassDEP reports that there is very limited capacity at materials recovery facilities (MRFs), and these facilities are operating at nearly 100 percent of capacity. Continuing efforts to remove contamination can increase recycling capacity by removing tons of contamination to open up capacity at these MRFs.

The County could consider approaching MassDEP about options for public material recycling facilities (MRF) to develop recycling markets in the region. These facilities could include organics management and typical recycling materials including glass. Statewide efforts are focused on reduction of greenhouse gas emissions and to mitigate disruptions in rail and truck hauling. The MassDEP is also looking forward to market development initiatives to foster instate markets for reusable and compostable materials.

The County should start thinking about potential market effects of the Plan, and how the County can support a regional waste diversion effort to position the Cape and Islands towns to get ahead of regulations and impending legislation.

> Waste and materials management in Massachusetts has changed dramatically since 2010. --- MassDEP

3.1 MASSACHUSETTS STATE SOLID WASTE MASTER PLAN 2030

Changes in global recycling markets have led to tight recycling capacity, enhanced commodity quality requirements, depressed prices, and increased recycling costs in the Commonwealth. The recent closure of a large glass processor in Massachusetts has further stressed these markets.

Solid waste disposal capacity in Massachusetts is becoming increasingly limited. As disposal options continue to decrease, it will get more logistically difficult and costly to transport waste to final disposal sites.

Dwindling disposal capacity has weakened the resiliency of Massachusetts waste disposal infrastructure, and facility outages that were routine in the past are causing frequent operational challenges. Routine maintenance outages at area waste-to-energy facilities are increasingly causing down-stream hauling and disposal challenges as the logistical disposal network scrambles to accommodate these transient shortfalls.

The State Solid Waste Master Plan 2030 establishes the Commonwealth's policy framework for reducing and managing solid waste that is generated, reused, recycled, or disposed by Massachusetts residents and businesses, and proposes a broad vision and strategies for how the Commonwealth will manage waste over the next decade and beyond.

In accordance with the requirements of Massachusetts General Law Chapter 16, Section 21, the Massachusetts Department of Environmental Protection (MassDEP) issued the final State Solid Waste Master Plan 2030 with established goals to reduce disposal statewide by 30 percent, from 5.7 million tons in 2018 to 4 million tons in 2030 over the next decade. The Solid Waste Master Plan 2030 also sets a long-term goal of a 90 percent reduction in disposal to 570,000 tons by 2050.

MassDEP will allow permitting of up to 350,000 tons of additional annual management capacity in the form of innovative waste to energy or other integrated waste management technologies and allow replacement of existing

waste to energy capacity with more advanced technologies that reduce emissions and increase separation of recyclable materials.

For Massachusetts to achieve their stated mid to long-term solid waste disposal reduction goals, it is reasonable to conclude that MassDEP and future rulemaking will continue to seek to ban materials from landfilling and incineration. In response to this, the statewide marketplace will require a substantial infusion of additional and/or enhanced recycling/diversion infrastructure and implementation of a safe and reliable waste conversion technology to address this additional capacity of material mandated for disposal diversion. In lieu of this, those charged with managing waste will be required to access disposal or processing options out-of-state as an alternative, which is likely to become an increasing costly, unsustainable solution as other northeastern states will also seek to pursue increasingly aggressive diversion mandates.

3.1.1 Recycling and End Market Development

The Baker-Polito Administration will establish a **State Agency Recycling Market Development Council**, which will be chaired by the Executive Office of Energy and Environmental Affairs. This group will focus on increasing the use of recycled materials in state building, construction, and renovation projects and increasing state purchasing of recycled content products. Focus materials are expected to include asphalt shingles, glass, compost, office furniture, and tires. As a result, Minimum Performance Standards (MPS) that have been recently enacted for C&D materials is likely forthcoming for other portions of the waste stream.

The towns of the Cape and Islands have historically expressed their desire to continue to maintain their current level of service at their existing facilities, but the County should consider what additional capabilities may be necessary in the future that is beyond individual towns to provide what might be imposed on towns by the revised SWMP. The Cape and Island towns may need to have in-County, secondary processing/transportation location options to be best positioned to respond to these state-imposed mandates. The flexibility of having properties identified for secondary processing could present a cost avoidance strategy over time, as it would allow the County and its member towns to either develop these facilities themselves or RFP service providers for bids to manage targeted commodities. Options for managing commodities could be benchmarked against mandate requirements and existing cost structures.

3.1.2 Mandatory Food Waste Recycling by 2030

MassDEP's organics waste reduction goal is to increase the annual organics diversion by 500,000 tons over the 2018 baseline of 280,000 tons to reach a total of 780,000 tons of food waste diversion by 2030.

Currently, the town transfer stations collect primarily yard debris, but would be increasingly expected to deliver more source separated food waste as the MassDEP lowers the threshold for commercial organics diversion ban to generators of a half-ton per year in November 2022. Future efforts should include further development of community and drop-off organics collection programs and efficient models for curbside food waste collection.

3.1.3 Environmental Justice

MassDEP identified increasing engagement with environmental justice populations[2] in all phases of the regulatory process from development to implementation. MassDEP recommends, and in some cases may require, providing program information and outreach materials in multiple languages to ensure equitable access for all people.

[2] https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts

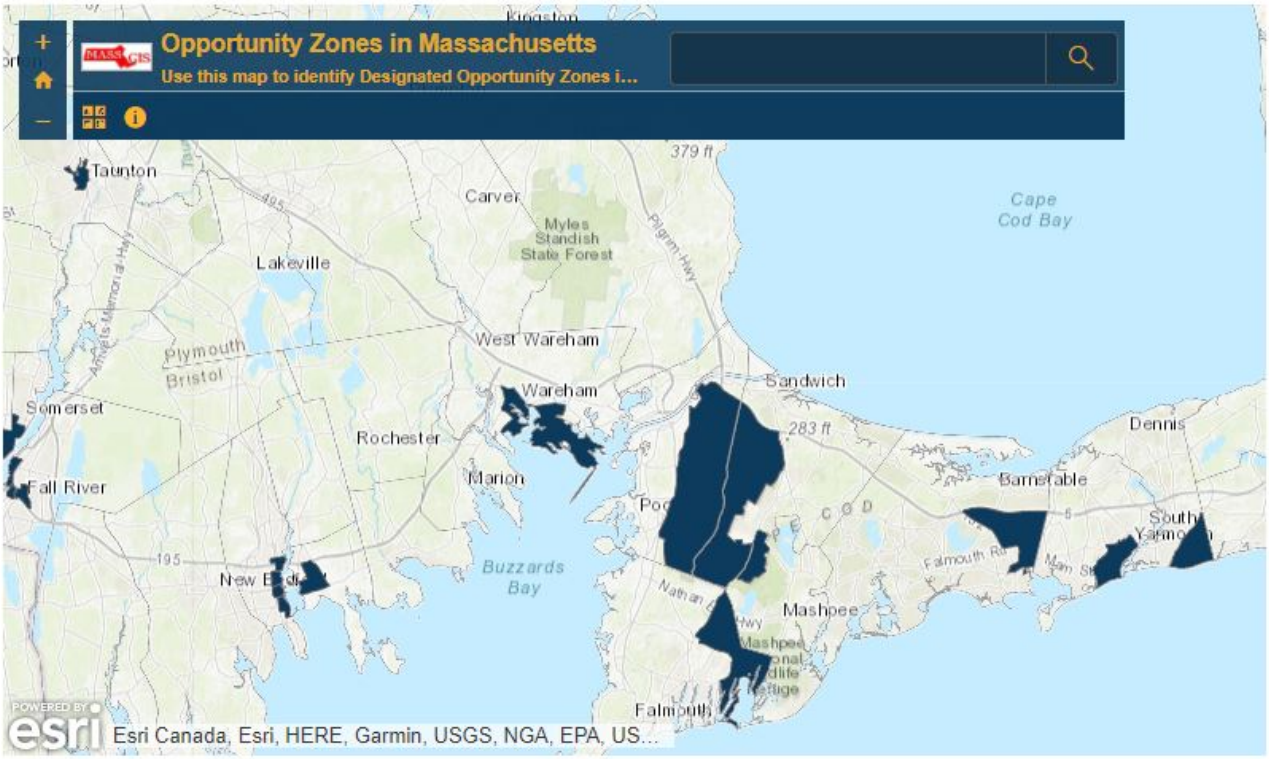
The County should also develop its own environmental justice engagement plan to follow the initiatives that the MassDEP has identified. This could include activities to promote and enable composting at community gardens in environmental justice areas, and use of electric, hybrid and recycling collection vehicles in Falmouth, Bourne and Provincetown, which include identified environmental justice populations and operate town curbside pickup programs.

The Joint Base Cape Cod (JBCC) is located within the four communities including Mashpee, Bourne, Sandwich, and Falmouth. The portions of these towns that host the JBCC are recognized as Environmental Justice populations *(Massachusetts Environmental Justice Policy June 2021)* with segments of the population or neighborhoods at risk of being unaware or unable to participate in environmental decision-making processes. Should infrastructure be developed at JBCC to support a long-term waste management plan, the County should engage with these communities with education and environmental decision-making through expanded and inclusive outreach.

3.1.3.1 Opportunity Zone Areas

JBCC is an Opportunity Zone that could have potential for federally funded tax incentives. The USEPA provides grants to partner with local community development efforts to realize improvements in solid waste operations that may reveal untapped local resources and synergies to fuel solutions to perennial solid waste challenges. **Figure 3-1** shows the Opportunity Zone areas *(similar in location to state mapped Environmental Justice Communities)* on Cape Cod.

Figure 3-1: Opportunity Zone Areas on Cape Cod and Nearby Towns



4.0 COST MITIGATION STRATEGIES

Each member municipality in the County manages their waste streams independently. Additionally, any and all recyclable materials collected from towns could be marketed together for lower administration costs (i.e. time negotiating with commodity brokers) and potentially higher commodity prices and lower transportation costs.

Program costs for individual towns are expected to continue to increase. Many towns duplicate efforts to set up contracts, manage communication strategies and respond to customer concerns. Collective organization should reduce administration costs and provide consistency in solid waste services.

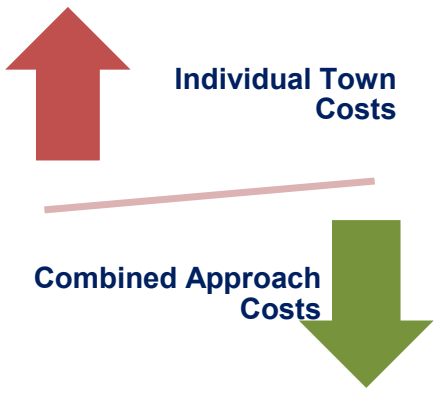
Working together to coalesce MSW materials from all the Cape and Islands towns may drive collection costs down due to leveraging larger volumes for service providers. Options pursued for municipal solid waste materials management are not only about managing costs, but also positioning Cape and Islands towns to respond to regulatory mandates and their intended, and unintended, consequences.

The County is positioned to work with the towns of the Cape Cod and Islands to respond to the dynamic changes in the Massachusetts and Northeast US solid waste marketplace. This includes the following:

1. **Establish a regional government structure with each Town having representation.**
2. **Provide information on trends in the recyclable materials market; conduct outreach to better understand the economic and environmental values of residents and commercial entities.**
3. **The County should understand the amount of waste created per generator with an emphasis on tracking and measuring to be in a better position in the market.**
4. **There is a need for firm tonnages from the town transfer stations. Towns currently use different metrics, and the measurements/monitoring is not consistent across all towns.**
5. **Determine how to provide vendors with specific volume for materials for future RFP processes so as to be able to obtain the best price for services from commercial service providers.**

4.1.1 Aggregating Waste Materials for Higher Value

Aggregating waste materials provides the necessary scale to yield a high performing value recovery. The waste generated from the region creates the potential for regional facilities such as a local organics management facility or other means of processing/disposal to be financially competitive and environmentally viable. This approach is the direction that most communities have/are moving toward.



It is feasible to look at the immediate needs of growing waste volumes and materials and plan ahead for infrastructure to create further value in the future.

To do so requires a system that respects the principles of the circular economy, which strives to create more economic, environmental, and social value by moving from landfill and incineration to source reduction, recycling and reuse.

4.1.2 Recognizing Economies of Scale

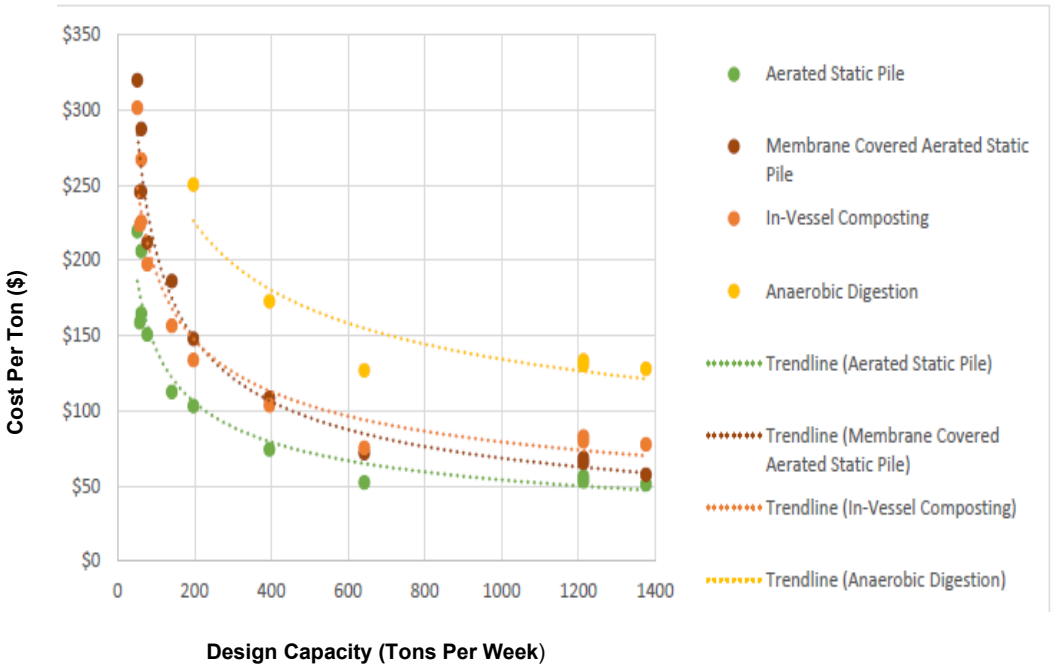
Tetra Tech recently conducted an organics facility feasibility assessment that reviewed organics processing technologies and prepared conceptual designs and cost estimates for selected technologies. The four technology options selected for the analysis include (1) Aerated Static Pile (ASP); (2) Membrane Covered Aerated Static Pile; (3) In-vessel Composting; and 4) Anaerobic Digestion.

Conceptual designs based on these technologies were prepared , using design capacity estimates based on projected quantities of organics feedstock over a 20-year period. For each design scenario, capital and operating cost estimates were calculated and presented as a unit processing cost (cost per ton). The cost per ton ranged from $52 to $320. Although the conceptual designs show that it would be possible to develop organics processing facilities, the unit processing cost was determined to be more economical for facilities with higher processing capacities, recognizing economies of scale. The unit processing costs were compared with the processing rate from each respective design scenario.

Figure 4-1 shows how unit processing costs change based on the processing design capacity of the conceptual facility and the technology selected for the design. This graph illustrates how the unit processing costs decrease as a function of when the facility's incoming feedstock capacity increases.

This underscores how regional or centralized organics processing facilities would be less expensive to operate on a unit basis when compared to having multiple, smaller facilities. This highlights how economies of scale may make processing cost more competitive when compared to an alternate disposal cost.

Figure 4-1: Cost Per Ton Versus Design Capacity and Technology



5.0 NEXT STEPS

The County is in a position to lead, coordinate, provide guidance and insights to assist Cape Cod towns and Islands towns in their collaborative planning to divert valuable materials through organics processing, materials reuse/recycling, and incorporate regional sustainability objectives. The following is a list of next steps that the County can pursue to advance collaboration and system resiliency within the County.

5.1.1 Vision Statement

The County should establish a mission and vision statement for solid waste management. Developing a vision statement is the first step to defining what the County's future system will be. A future system may very well cost more than the towns' current system but may be preferable due to environmental or social outcomes. It is possible that the current system of towns working independently is unable to respond to MassDEP's mandates in the future, and that a new collaborative system can respond to and provide return on investment through shared resources and aggregated material volumes for better pricing.

A draft vision statement has been prepared for the County to consider.

> *Barnstable County and the towns of the Cape and Islands will collaborate to evolve their solid waste management system to respond to current and future statewide planning mandates and maximize resource reuse for a more flexible, circular paradigm of resource management.*

5.1.2 Assemble Towns

Barnstable County is a unique area within Massachusetts geographically, with the benefit that the County serves as an over-arching governing entity. The County can bring together the Cape towns, including Martha's Vineyard and Nantucket, to develop common goals. Utilizing the State Solid Waste Master Plan 2030 and this MSW Diversion report as a basis for planning, the County should establish a forum for consensus building and develop a future planning process for the towns to organize around a Diversion Collaborative and a solid waste management infrastructure designed to be resilient to what will be the ever-increasing MassDEP rulemaking concerning waste diversion and recycling mandates.

5.1.3 Material Tracking

Understanding materials and solid waste volumes will enable the County to better understand their position for negotiation of disposal contracts, along with all recyclable materials collected within the County. Together, the waste generated from multi-community agreements enables the potential for facilities such as a County-wide organics management facility to be financially and environmentally viable.

1. **Establish a regional governance structure with each Town having representation.**

2. **Provide information on trends in the recyclable materials market to better understand the economic and environmental values of residents and commercial entities.**

3. **The County needs to understand the amount of waste created per generator with an emphasis on tracking and measuring to be in a better position in the market.**

4. **Towns should measure and monitor solid waste management tonnage using similar metrics for reporting purposes and equitable funding models.**

5. **Monthly monitoring for material volumes will inform future RFP processes so that the best prices for services from commercial service providers are achievable.**

If the JBCC parcels are under County use, the County would be in position to issue Request For Proposals (RFPs) for interest in providing desired programs or services. To the degree the County can provide a collectively accurate account of the volume of materials that the Cape and Islands towns generate, it will make it easier for private entities to respond with both certainty and best available pricing. Barnstable County could coordinate with the Upper Cape Regional Transfer Station Management Board to identify possible options for further development of regional waste management solutions.

Planning activities should be based on developing a framework for the towns to make decisions based on their knowledge and best interests of their residents, businesses, and visitors.

5.1.4 Existing Facilities and Service / Secondary Processing Location

Historically, towns have indicated a strong desire to maintain the current system of discreet, autonomous community infrastructure to provide conveniently located waste transfer and recycling services to residents. As such, the system as constituted is not conducive to driving to the lowest cost operation as it is philosophically geared more toward locational convenience, high-level of personal service and municipal autonomy as opposed to regionality and economy of scale.

However, current and future State regulation concerning landfill and waste-to-energy (incineration) moratoriums and diversion (quantity and quality) mandates may make it increasingly challenging for individual Cape towns to respond to these yet to be determined directives with the existing infrastructure in place. Because of the strong inclination of towns to continue to provide services at the existing network of municipal facilities, it is incumbent upon local and regional entities to formulate a planning foundation flexible enough to identify suitable locations for secondary processing facilities that is capable of responding to future mandates. To do so is consistent with the historical inclination of towns to maintain control of their solid waste management responsibilities and to be reasonably positioned to avoid costs to the system, to the degree possible, that future moratoriums or mandates may impose.

Future recycling/diversion mandates that may be imposed:

- Organics diversion mandates are becoming more common because it typically represents the largest proportion of the waste stream. Important considerations for organics diversion are processing systems, quality of end use product and local market development.
- Material Performance Standards (MPS) on C&D material has been recently codified and is expected to continue evolving in terms of its long-term impact to the existing C&D management infrastructure in Massachusetts.
- Materials recovery facilities (MRFs) have been in a state of flux since the 2017-2018 upheaval in commodity markets resulting from contamination issues. Moving forward, Material Performance Standards (MPS) may also be targeted to be codified for recyclable materials collected at transfer stations and from curbside collection programs. As a result, there may be a statewide re-evaluation of recyclables collection and processing, such as the re-emergence of dual-stream recycling or other enhanced processing methods, to reduce contamination and promote higher material quality end-use material.

Future implications of landfill / incineration moratoriums:

- As in-state landfill or incineration capacity decreases, the towns will have two choices; 1) Develop additional infrastructure to ship waste to more distant disposal facilities, or 2) Identify in-County properties to advance conversion technology alternatives as they become available in the future as a waste disposal alternative to landfilling and incineration.

Lack of Disaster/Emergency debris staging or processing capability on Cape:

- Disasters along the coast are occurring with greater frequency and intensity. The Cape does not have an identified in-County location to store/process/transport Disaster/Emergency related debris. This limits the towns' ability to respond to these "black swan" waste generation scenarios.

The notion and pursuit of a County initiated Eco-Park would serve as a platform, parallel to the existing network of town transfer stations and collection sites, to establish secondary processing locations that would be implemented over time to source Cape material. Infrastructure and operations of these facilities could be borne by local and regional governments, commercial waste/recycling processors, or some combination of these entities as the towns would see fit.

There are solutions for waste stream materials conversion technologies that are acceptable to the Massachusetts Department of Environmental Protection (MassDEP), which include gasification, pyrolysis, and other integrated waste management solutions. The Eco-Park would be an ideal future platform/laboratory for MassDEP to permit new technologies on an experimental basis and would allow private companies seeking to implement emerging conversion technologies on the Cape as an intermediate step moving away from landfill and incineration, and toward a zero-waste future.

These technologies could include a County-wide anaerobic digestion facility to process organics to energy, and advanced recycling technologies such as pyrolysis and gasification of plastics into fuels and chemical processes that break down used plastics into monomers for reintroduction into the commodities market.

5.1.5 Return on Investment Versus Cost Avoidance: Values

The idea of Return on Investment (ROI) is a multifaceted concept that is both driven by financial considerations and values. In this case, ROI should be analyzed through the towns working individually versus the potential future of the towns working as a Diversion Collaborative or Collective, which the County could initiate and assist the towns to achieve together.

As stated earlier in this section, the towns will need to reach a consensus and agree on what they value. As an example, the level of service and programs provided by each town transfer station and the amount of self-sufficiency that is most important for them to maintain over time should be considered.

A possible scenario is it is more cost effective to close fourteen of the town transfer facilities and operate a single point of collection for all town waste materials and recyclables to be administered by a commercial waste provider. How would the towns make that decision and potentially agree to that arrangement?

It might be cheaper to dispose of many of the waste material items that the towns are currently diverting, but is that what the towns value most? As a collective, are the towns ready to strive to be compliant with MassDEP's 2030 waste diversion goals and begin the process to resiliently achieve that? These questions have yet to be discussed.

Jack Units, the recently retired Barnstable County Administrator, envisioned the member towns working toward a resilient system for materials management through a cohesive transfer station network. It is well-known that the

towns work well together, and reuse and recycling of all types of materials is extensive across the Cape and Islands.

This is a starting point for the County to coordinate the towns and build early consensus and focus on future solid waste management and zero-waste. The County and towns should work together starting with a review of the management of waste on the Cape and Islands, and collaborating on a solution for potential energy generation that doesn't compete with the Town of Yarmouth's wastewater/food waste AD system. Moreover, a Waste Diversion Collaborative opportunity with regional infrastructure to address current and future waste bans is recommended.

6.0 BIBLIOGRAPHY

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- Massachusetts Environmental Justice Policy, June 2021
- Massachusetts Materials Management Capacity Study Final Report February 11, 2019
- United States Environmental Protection Agency, Sustainable Materials Management
- Cape Cod Commission Climate Action Plan July 2021

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