Agenda Item # 2d)

Tisbury Oak Bluffs Solid Waste Transportation Alternatives

Tisbury and Oak Bluffs
Martha's Vineyard, Massachusetts

Submitted to:
Woods Hole, Martha's Vineyard and Nantucket Steamship Authority

TETRA TECH

April 25, 2018

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Steven M. Sayers
General Counsel
Woods Hole, Martha's Vineyard and Nantucket Steamship Authority

Re: Tisbury Oak Bluffs Solid Waste Transportation Alternatives
Tisbury and Oak Bluffs
Martha's Vineyard, Massachusetts

Dear Mr. Sayers:

Tetra Tech, Inc. (Tetra Tech) has prepared this report to document our review of municipal solid waste (MSW) management and transport options for Martha's Vineyard. The primary focus of our analysis was to review MSW management considerations for the waste stream that is being generated from the towns of Oak Bluffs and Tisbury including the feasibility and approximate costs associated with the installation and operation of a MSW baling or compacting system and the possibility of utilizing a private contractor to haul waste from Martha's Vineyard to the mainland via barge. This report summarizes our findings based upon our review of existing studies, observations at the current and proposed MSW management facilities, interviews and information provided by personnel currently involved in the management of MSW, and assumptions and calculations performed to estimate costs associated with alternative transportation options. Questions regarding this report may be directed to Christopher Nitchie at 508-786-2203.

Very truly yours,

Christopher K. Nitchie, PE, LSP
Project Manager

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Director

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TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Methodology 1

1.1.1 Site Visits 1

1.1.2 Interviews 1

1.2 Previous Studies 2

1.2.1 Solid Waste Management Consolidation Study - 2011 2

1.2.2 Feasibility of Establishing a Port-to Port Containerized Transportation Service between New Bedford and Martha's Vineyard – 2012 2

2.0 CURRENT MSW MANAGEMENT 3

2.1 Current MSW Generation 3

2.2 Current MSW Transportation 3

2.3 Current MSW Disposal Costs 3

3.0 PROPOSED MSW MANAGEMENT 4

3.1 Baler Installation Options 4

3.2 Baler ModeL 4

3.3 Location 5

3.4 Installation Costs 5

3.5 Operational Costs 6

3.6 Disposal of Baled MSW 6

3.7 Baled MSW TRANSPORTATION OPTIONS 7

3.7.1 Barge Transport by R.M. Packer to Local Facility 7

3.7.2 Barge Transport by R.M Packer with Transfer to Rail Cars 8

3.7.3 Transport of Baled MSW on SSA Ferries 8

4.0 ALTERNATIVE MSW DISPOSAL OPTIONS 9

4.1 On-island Landfill 9

4.2 On-Island Waste to Energy Facility 9

5.0 RECYCLING AND CONSTRUCTION RELATED WASTES 10

5.1 Recycling Transporation 10
5.2 Construction and Demolition Waste Transportation 11
5.3 Recycling and Construction Waste Recomendations 12
6.0 CONCLUSIONS **12**

LIST OF TABLES

Table 1 2017 Solid Waste Stream Data for the Oak Bluffs and Tisbury Transfer Station
Table 2 Costs Associated with Solid Waste Disposal January 2018
Table 3 Motor Carrier Costs Based on 2016 National Averages
Table 4 Transportation Costs Summary Table

LIST OF FIGURES

Figure 1 Potential Sorting Building Expansion
Figure 2 Receiving Facility Locations

LIST OF APPENDICES

Appendix A Limitations
Appendix B Historical Solid Waste Management Studies for the Island of Martha's Vineyard
Appendix C Baler Schematic

1.0 INTRODUCTION

Management of solid waste for the communities of Martha's Vineyard presents unique challenges beyond those experienced in most cities and towns in Massachusetts. Currently no active landfills or waste disposal facilities exist on the island; therefore, most generated waste must be shipped off the island for disposal or recycling.

Martha's Vineyard has two solid waste management districts. The towns of Aquinnah, Chilmark, Edgartown and West Tisbury jointly manage their solid waste through the Martha's Vineyard Regional Refuse Disposal and Resource Recovery District (MVRD). MVRD currently operates a transfer station in Edgartown. The towns of Tisbury and Oak Bluffs manage their waste separately from MVRD through operation of a transfer station in Oak Bluffs. Currently all the waste that passes through the two transfer stations on the island is transported to the mainland via open top trailer trucks on Steamship Authority (SSA) ferries.

Tetra Tech, Inc. (Tetra Tech) has prepared this report to document our review of municipal solid waste (MSW) management and transport options for Martha's Vineyard. The primary focus of our analysis was to review MSW management considerations for the waste stream that is being generated from the towns of Oak Bluffs and Tisbury including the feasibility and approximate costs associated with the installation and operation of a MSW baling or compacting system and the possibility of utilizing a private contractor to haul waste from Martha's Vineyard to the mainland via barge. This report summarizes our findings based upon our review of existing studies, observations at the current and proposed MSW management facilities, interviews and information provided by personnel currently involved in the management of MSW, and assumptions and calculations performed to estimate costs associated with alternative transportation options.

1.1 METHODOLOGY

In preparing this report Tetra Tech conducted site visits and interviews and conducted research including reviews of previously conducted solid waste management studies for Martha's Vineyard. The following sections summarize the research conducted:

1.1.1 Site Visits

Tetra Tech conducted site visits at the following facilities to evaluate the current waste management operations and proposed alternative options:

- Oak Bluffs/Tisbury Transfer Station
- Packer Terminal (Vineyard Haven, MA)
- SSA's Vineyard Haven Ferry Terminal
- SSA's Woods Hole Ferry Terminal
- Goodale Construction Company Facility (Oak Bluffs, MA)

1.1.2 Interviews

Tetra Tech interviewed or requested information from the following people to evaluate the current waste management operations and proposed alternative options:

- Greg Carroll, Bruno's Rolloff Inc.

- Mick Vukota, Bruno's Rolloff Inc.
- Patrick Medeiros, Bruno's Rolloff Inc.
- Jay Grande, Town of Tisbury
- Ralph Packer, R.M. Packer
- John Packer, R.M. Packer
- Thomas Maguire, Maguire Equipment Inc.
- Rich O'Conner, Covanta SEMASS
- Scott Alfonse, Greater New Bedford Regional Refuse Management District
- Peter Goodale, Goodale Construction Company

1.2 PREVIOUS STUDIES

Historical solid waste management studies for the island of Martha's Vineyard were reviewed prior to preparation of this report to provide context regarding waste management alternatives that have been evaluated and/or implemented in the past. Each of the studies reviewed is presented below with a summary of the study performed. Copies of each of the reports referenced in this section are presented in Appendix B.

1.2.1 Solid Waste Management Consolidation Study - 2011

The Solid Waste Management Consolidation Study was prepared by Environmental Partners and is dated February 2011. This document focuses on the feasibility of consolidating the MVRD and Oak Bluffs and Tisbury waste disposal service communities into a single island-wide district serving all the towns on Martha's Vineyard.

The report included the conclusion that if all the solid waste for an island-wide district were to be processed in one of the two existing facilities, the daily and/or annual tonnage limits for either of the two facilities would likely be exceeded. While it may be possible to request an increase in the tonnage thresholds from MassDEP and/or the local Boards of Health, the report also identified a steadily increasing volume of solid waste that is generated by the communities on Martha's Vineyard. Therefore, a consolidated solid waste management district would likely need to continue to utilize both of the existing transfer stations on the island, but the materials processed in the two facilities might be altered to maximize efficiency.

1.2.2 Feasibility of Establishing a Port-to Port Containerized Transportation Service between New Bedford and Martha's Vineyard – 2012

This feasibility study was prepared by HDR Engineering, Inc. in 2012 to assess the feasibility of shipping solid waste from the Oak Bluffs and Tisbury Transfer Station off the island on barges instead of the current practice of trucking the waste off the island on SSA ferries. This document provides an overview of a variety of transportation options including shipping solid waste off the island on barges in shipping containers or in plastic wrapped bales and transporting the shipping containers and/or bales to waste receiving facilities. The study provides estimated costs for the various segments of the transport pathway including estimated costs to purchase and operate barges and trucks and a summary of available disposal facility pricing at that time. The study concluded that transport and disposal costs for MSW and construction and demolition waste (C&D), including transport off the island by barge, would cost between approximately $140 and $167 per ton at the time that the study was performed. The document recommended that the feasibility and costs associated with installing and operating a baling system for

MSW be evaluated as well as identifying and reviewing alternative ports where shipments of solid waste could be shipped to by barge.

2.0 CURRENT MSW MANAGEMENT

The Oak Bluffs and Tisbury Transfer Station is currently operated by Bruno's Rolloff, Inc. (Bruno's). Bruno's manages the waste transfer station and provides transportation services for MSW, recycling and C&D. Bruno's provided Tetra Tech with monthly waste stream data for 2017 including the volume of MSW, recycling and C&D processed by the facility and estimated overhead, transportation and disposal costs associated with each waste stream as of January 2018. The waste stream data provided by Bruno's was tabulated and is presented in Table 1. This report focuses specifically on MSW management including the feasibility and approximate costs associated with the installation and operation of a MSW baling or compacting system and utilizing a private contractor to haul waste from Martha's Vineyard to the mainland via barge. C&D and single stream recycling are not candidates for baling and compacting without significant processing; however, transportation alternatives for these waste streams are discussed briefly in Section 5.0 of this report.

2.1 CURRENT MSW GENERATION

Based upon the hauling data provided by Bruno's, the Oak Bluffs and Tisbury Transfer Station processed approximately 22,258 tons of waste through the facility in 2017 of which approximately 12,050 tons was MSW. The volume of MSW processed by the transfer station has generally increased from year to year. Historical reports indicate that MSW generation in 2009 was approximately 8,300 tons.

2.2 CURRENT MSW TRANSPORTATION

MSW is currently hauled by Bruno's to Crapo Hill Landfill in North Dartmouth, Massachusetts. The waste is hauled in open top trailers from the transfer station to Vineyard Haven where the trucks are transferred to Woods Hole via SSA ferries. From Woods Hole the trucks drive to Crapo Hill Landfill to dispose of the waste. The roadway hauling limit for the trucks utilized to transport the waste limits each truck to hauling less than approximately 31 tons of waste per load and on average it is estimated that each truck transfers approximately 30 tons of waste per trip. The towns of Oak Bluffs and Tisbury have a contract with the Greater New Bedford Regional Refuse Management District, which owns and operates the Crapo Hill Landfill, to accept their waste through 2022.

2.3 CURRENT MSW DISPOSAL COSTS

The estimated costs to transport and dispose of MSW are presented on Table 2. Based upon the figures provided by Bruno's, that are current as of January 2018, we estimate that it costs approximately $150 per ton to transport and dispose of MSW from the Oak Bluffs and Tisbury Transfer Station. Bruno's cost figures indicate that it costs approximately $39 per ton to transport MSW to Crapo Hill Landfill with the remaining costs associated with the landfill disposal fee, town fee, and the labor and equipment costs associated with operating the transfer station. Of the $39 per ton in transportation costs, Bruno's attributes approximately $18 per ton to SSA fees associated with transporting the MSW from Vineyard Haven to Woods Hole on SSA ferries.

The trucks hauling MSW off the island backhaul mulch, stone, sod and other products to the island when there is demand for these products. According to Bruno's the majority of truck capacity is used for

backhauling during the peak season from March to October but backhauling operations are reduced to approximately 25% of hauling capacity in the mid-winter. Bruno's has indicated that the additional income from backhauling operations is considered during bidding for the MSW hauling contract and therefore reduces waste transportation costs for the towns. In order to account for return trips where trucks are backhauling materials we have estimated that 50% of the trucks annually return to the island backhauling materials and that no transportation costs are incurred by the towns for trucks that return to the island carrying goods.

3.0 PROPOSED MSW MANAGEMENT

The 2012 feasibility study recommended that the feasibility of baling MSW on the island and hauling the waste off island by barge be evaluated further. The following sections discuss some of the logistical and cost-related considerations likely to be encountered during the installation and operation of an MSW baler at the Oak Bluffs and Tisbury Transfer Station.

3.1 BALER INSTALLATION OPTIONS

Historical studies regarding potential MSW transportation options for Martha's Vineyard communities have identified that one of the limiting factors with regard to hauling waste off of the island is a lack of waste storage space on the island. MSW can create odor and pest issues if it is stored in open containers for extended periods of time. For this reason, waste is rarely stored at the Oak Bluffs and Tisbury Transfer Station for more than 24 hours before being loaded into open top trailers and transferred off the island on SSA ferries. The need to dispose of the waste quickly to avoid odor and pest issues limits the available transportation options. Barging of MSW to the mainland has been historically discussed; however, to efficiently transport the waste off the island by barge, the transporter would need the option of storing the waste for up to several days until sufficient waste has accumulated to warrant use of the barge or until a barge with additional capacity was scheduled to leave the island. Some mainland communities have overcome this obstacle by baling the waste and wrapping it in plastic. Baling and plastic wrapping MSW will reduce odor and pest concerns and provide a significantly longer window within which to transport the waste to its final disposal location. For the purposes of this study Tetra Tech gathered information on one baling system that would be capable of compacting and baling the current MSW stream for the Oak Bluffs and Tisbury Transfer Station. The feasibility and estimated costs associated with installing and operating a baler are presented in the sections below.

3.2 BALER MODEL

The baler model selected for evaluation in this study is a Galaxy 2R-310W-102 Two-Ram Baler produced by Marathon. The baler would be outfitted with a conveyor to feed the baler and a wrapping system to produce plastic wrapped bales of MSW. A schematic of the proposed equipment is included along with equipment specifications in Appendix C. The baler specifications indicate that it would produce bales of MSW that measure 30-inches high, 45-inches wide and 64-inches long and weigh approximately 2,200 lbs. This baler model was recommended by Tom Maguire of Maguire Equipment, Inc. as a typical baler in terms of size and cost for a MSW baling operation at a municipal transfer station. The selected baler has a cycle time of less than 30 seconds, and typically loading MSW into the baler is the limiting factor regarding the number of bales that the unit can produce per hour of operation. If the towns of Oak Bluffs and Tisbury elect to purchase a MSW baler we recommend that proposals and bids from multiple baler manufacturers be sought prior to purchase.

3.3 LOCATION

The 2R-310W-102 baler system requires a minimum area of 120-feet by 50-feet to allow for sufficient space to feed and operate the baler. The manufacturer recommends that the baler be installed on a minimum 6-inch steel reinforced concrete slab with a ¾-inch steel foundation plate anchored to the sub-floor. The thickness of the floor slab in the existing waste sorting building at the Oak Bluffs and Tisbury Transfer Station is not known; however, based on the need to continue using the existing building for sorting of recyclables and C&D, it is anticipated that an addition to the existing structure would need to be constructed at the transfer station to house the baler and support space. Based upon our measurements an expansion of the western half of the existing sorting building in the southern direction would likely provide the approximately 120 foot by 50 foot area necessary to house the baler while preserving the eastern half of the existing building for recycling and C&D operations.

Figure 1: Potential Sorting Building Expansion

If the proposed building configuration shown above is going to be considered in greater detail, a survey of the property boundaries and inquiry into the local building codes are necessary to further assess the feasibility of expanding the sorting building.

3.4 INSTALLATION COSTS

The Galaxy 2R-310W-102 Two-Ram Baler with a conveyor suitable for MSW application is estimated to cost around $550,000. Costs for a plastic wrapping system and with shipping and installation of the baler add an additional approximately $200,000 in capital costs. Site work and building renovation/construction are anticipated to add between $250,000 and $500,000 to the cost of installing the unit. As a conservative estimate, for the purposes of evaluating the feasibility of implementing a baling operation at the facility,

we estimate the total infrastructure costs to purchase and install the proposed equipment will fall somewhere between $1,000,000 and $1,250,000. For the purposes of comparing waste disposal alternatives, we have distributed the installation costs over a 10-year time frame (with no assumed interest on the payments) at $100,000 to $125,000 per year. In 2017 Bruno's reported that the Oak Bluffs and Tisbury Transfer Station processed approximately 12,050 tons of MSW. The installation costs of a baling and wrapping system thus represent a processing cost (equipment only) of approximately $8.30 to $10.37 per ton of MSW generated based upon the 2017 MSW generation rate, and for the purposes of this study we will assume that the cost will be approximately $10 per ton.

3.5 OPERATIONAL COSTS

Operational costs associated with the baling system are driven primarily by labor, equipment, the cost of plastic wrapping material, and electricity. The costs associated with labor could vary substantially based upon the efficiency of the operation and the volume of MSW being processed at the facility. During off-peak time periods operation of the baling unit would likely only be necessary for one to two hours per day; however, during peak summer months, it is likely that at least one full time employee will be needed to operate the baler for six to eight hours per day. Plastic wrapping units at similar municipal waste baling operations are reported to use approximately four pounds of plastic wrap for each bale. The plastic wrap costs about $1.50 per pound, representing a material cost of $6 per wrapped bale of MSW. The transfer of the bales to waiting flatbed trucks is typically accomplished with a forklift designed specifically for this task, and the transfer of each bale of MSW to a storage location or onto a truck represents costs in the form of labor, fuel and equipment costs. A cost of $5 per bale per location transfer (pick up and put down) was provided to Tetra Tech as a general budgeting estimate. In total, operators of balers have reported that they spend about $20 per ton on operational costs such as labor, fuel, equipment and materials associated with the operation of the baling equipment. Bruno's current operational costs include costs to sort and load open top trailers. Loading MSW into the baler would involve a process similar to the current activities at the transfer station; however, additional personnel would likely be necessary to operate the baler and load the baled MSW onto trucks. Because some portion of the baling operation is similar to the operations currently being performed by Bruno's, we do not anticipate that operation of a baler would represent an increase of $20 per ton relative to the costs currently being incurred to sort and load the MSW. For the purposes of cost comparison, we estimate that operation of the baler would represent an increase of $15 per ton of MSW relative to the current operational costs. This cost assumes that flatbed trucks will be staged at the facility to receive the bales immediately after being wrapped. If bales need to be staged at the facility and then loaded onto trucks at a later time, this would increase operational costs.

3.6 DISPOSAL OF BALED MSW

Neither Crapo Hill Landfill nor Covanta's SEMASS facility in Rochester, MA has indicated that it accepts baled waste at this time. Covanta's Haverhill, MA waste-to-energy facility does accept baled waste, but transporting baled waste to Haverhill would represent a significant cost increase because of the additional distance, as shown below.

Starting Location	Distance/Travel Time to Crapo Hill Landfill	Distance/Travel Time to Covanta Haverhill
Packer Marine, New Bedford	less than 10 miles 15-20 minutes	90-115 miles (depending on route) almost 2 hours

SSA Woods Hole Ferry Terminal	52 miles 1 hour	112 miles 2 hours

Additional research into facilities that accept baled MSW or negotiations with Crapo Hill Landfill and/or Covanta's SEMASS facility will be necessary prior to implementing a waste baling program. Transferring baled MSW to rail cars for out-of-state disposal has been discussed as a potential alternative to in-state landfill or waste-to-energy facilities. While not the primary focus of this feasibility assessment, rail transportation of MSW is discussed further in Section 3.7.2 below.

3.7 BALED MSW TRANSPORTATION OPTIONS

The baler model and plastic wrapping system selected for this feasibility study create plastic-wrapped blocks of MSW that are estimated to weigh 1.1 tons each. The 1.1-ton bales are typically transported on flatbed trucks but can be loaded into open top or closed top trucks or rail cars if suitable loading and offloading equipment is available. The following sections discuss the transportation options that may be available. For the purposes of cost estimating the cost of roadway transport in these alternatives was estimated based upon national average hauling costs available in *An Analysis of the Operational Costs of Trucking: 2017 Update* dated October 2017 and prepared by the American Transportation Research Institute. Table 3 presents a summary of the Roadway Transportation estimates. It is likely that localized hauling costs in southeastern Massachusetts and on Martha's Vineyard may exceed the national averages; however, the national averages were selected for cost comparison methods in this report to standardize the roadway transportation costs and to provide cost estimates that can be easily updated with published values in future years. Transportation cost estimates for the various transportation pathways evaluated are presented on Table 4. Table 4 does not include administrative costs or profit margins associated with roadway transportation, these elements likely represent the discrepancy between the costs calculated in Table 4 for the current MSW disposal operation ($130.73/ton) and the amount charged by Bruno's to the towns of Oak Bluffs and Tisbury ($150.09) as presented in Table 2.

Bruno's has indicated that they back haul goods to the island and attempt to maximize the efficiency of their hauling operations. Backhauling of goods occurs on most trucks during the busy summer months but occurs on only approximately 25% of the trucks during the winter months. Bruno's has indicated that the additional income derived from backhaul operations is considered during contract bidding and allows Bruno's to offer a lower contract price for transport and disposal of MSW. The dynamic nature of the backhauling operations makes quantifying the dollar value of savings associated with the backhauling operations challenging. For the purposes of cost comparison in Table 4, we assumed that 50% of Bruno's trucks backhaul goods to the island throughout the year and that the transportation costs of returning the truck to the island are fully covered by the backhauling operation.

3.7.1 Barge Transport by R.M. Packer to Local Facility

Ralph Packer of R.M. Packer Company has proposed that baled MSW could be transported from Martha's Vineyard to the mainland by barge. R.M. Packer regularly ships materials to and from Martha's Vineyard by barge and hauling of MSW to the mainland would represent primarily a back-haul operation. Plastic-wrapped bales of MSW could be staged at the R.M. Packer facility in Vineyard Haven and loaded onto outgoing barges as space permits. The bales would be barged to R.M. Packer's New Bedford facility and transferred to flatbed trucks for transport to a landfill or a waste-to-energy facility. Due to odor and pest related concerns, it is unlikely that MSW could be hauled by barge in unsealed containers. Plastic wrapped bales have been proposed as a solution to odor and pest related concerns and would give the hauler a longer window within which to arrange transportation to the mainland.

As previously discussed, installation and operational costs associated with baling and wrapping MSW at the Oak Bluffs and Tisbury Transfer Station are currently estimated to add $10 and $15 per ton, respectively, to the cost of disposing MSW via barge to the mainland. The cost of transferring the MSW bales by barge to the New Bedford is estimated by R.M. Packer to be approximately $8,000 per barge trip for a barge which could haul up to 1,200 tons. Based upon these costs we have estimated the barging cost to be $6.67 per ton; however, hauling bales of MSW would be a backhaul operation for R.M. Packer and there may be an opportunity to negotiate lower rates for barging if MSW would be hauled primarily on barges that carry freight to Martha's Vineyard and otherwise would travel empty back to New Bedford.

In addition to the barging costs, industry professionals often estimate handling costs based on a fee of $5 per bale per time that the bale is relocated (picked up and put down). Barging of waste will involve additional handling of the waste relative to the current operations since the bales will not only need to be loaded onto trucks at the transfer station; but also offloaded from trucks in Vineyard Haven (an additional $5 per bale); then loaded onto barges in Vineyard Haven (an additional $5 per bale); and finally off-loaded from the barges in New Bedford onto flatbeds (an additional $5 per bale) for transit to a disposal facility. Further, as described in Section 3.6, the nearest facility that Tetra Tech has identified that is currently accepting baled MSW waste streams, without a price mark up to break apart the bales, is in Haverhill, Massachusetts which is anticipated to increase transportation costs. Table 4 presents the estimated costs associated with transport of baled MSW by barge to Crapo Hill Landfill and to the Haverhill, Massachusetts facility.

3.7.2 Barge Transport by R.M Packer with Transfer to Rail Cars

Baled MSW is well suited for transportation by rail cars. The baling process compacts the waste and wraps the waste in plastic which mitigates the majority of odor and pest-related issues. MSW bales can be staged in a rail yard or on rail cars for days or weeks prior to departing for their ultimate destination. Bales may be hauled to waste-to-energy facilities or to landfills. Due to lack of available landfill space in northeastern states, hauling waste by rail to landfills in states with more abundant landfill space such as upstate New York, Pennsylvania and Ohio is becoming increasing common and can represent an economical alternative to disposal of waste at local facilities. R.M. Packer's New Bedford facility is located adjacent to a rail spur and the potential for development of an intermodal facility to transfer MSW bales to rail cars may represent an efficient transportation pathway for waste from Martha's Vineyard at some point in the future. Cost estimates for the transfer of MSW to out-of-state facilities for disposal is beyond the scope of this study; however, we recommend additional investigation into this alternative. The proximity of the R.M. Packer facility to the rail spur may make this alternative a competitive option, particularly if a substantial increase in the cost of local landfill disposal is encountered as many industry professionals have predicted will occur in the region in the coming years. The Oak Bluffs and Tisbury contract with Crapo Hill Landfill expires in 2022.

3.7.3 Transport of Baled MSW on SSA Ferries

Following baling and wrapping of MSW, the waste bales could continue to be transported off the island on SSA ferries instead of being barged to New Bedford. Plastic-wrapped MSW can be transported on flatbed trucks or in open top or closed top trucks as long as appropriate loading and unloading equipment is available for the trailers selected. Plastic-wrapped bales of MSW will have significantly less odor than transport of MSW in open top trailers during transit. The compaction of MSW into bales means that the waste will occupy less space within the trailers used to haul the waste. Unfortunately, due to roadway weight limits along the current transport route, most trucks are limited to hauling approximately 30 tons of waste at a time. Open top trailers hauling loose MSW already currently haul approximately 30 tons of

waste per trip; therefore, the baling of waste would not reduce the number of trucks necessary to haul the waste or the number of trucks on SSA ferries. The baled waste could however be shipped on smaller trucks than are currently used to haul the waste. Thirty (30) tons of baled and wrapped MSW could be shipped on a 40-foot-long flatbed truck if stacked two bales high or on a 28 foot long flatbed truck if stacking three bales high is permitted. The reduction in truck length would result in a slight reduction in SSA fees per truck and would also allow for additional vehicles to be transported on each Ferry.

Due to the additional installation and operational costs associated with baling and wrapping waste, which are currently estimated to be $25 per ton with no reduction in transportation costs, the option to bale MSW and haul it on trucks on the SSA ferries is likely more expensive than continuing to haul loose MSW in open top trailers on SSA ferries. Additionally, Tetra Tech has not identified landfills or waste-to-energy facilities in southeastern Massachusetts currently accepting baled MSW. Therefore, unless an agreement with Crapo Hill Landfill can be reached to accept the baled waste or a suitable alternative disposal facility is identified, there will also be significantly higher costs to transport the waste by truck to an acceptable facility, such as Covanta Haverhill, due to the longer distance that they will need to travel.

4.0 ALTERNATIVE MSW DISPOSAL OPTIONS

From a transportation perspective, identification or construction of a facility capable of disposing of MSW on Martha's Vineyard would substantially reduce the logistical challenges of hauling the waste off of the island for disposal. Unfortunately, no facility currently exists on the island that is capable of disposing of the current waste stream volume, and the construction of a waste disposal facility on the island would present considerable permitting challenges. While the disposal options described below are not considered feasible to implement in the near future, these alternatives might be weighed against off-island disposal options in long-term planning for the island communities.

4.1 ON-ISLAND LANDFILL

One alternative to transporting MSW off the island would be to identify an on-island location for the construction of an MSW landfill. A possible location for an on-island landfill could be a lined former gravel pit. While opening and operating a landfill would present significant logistical challenges, the economic benefits of limiting the transportation of MSW could potentially outweigh the costs, particularly if transportation costs continue to increase in the future. In general, limited available land, the increased cost of land, permitting restrictions and public perception surrounding living proximate to a landfill have each contributed to the decrease in operating landfills in the region and these barriers are likely to be even more prohibitive on an island than on the mainland.

4.2 ON-ISLAND WASTE TO ENERGY FACILITY

Over the last few decades the number of landfills in New England has decreased as existing landfills have reached their capacity and closed while fewer new landfills have opened. As described above, limited available land, the increased cost of land, permitting restrictions and public perception surrounding living proximate to a landfill have each contributed to the decrease in operating landfills in the region. Currently it is anticipated that this trend will continue and that landfill space in the region will command a higher premium in the future. One alternative to landfills for disposal of MSW that has emerged over the past 30 years is the construction of waste-to-energy facilities where MSW is combusted to produce electricity for the community. While the economics of installing a waste-to-energy facility are complex and would likely take many years to implement, installation of an on-island facility may be considered in the

future as a solution not only to manage the increasing volume of MSW on Martha's Vineyard, but also to provide on-island power generation to meet the increasing power demands of the island communities. Small waste-to-energy facilities are more common in Europe than they are in the United States and some attribute this to the higher cost of electricity in Europe which offsets the initial investment into the facility. Smaller waste-to-energy facilities in Europe are reported to cost around $30M to build and to generate approximately 2.5 megawatt hours of electricity per ton of waste burned.

5.0 RECYCLING AND CONSTRUCTION RELATED WASTES

In 2017 single stream recycling represented approximately 9.0% of the waste hauling trips from the island; and C&D made up approximately 39.5% of the trips. Overall these combined two waste streams make up nearly half of the waste transferred through the Oak Bluffs and Tisbury Transfer Station. In recent years the volume of these two wastes transported from the island has increased at a faster pace than MSW which is likely attributable to efforts to increase recycling among visitors and guests to the island and building construction and renovation activities associated with the recent strong economic conditions. While the volume of recycling and C&D may fluctuate in future years as a percentage of the overall waste stream, it is likely that these waste streams will continue to increase over time along with the MSW stream. This study focused primarily on MSW transportation alternatives and the scope of this study did not include a comprehensive review of disposal alternatives for recyclables or C&D; however, our observations regarding management of these waste streams are discussed in the following sections to provide additional solid waste management options that may be worth investigating in the future.

5.1 RECYCLING TRANSPORATION

Single stream recycling was initiated for Oak Bluffs and Tisbury approximately 12 years ago, and the volume of recycling generated by the two towns is reported to have steadily increased since then. Bruno's reported that approximately 1,772 tons of single stream recycling was transported through the Oak Bluffs and Tisbury Transfer Station in 2017 with a peak monthly volume of 289 tons transported in August. Single stream recycling is currently loaded into open top trailers at the Oak Bluffs and Tisbury Transfer Station and transported in the trailers off the island on SSA ferries. Single stream recycling is transported to an E.L. Harvey facility in Westborough, Massachusetts for sorting. An estimated 71 trailers of single stream recycling were hauled off the island on SSA ferries in 2017.

The value of recycled materials as a commodity fluctuates, and therefore the tipping fees that Oak Bluffs and Tisbury must pay to manage recyclable materials also fluctuate. The value of recyclables has decreased substantially over the last approximately 6 years. As a result, tipping fees for disposal of single stream recyclables have increased and are currently approximately $45 per ton. While tipping fees for recyclables remain below MSW and C&D tipping fees, the distance of the Westborough recycling facility from Woods Hole increases the costs associated with transportation. Based upon the costs provided by Bruno's, the current cost to dispose of a ton of recyclables is estimated to be $143.

Municipalities are limited in their ability to control the cost of recyclables management because receiving facilities do not typically enter into long term fixed price contracts for recyclables. Single stream recyclables cannot be compacted and baled prior to being sorted. Constructing a single stream recycling sorting facility on the island has the potential to increase the value of the recyclables as a commodity once it is transported off the island; however, sorting the recyclables is unlikely to have a significant impact on the transportation costs.

It would take further study to determine whether the transport of recycling from Martha's Vineyard to the mainland on barges within covered roll-off containers would result in financial or logistical benefits for the island communities. However, the over-the-road transportation costs to the E.L. Harvey facility in Westborough would not be substantially reduced if the recycling were barged to New Bedford, as that facility is around 90 miles from Woods Hole (1-½ hours driving time) and just under 70 miles from New Bedford (with a driving time of a little more than 1 hour). A more detailed evaluation of transport of recyclables by barge may be considered in the future if limiting waste shipments on SSA vessels is desired. It also may be unnecessary to bale and wrap single stream recycling, as odors and pests are anticipated to be less of an issue for recyclable materials than for MSW. However, industry professionals should be consulted with regard to the length of time these materials could be staged at any given location without creating a nuisance to the surrounding community.

5.2 CONSTRUCTION AND DEMOLITION WASTE TRANSPORTATION

The volume of C&D received by the Oak Bluffs and Tisbury Transfer Station fluctuates seasonally and in 2017 ranged from approximately 500 tons per month in the summer months to a maximum of 1,050 tons per month in the fall construction season. An estimated 310 trailers of C&D were hauled off on SSA ferries in 2017. C&D is currently loaded into open top trailers at the Oak Bluffs and Tisbury Transfer Station and is transported via SSA ferries to the J.R. Vinagro disposal facility in Johnston, Rhode Island. Tipping fees for C&D disposal at the receiving facility are currently approximately $80 per ton, and the total cost to dispose of C&D including transportation costs for 2017 are estimated to be approximately $172 per ton.

C&D cannot be compacted in a standard baler without substantial processing. C&D processing typically involves multiple stages of sorting and shredding to remove recyclable materials and process the material to a size suitable for disposal in a landfill. A typical commercial C&D transfer station might shred C&D to particle sizes of 2 feet or less before screening out fine particles and sorting out recyclable materials such as wood, metal and plastic. The remaining material could then be processed through a secondary grinding system to achieve a particle size of around 8 inches or smaller. Tetra Tech was unable to identify examples of locations where C&D is currently being processed and then bailed and wrapped, but if sufficient processing is performed it should be theoretically possible. Alternatively, C&D processed through an initial shredder may be suitable for barging to the mainland without compaction or plastic wrapping. C&D shredded to break down particles to sizes of less than 2 feet could theoretically be shipped on the barge deck similar to bulk commodities like stone or mulch. The C&D would then need to be transferred to a C&D disposal facility for further processing and sorting. Mobile primary shredders capable of reducing C&D to particle sizes of 2 feet or less are available for approximately $600,000 and would require limited infrastructure improvements for use. A mobile shredding machine could be operated at the Oak Bluffs and Tisbury transfer station or at an alternative location on the island as a standalone C&D transfer facility.

If barging of C&D is desired without the capital costs associated with purchasing a shredder, it may be possible to barge the unprocessed waste to the mainland in roll-off containers or as a loose material. Odor and pest related concerns that can be an issue when storing MSW are generally less of a concern with C&D. The ability to stage loads of C&D for additional time until space on a barge is available could provide similar flexibility for the hauler as with baled MSW. Assuming that C&D waste continues to be transported to Johnston, Rhode Island, it is anticipated that trucking of C&D from New Bedford to Johnston (a distance of 40 miles that takes around 45 minutes) would represent a cost savings over the current trucking route from Woods Hole to Johnston (a distance of 82 miles that takes around 1-½ hours).

A comprehensive analysis of the feasibility of hauling C&D waste from the island by barge is outside of the scope of this assessment. However, we recommend that this alternative be studied further as C&D currently represents approximately 40% of the waste being transferred through the Oak Bluffs and Tisbury Transfer Station.

5.3 RECYCLING AND CONSTRUCTION WASTE RECOMENDATIONS

Approximately 48.5% of the solid waste transferred through the Oak Bluffs and Tisbury Transfer Station in 2017 were loads of recyclables and C&D. These waste streams represented 381 truckloads of solid waste. While these waste streams would require substantial processing in order to be suitable for compaction with a baler, there is still the potential for these waste streams to be hauled off the island by barge in covered roll-off style containers or as a loose material on a barge deck. Figure 2 presents the locations of the recycling and C&D receiving facilities currently in use by Oak Bluffs and Tisbury. Due to the proximity of the Packer New Bedford facility to the current C&D receiving facility in Johnston Rhode Island, there would be a decrease in the number of miles that C&D is hauled on the roadways if it were transported off the island on RM Packer barges instead of SSA ferries. Transportation of C&D and/or recyclables by barge may involve investment in additional roll off canisters, particularly if materials would need to be staged for periods of time prior to or after being barged to the mainland. The capital investments to barge C&D and/or recycling are likely to be much less than those associated with installation and operation of a MSW baling system and represent an alternative that should be considered in more detail if reducing the transport of these materials on SSA vessels is desired.

6.0 CONCLUSIONS

Tetra Tech has performed a review of MSW management and transport options for the towns of Oak Bluffs and Tisbury with a focus on evaluating the feasibility and approximate costs associated with the installation and operation of a MSW baling or compacting system at the Oak Bluffs and Tisbury Transfer Station and the possibility of utilizing a private contractor to haul baled MSW from Martha's Vineyard to the mainland via barge. Our review indicates that installation and operation of an MSW baling or compacting system at the transfer station is feasible. A Galaxy 2R-310W-102 Two-Ram Baler produced by Marathon was recommended as a suitable baler capable of baling the current peak volume of MSW processed by the transfer station. Installation of the MSW baling system, including expansion of the existing sorting building to house the baling system and installation of a bale wrapping system is estimated to cost somewhere between $1,000,000 and $1,250,000. The plastic wrapped bales could be hauled to the R.M. Packer facility in Vineyard Haven on flatbed trucks and loaded onto outgoing barges for transfer to the R.M. Packer facility in New Bedford where they could be re-loaded onto trucks and transported to a local landfill or waste-to-energy facility. The baling and wrapping of MSW would reduce odor and pest related concerns surrounding the waste during transit and allow additional flexibility regarding the timing of waste hauling.

Our estimates indicate that the installation and operation of the baler are likely to represent a cost of approximately $25 per ton over a 10-year time frame based on the 2017 rate of MSW generation. This additional cost would be partially off-set by the reduced transportation costs associated with barging the waste which eliminates the SSA fees and substantially reduces labor costs associated with truck drivers waiting for and traveling on the SSA ferries. Based upon our estimates it is likely to cost approximately $28 more per ton to transport baled and wrapped MSW to Crapo Hill Landfill on barges relative to the current operation. Based upon the 2017 MSW generation rate this alternative would cost the towns of Oak Bluffs and Tisbury approximately $340,000 more than their current expenditures annually and would

reduce the number of trips by Bruno's trucks on SSA ferries to the extent that Bruno's carries MSW off-island without backhauling other goods on its return trips.

While the additional costs associated with bailing and wrapping MSW are partially offset by the cost savings associated with eliminating SSA ferries from the transport pathway, it is still anticipated that baling and wrapping MSW for transport via barge and then disposal at a local landfill or waste-to-energy facility will come at a relatively substantial cost premium. Further, the nearest facility that Tetra Tech has identified which is currently accepting baled MSW waste streams, without a price mark up to break apart the bales, is in Haverhill, Massachusetts which is anticipated to increase roadway transportation costs substantially.

While hauling MSW by barge for disposal at Crapo Hill Landfill represents a cost increase of approximately $28 per ton, the cost premium increases to approximately $33 per ton if an agreement to accept the bales cannot be reached with Crapo Hill Landfill and the waste must be hauled to Haverhill for disposal. Based upon the volume of MSW managed by the transfer station in 2017 a $33 per ton increase would represent an approximately $400,000 increase in MSW disposal costs annually. Due to the current cost differential of between $28 and $33 per ton, installation of a baling and wrapping system at the Oak Bluffs and Tisbury Transfer station is not recommended at this time. If barging of MSW is desired, despite the cost premium, we recommend engaging with Crapo Hill Landfill and other local disposal facilities to attempt to identify a local facility that will accept baled and wrapped MSW at a reasonable mark up.

While baling MSW and barging the waste to the mainland for disposal at an in-state facility is likely to be more expensive than the current operations, hauling waste by rail to an out of state facility may represent an economical alternative. In general, our estimates indicate that costs associated with baling and wrapping waste and transporting it to the mainland via barge are not substantially greater than the costs currently being incurred to transport the waste on SSA ferries. The most significant cost increase associated with barging the waste is associated with handling the waste multiple times and the roadway transportation to get the bales to a facility equipped and willing to dispose of them. Railway transportation may provide a solution to this problem. Baled MSW exhibits minimal odor and pest related issues and is well suited for transportation by rail cars. MSW bales can be staged in a rail yard or on rail cars for days or weeks prior to departing for their ultimate destination. Due to lack of available landfill space in northeastern states, hauling waste by rail to landfills in states with more abundant landfill space such as upstate New York, Pennsylvania and Ohio is becoming increasing common and can represent an economical alternative to disposal of waste at local facilities. R.M. Packer's New Bedford facility is located adjacent to a rail spur, and the potential for development of an intermodal facility to transfer MSW bales directly to rail cars may would eliminate the need to load the bales onto trucks on the mainland and may represent an efficient transportation pathway for waste from Martha's Vineyard at some point in the future. Generating cost estimates for the transfer of MSW to out of state facilities for disposal is beyond the scope of this study; however, we recommend additional investigation into this alternative. The proximity of the R.M. Packer facility to the rail spur in New Bedford may make this alternative a competitive option particularly if a substantial increase in the cost of local landfill disposal is encountered as many industry professionals have predicted will occur in the region in the coming years.

In addition to reviewing MSW rail transportation options in the coming years, we recommend that additional investigations regarding the potential for barging C&D waste and recyclables be conducted to assess the feasibility of hauling these waste streams by alternative methods. Approximately 48.5% of the solid waste transferred through the Oak Bluffs and Tisbury Transfer Station in 2017 consisted of loads of recyclables and C&D. These waste streams represented 381 truckloads of solid waste. While these waste streams are not suitable for compaction with a baler without processing, there is still the potential for these waste streams to be hauled off the island by barge in covered roll-off style containers or as a bulk

material on a barge deck. Due to the proximity of RM Packer's New Bedford facility to the current C&D receiving facility in Johnston, Rhode Island, there would be a decrease in the number of miles that C&D is hauled on the roadways if it were transported off the island on Packer barges instead of SSA ferries.

Table 1: 2017 Solid Waste Stream Data for the Oak Bluffs and Tisbury Transfer Station

MSW

Month	Year	tons	cost	trips
January	2017	749.85	112547.486	25
February	2017	610.77	91672.5052	20
March	2017	622.52	93436.10187	21
April	2017	689.88	103546.3888	23
May	2017	991.6	148832.5493	33
June	2017	1257.08	188679.3275	42
July	2017	1616.02	242553.8285	54
August	2017	1665.54	249986.4504	56
September	2017	1199.26	180000.9309	40
October	2017	1141.75	171369.0633	38
November	2017	875.53	131411.2161	29
December	2017	630.58	94645.85413	21
Totals for MSW		12050.38	$1,808,682	402

Single Stream Recycling

Month	Year	tons	cost	trips
January	2017	106.69	$15,273.74	4
February	2017	72.24	$10,341.88	3
March	2017	89.54	$12,818.55	4
April	2017	92.76	$13,279.52	4
May	2017	159.22	$22,793.94	6
June	2017	210.59	$30,148.06	8
July	2017	245.57	$35,155.80	10
August	2017	288.91	$41,360.36	12
September	2017	206.52	$29,565.40	8
October	2017	150.13	$21,492.61	6
November	2017	67.23	$9,624.65	3
December	2017	83.03	$11,886.57	3
Totals for SSR		1772.43	$253,741	71

C&D

Month	Year	tons	cost	trips
January	2017	523.68	$90,292.52	19
February	2017	666.2	$114,865.71	25
March	2017	732.5	$126,297.11	27
April	2017	708.49	$122,157.32	26
May	2017	780.56	$134,583.58	29
June	2017	754.66	$130,117.92	28
July	2017	499.88	$86,188.94	19
August	2017	500.62	$86,316.53	19
September	2017	633.64	$109,251.74	23
October	2017	1051.26	$181,257.47	39
November	2017	791.1	$136,400.88	29
December	2017	721.93	$124,474.64	27
Totals for C&D		8364.52	$1,442,204	310

Table 2: Costs Associated with Solid Waste Disposal January 2018

	unit	MSW	Single Stream Recycle	C&D
Overhead Costs				
Transfer Employees	ton	$26.66	$26.66	$26.66
Transfer Equipment/Maintenance	ton	$19.50	$19.50	$19.50
Total Overhead Costs	ton	$46.16	$46.16	$46.16
Disposal Costs				
Tipping Fees	ton	$62.00	$45.00	$80.00
Town Fee	ton	$3.00	$3.00	$3.00
Total Disposal Costs	ton	$65.00	$48.00	$83.00
Transportation Costs				
SSA Fee	trip	$535.00	$475.00	$533.00
Hauling Costs	trip	$633.00	$750.00	$633.00
Average weight of loaded truck	tons/trip	30	25	27
SSA Fee	ton	$17.83	$19.00	$19.74
Hauling Costs	ton	$21.10	$30.00	$23.44
Total Cost per trip		$4,502.80	$3,579.00	$4,653.32
Total cost per ton		$150.09	$143.16	$172.35

Table 3: Motor Carrier Costs Based on 2016 National Averages[1]

	Cost per Mile Traveled	Cost per Hour Traveled[2]
Motor Carrier Costs		
Fuel	0.336	13.45
Truck/Trailer Lease or Purchase Payments	0.255	10.20
Repair & Maintenance	0.166	6.65
Truck Insurance Premiums	0.075	3.00
Permits and Licenses	0.022	0.88
Tires	0.035	1.41
Tolls	0.024	0.97
Driver Wages	0.523	20.91
Driver Benefits	0.155	6.18
Total Roadway Transportation Cost	1.59	63.65
Total Vehicle Costs During Downtime[3]	1.03	41.17

1 -National Average costs for 2016 based upon ATRI An Analysis of the Operation Costs of Trucking: 2017 Update - October 2017

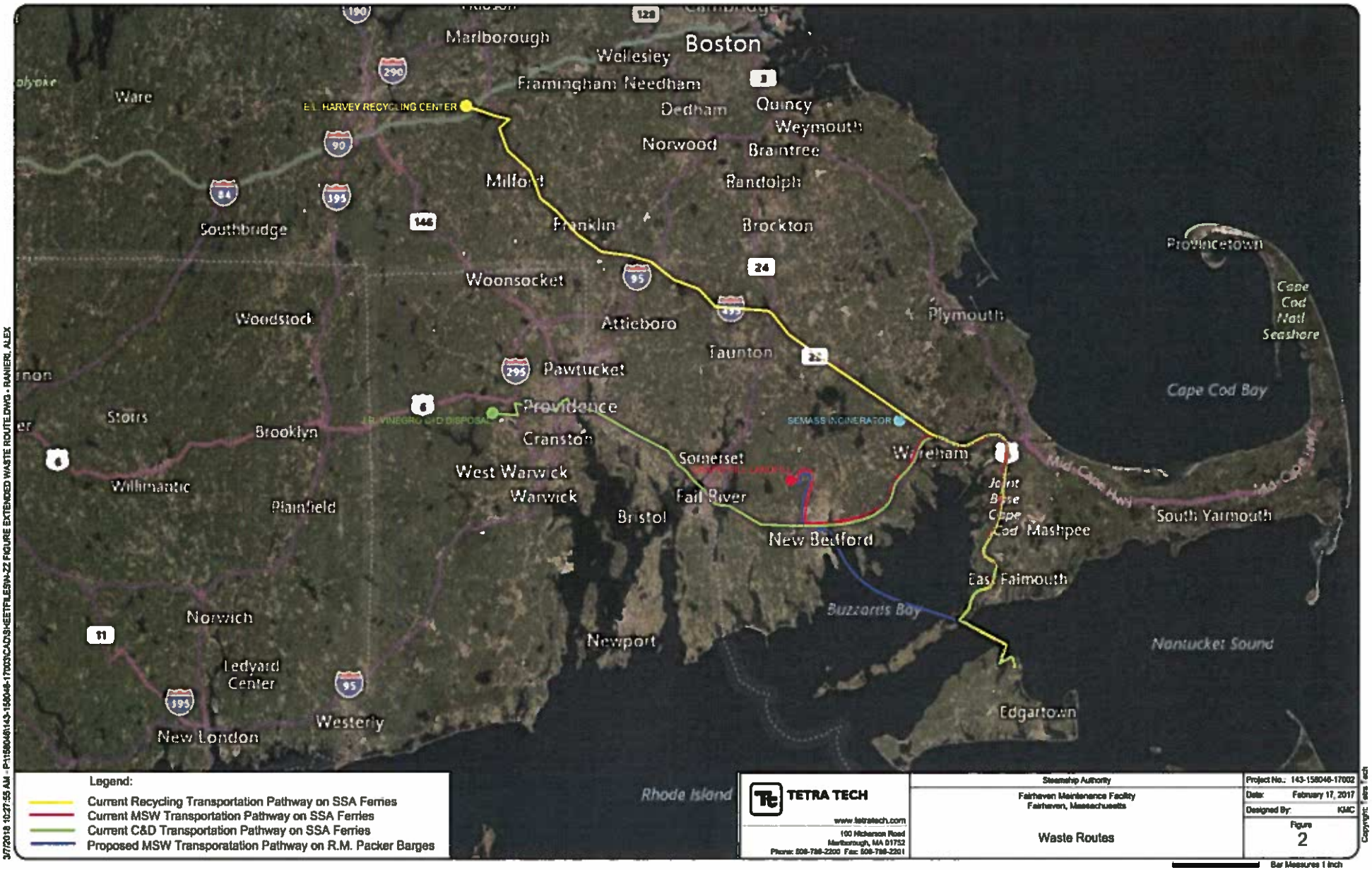
2 - Based upon an average of 40 miles traveled per hour.

3 - Costs during downtime waiting for ferry or riding on ferry include truck/trailer lease or purchase payments, insurance premiums, permits and licenses, driver wages and driver benefits.

Table 4: Transportation Costs Summary Table

	unit	Transport of MSW on SSA Ferries	Barge Transport by R.M. Packer to Local Facility (Crapo Landfill)[1]	Barge Transport by R.M. Packer to Facility that Currently Accepts Baled MSW (Haverhill)[2]	Transport of Baled MSW on SSA Ferries to Local Facility (Crapo Landfill)[1]	Transport of Baled MSW on SSA Ferries to Facility that Currently Accepts Baled MSW (Haverhill)[2]	Barge Transport by R.M. Packer with Transfer to Rail Cars[6]
Overhead Costs							
Transfer Employees	$/ton	$26.66	$26.66	$26.66	$26.66	$26.66	$26.66
Transfer Equipment/Maintenance	$/ton	$19.50	$19.50	$19.50	$19.50	$19.50	$19.50
Total Overhead Costs	$/ton	$46.16	$46.16	$46.16	$46.16	$46.16	$46.16
Disposal Costs							
Tipping Fees	$/ton	$62.00	$62.00	$62.00	$62.00	$62.00	$40.00
Town Fee	$/ton	$3.00	$3.00	$3.00	$3.00	$3.00	$3.00
Total Disposal Costs	$/ton	$65.00	$65.00	$65.00	$65.00	$65.00	$43.00
Transportation Costs							
Average weight of loaded truck	tons/trip	30	30	30	30	30	30
SSA Fee Truck (one way trip)	$/trip	$259.00	NA	NA	$259.00	$259.00	NA
SSA Fee Driver (assumes 10 ride ticket book) one way	$/trip	$6.90	NA	NA	$6.90	$6.90	NA
Roadway Transportation Miles (one way trip)	miles	52	10	103	52	112	0
Estimated Downtime on Ferry - one way trip	hours	1.5	0	0	1.5	1.5	0
Estimated Roadway Transport Time - one way trip	hours	1	0.25	2	1	2	0
Transportation Costs Per Hour While Driving[3]	$/hour	63.65	63.65	63.65	63.65	63.65	63.65
Transportation Costs Per Hour During Truck Down Time[4]	$/hour	41.17	41.17	41.17	41.17	41.17	41.17
Total Cost of Transport Driving - one way trip	$	63.65	15.91	127.30	63.65	127.30	0.00
Total Cost of Truck Down Time - one way trip	$	61.76	0.00	0.00	61.76	61.76	0.00
Total Roadway Transportation Cost Estimate One way	$/trip	$125.41	$15.91	$127.30	$125.41	$189.06	$0.00
R.M. Packer Barge Costs (not including handling) on 1,200 ton barge	$/trip	NA	$8,000.00	$8,000.00	NA	NA	$8,000.00
R.M. Packer Barge Costs (not including handling)	$/ton	NA	$6.67	$6.67	NA	NA	$6.67
Handling Bales onto and off of Barges	$/ton	NA	$15.00	$15.00	NA	NA	$15.00
Total Barging Transportation Costs	$/ton	NA	$21.67	$21.67	NA	NA	$21.67
Rail Transportation Costs	$/ton	NA	NA	NA	NA	NA	Unknown
Total Transportation Costs (one way trip/backhauling covers all return trip trucking costs)	$/ton	$13.04	$22.20	$25.91	$13.04	$15.17	$21.67
Total Transportation Costs (assuming no backhauling in trucks)	$/ton	$26.09	$22.73	$30.15	$26.09	$30.33	$21.67
Baler Installation and Operation Costs							
Installation Costs	$/ton	NA	$10.00	$10.00	$10.00	$10.00	$10.00
Operational Costs	$/ton	NA	$15.00	$15.00	$15.00	$15.00	$15.00
Total Baler Related Costs	$/ton	NA	$25.00	$25.00	$25.00	$25.00	$25.00
Total cost per ton[5]		$130.73	$158.89	$164.19	$155.73	$158.91	$135.83
	notes	Assumes 50% backhaul rate for roadway transportation	Assumes no backhauling for roadway transportation due to limited distance traveled, does not include additional fees from Crapo Hill to accept baled MSW	Assumes 50% backhaul rate for roadway transportation	Assumes 50% backhaul rate for roadway transportation, does not include additional fees from Crapo Hill to accept baled MSW	Assumes 50% backhaul rate for roadway transportation, does not include additional fees from Crapo Hill to accept baled MSW	Does not include rail transportation costs, rail transportation costs unknown

1 - Crapo landfill does not currently accept baled MSW and an agreement with Crapo to begin accepting the waste would need to be reached. This agreement might include an increase to the tipping fee.
2 - A tipping fee was not provided by Covanta Haverhill, but is assumed to be similar to the current Crapo landfill tipping fee for the purposes of this cost comparison.
3 - Truck Transportation cost based upon ATRI An Analysis of the Operation Costs of Trucking: 2017 Update - October 2017 and includes average fuel, truck/trailer lease or purchase payments, repair and maintenance, truck insurance payments, permits and licenses, tires, tolls, driver wages and driver benefits.
4 - Truck Transportation cost based upon ATRI An Analysis of the Operation Costs of Trucking: 2017 Update - October 2017 and includes average truck/trailer lease or purchase payments, truck insurance payments, permits and licenses, driver wages and driver benefits.
5 - Total Cost per ton does not include administrative costs or profit for roadway transportation
6 - Rail transit tipping fee based upon Ohio 2014 average landfill tipping fee obtained from www.conservationadvocate.org



3/7/2018 10:27:55 AM - P:\158048\143-158048-17005\CAD\SHEETFILES\N-ZZ FIGURE EXTENDED WASTE ROUTE.DWG - RANIERI, ALEX

Appendix A
Limitations

LIMITATIONS

1. The observations described in this report were made under the conditions stated therein. The conclusions presented in the report were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by the CLIENT. The work described in this report was carried out in accordance with the Terms and Conditions in our contract.

2. In preparing this report, ENGINEER has relied on certain information provided by state and local officials and other parties referenced therein, and on information contained in the files of state and/or local agencies available to ENGINEER at the time of the site assessment. Although there may have been some degree of overlap in the information provided by these various sources, ENGINEER did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this site assessment.

3. Observations were made of the Site and of structures on the Site as indicated within the report. Where access to portions of the Site or to structures on the Site was unavailable or limited, ENGINEER renders no opinion as to the presence of hazardous materials or oil, or to the presence of indirect evidence relating to hazardous material or oil, in that portion of the Site or structure. In addition, ENGINEER renders no opinion as to the presence of hazardous material or oil, or the presence of indirect evidence relating to hazardous material or oil, where direct observation of the interior walls, floor, or ceiling of a structure on a Site was obstructed by objects or coverings on or over these surfaces.

4. ENGINEER did not perform testing or analyses to determine the presence or concentration of asbestos at the Site or in the environment at the Site.

5. It is ENGINEER's understanding that the purpose of this report is to assess the physical characteristics of the subject Site with respect to the presence on the Site of hazardous material or oil. This stated purpose has been a significant factor in determining the scope and level of services provided for in the Agreement. Should the purpose for which the Report is to be used or the proposed use of the site(s) change, this Report is no longer valid and use of this Report by CLIENT or others without ENGINEER's review and written authorization shall be at the user's sole risk. Should ENGINEER be required to review the Report after its date of submission, ENGINEER shall be entitled to additional compensation at then existing rates or such other terms as agreed between ENGINEER and the CLIENT.

6. The conclusions and recommendations contained in this report are based in part, where noted, upon the data obtained from a limited number of soil samples obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until further exploration. If variations or other latent conditions then appear evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

7. Any water level readings made in test pits, borings, and/or observation wells were made at the times and under the conditions stated on the report. However, it must be noted that fluctuations in the level of groundwater may occur due to variations in rainfall and other factors different from those prevailing at the time measurements were made.

8. Except as noted within the text of the report, no quantitative laboratory testing was performed as part of the site assessment. Where such analyses have been conducted by an outside laboratory, ENGINEER has relied upon the data provided and has not conducted an independent evaluation of the reliability of these data.

9. The conclusions and recommendations contained in this report are based in part, where noted, upon various types of chemical data and are contingent upon their validity. These data have been reviewed and interpretations made in the report. As indicated within the report, some of these data may be preliminary screening level data and should be confirmed with quantitative analyses if more specific information is necessary. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time, and other factors. Should additional chemical data become available in the future, these data should be reviewed, and the conclusions and recommendations presented herein modified accordingly.

10. Chemical analyses have been performed for specific constituents during the course of this site assessment, as described in the text. However, it should be noted that additional chemical constituents not searched for during the current study may be present in soil and/or groundwater at the Site.

11. This Report was prepared for the exclusive use of the CLIENT. No other party is entitled to rely on the conclusions, observations, specifications, or data contained therein without the express written consent of ENGINEER.

12. The observations and conclusions described in this Report are based solely on the Scope of Services provided pursuant to the Agreement. ENGINEER has not performed any additional observations, investigations, studies, or testing not specifically stated therein. ENGINEER shall not be liable for the existence of any condition, the discovery of which required the performance of services not authorized under the Agreement.

13. The passage of time may result in significant changes in technology, economic conditions, or site variations that would render the Report inaccurate. Accordingly, neither the CLIENT, nor any other party, shall rely on the information or conclusions contained in this Report after six months from its date of submission without the express written consent of ENGINEER. Reliance on the Report after such period of time shall be at the user's sole risk. Should ENGINEER be required to review the Report after six months from its date of submission, ENGINEER shall be entitled to additional compensation at then existing rates or such other terms as may be agreed upon between ENGINEER and the CLIENT.

14. ENGINEER has endeavored to perform its services based upon engineering practices accepted at the time they were performed. ENGINEER makes no other representations, express or implied, regarding the information, data, analysis, calculations, and conclusions contained herein.

15. The services provided by ENGINEER do not include legal advice. Legal counsel should be consulted regarding interpretation of applicable and relevant federal, state, and local statutes and regulations and other legal matters.

Appendix B

Historical Solid Waste Management Studies for the Island of Martha's Vineyard

Feasibility of Establishing a Port-to-Port Containerized Transportation Service between New Bedford and Martha's Vineyard

Prepared by: HDR Engineering, Inc.

1.0 Introduction

HDR Engineering, Inc. (HDR), under contract to the Town of Tisbury and Oak Bluffs, was asked to evaluate the feasibility of establishing a Port-to-Port Containerized Freight Service between Martha's Vineyard, Massachusetts and New Bedford, Massachusetts. The scope of the evaluation was to focus specifically on the potential for establishing this port-to-port freight transportation system as it relates to transporting municipal solid waste (MSW) and construction & demolition debris (C&D) generated by the towns of Tisbury and Oak Bluffs. The study scope included an assessment of the feasibility of both rail and truck service from New Bedford to disposal facilities.

2.0 Methodology

In order to evaluate the feasibility of this system, HDR conducted numerous site visits and interviews as well as conducted research of various elements. Below is a summary of HDR's activities:

Site Visits

HDR conducted site visits of the following facilities/locations:

- Tisbury Transfer Station
- Steamship Authority's (SSA) Vineyard Haven Pier
- SSA's Oak Bluffs Pier
- Packer Terminal (Vineyard Haven, MA)
- Packer Terminal (New Bedford, MA)
- New Bedford Harbor Development Commission's State Pier (inclusive of rail infrastructure in the surrounding area)
- Covanta's SEMASS Energy-from-Waste Facility
- ABC Waste Disposal Facility in New Bedford
- Bourne Landfill
- Yarmouth Transfer Station
- Roadway between Tisbury Transfer Station and SSA Pier at Vineyard Haven as well as the roadway between Tisbury Transfer Station and SSA Pier at Oak Bluffs

Interviews

HDR conducted interviews with the following people:

- Greg Carroll, CEO of Bruno's Inc.
- Ralph Packer, Owner of RM Packer Co.
- Mike Camara, President of ABC Waste Disposal (New Bedford)

- Tom Cipolla and Richard O'Connor of Covanta
- Robert Angell, Superintendent for the Town of Yarmouth
- Raymond Jack, Public Works Director for the Town of Falmouth
- Dan Wahle of Mass Coastal Railroad
- Dan Barrett, Bourne ISWM Dept.
- Kristen Decas and Ed Anthes-Washburn of New Bedford Harbor Development Commission
- Joe Dugary, Northeast Representative for MSW & C&D, CSX
- Representatives from the following barge towing companies
    - Island Barge, Inc
    - Mitchell Towing & Salvage
    - Tucker-Roy Marine Towing
- Richard Harris, Sales Representative for Sierra International (Baling Company)Representatives from the following landfills / transfer stations:
    - Crapo Hill Landfill (New Bedford, MA)
    - Johnston Landfill
    - Transload America Pond View (Rhode Island)
    - EnviroSolutions (Kentucky)
    - Apex Landfill (Ohio)
    - Champion City Recovery Transfer Station (Brockton, MA)
    - Trojan Demo Transfer Station (Brockton, MA)
    - Town of Wellesley Recycling Facility (MA)

Data

HDR purchased the following database:

- Waste Business Journal Inc's Database of Disposal Facilities (inclusive of available capacity, type of waste received, transportation access, average tip fees, and average amount of waste received in 2010)

3.0 Background

Current System for Handling MSW and C&D

Currently, the towns of Tisbury and Oak Bluffs have a contract with Bruno's Inc. to operate the Tisbury Transfer Station as well as transport and dispose of all the MSW, C&D and recyclables received at the Transfer Station. The Tisbury Transfer Station has three receiving stations, or "doors", consisting of one door for MSW and "clean" C&D, one door for "contaminated" C&D and one door for recyclables. The "clean" C&D includes some C&D items, such as sheetrock that can be mixed with the MSW after being compacted via a front-end loader. The MSW and C&D are then transferred to open-top "walking floor" trailers such as the one shown in Figure 1 below.

Figure 1: Bruno's Open-top Trailer Truck

Bruno's uses seven (7) of these trailers, which are dedicated to transporting waste received at the Tisbury Transfer Station. These trailers cost approximately $60,000 each and transport approximately 28 tons of either MSW or C&D per load. From the Tisbury Transfer Station, Bruno's transports the trailers onto the SSA freight boat on a daily basis. Typically, the trucks are scheduled to depart out of SSA's Vineyard Haven Pier on the first freight ferry in the morning. Each truck is accompanied by one driver, who then delivers the waste to:

- If MSW, the truck travels to Covanta's SEMASS facility in Rochester, MA
- If C&D, the truck travels to Transload America's Pond View facility in East Providence, RI

After disposing of the MSW or C&D, the driver then travels back to Woods Hole to get transported back to Vineyard Haven on either a late morning or early afternoon freight ferry. According to Greg Carroll, approximately 60% of these empty trailers pick up a commodity to be back-hauled to Martha's Vineyard. Typical back-haul commodities include sand, gravel or landscape materials such as mulch. As far as HDR was able to determine, the Town of Tisbury does not currently receive any benefit from this back-haul.

Based on our interviews as well as the assumptions described below, HDR has calculated the costs for transporting these trailers on the SSA freight ferry as follows:

- The SSA tariff for trucks transporting MSW and C&D one-way is $246.50 for trucks with a length between 60' and 65'
- The SSA charge for each driver (one-way) is $15.00

- Each truck trip requires one day's labor for the driver. Per the Massachusetts 2011 prevailing wage for a truck driver, we have assumed a minimum wage of $39.71 per hour. At 8 hours per day, this equates to $317.68 per trip
- According to Greg Carroll, the capital cost of the walking floor trailer is approximately $60,000. Assuming a 7% interest rate and 10 year useful life, the amortized cost per trip is estimated to be $23.22.
- The capital cost for the tractors required to transport the trailers is estimated to be approximately $150,000. Assuming a 7% interest rate and 10 year useful life, the amortized cost per trip is estimated to be $58.05.
- The one-way distance from the SSA Terminal at 1 Cowdry Road, Woods Hole, MA to the SEMASS facility at 141 Cranberry Highway, West Wareham, MA is approximately 31 miles. The one-way distance from the SSA Terminal at 1 Cowdry Road, Woods Hole, MA to the Transload America Disposal Facility located at 1 Dexter Road in East Providence, RI is approximately 70 miles. The weighted average (given that 60% of the waste is MSW and 40% is C&D) one-way transit distance is therefore approximately 46.6 miles, with the average round-trip distance being approximately 93.2 miles. Assuming that each truck travels approximately 7 miles per gallon of fuel, and an estimated fuel price of $4 20 per gallon, the fuel cost per trip would be $55.92
- The annual insurance, licensing and taxes per truck are estimated to be approximately $5,000, which equates to $13.69 per day or per trip
- The annual maintenance is assumed to be approximately 25 cents per mile. At an average of 93.2 miles per trip, this is estimated to be $23.30

Table 1: Estimated Costs per Trip for Current Transport of Waste

Component	Estimated Cost per Trip
SSA Tariff	$493.00
SSA Charge (Driver)	$15.00
Labor	$317.68
Trailer (Amortized)	$23.22
Tractor (Amortized)	$58.05
Fuel	$55.92
Insurance, licensing, taxes	$13.69
Truck maintenance	$23.30
Total Estimated Cost per Trip	$999.86
Estimated Cost per Ton (Assuming 28 tons per truck)	$35.71

Annual Waste Data

As part of the evaluation for the feasibility of developing a containerized freight service for MSW and C&D from Martha's Vineyard, it is important to analyze the volume of waste that is generated. The following table provides a summary of the amount of waste that was received by the Tisbury Transfer Station in 2010.

Table 2: Monthly Waste Quantities at Tisbury Transfer Station, 2010 (Tons)

Month	MSW	C&D	Recycle	Cardboard	Metal	Newspaper	Sheetrock
January	381	341	43	5	9	9	0
February	362	319	31	4	6	0	3
March	478	474	49	6	12	8	
April	495	634	45	10	21	17	
May	681	576	54	11	11	8	
June	941	555	87	13	14	10	
July	1,216	441	107	28	10	1	
Aug	1,344	366	140	26	26	9	
Sept	855	538	97	10	9	9	
Oct	681	507	55	6	12	12	
Nov	543	416	50	5	6	18	
Dec	457	457	31	15	9	0	
Annual	8,434	5,624	788	140	143	101	4

Total MSW and C&D: 14,058 tons

The table below summarizes the daily tonnage for each month in 2010 for both MSW and C&D (recyclables was not part of the scope of this study). As expected, there is significant seasonal variability in the waste volumes, particularly with the MSW portion of the waste stream. In August, for example, the Tisbury Transfer Station generates approximately 2.4 containers of MSW and 1.7 containers of C&D per day, for a total of over 4 containers per day. As noted in the table below, we have assumed 18 tons per container, which is an average (non-compacted) payload for typical containers used to transport waste, with dimensions of 20' long, 12' high and 8.5' wide.

Table 3: Tons and Containers Per Day, Tisbury Transfer Station - 2010

	Tons per Day		Containers per day [1]	
Month	MSW	C&D	MSW	C&D
January	12	11	0.7	0.6
February	13	11	0.7	0.6
March	15	15	0.9	0.8
April	17	21	0.9	1.2
May	22	19	1.2	1.0
June	31	19	1.7	1.0
July	39	14	2.2	0.8
Aug	43	12	2.4	0.7
Sept	29	18	1.6	1.0
Oct	22	16	1.2	0.9
Nov	18	14	1.0	0.8
Dec	15	15	0.8	0.8
Average	23	15	1.3	0.9
Maximum	43	21	2.4	1.2
Minimum	12	11	0.7	0.6

Table Notes:
1. Assumes 18 tons per container

4.0 Findings

4.1 Waste Transport/Storage Background

A key element to this assessment is the type of container that the waste is transported in. Below are the primary options considered in this Study:

- Top-loaded sealed containers (required lidding / de-lidding capabilities). Containers can be either an integrated wheeled container or a container on a chassis
- Open-top trailers with walking floors
- Open-top trailers with tip chassis
- Plastic-wrapped bales (typically transported on flatbed trailers or in gondolas with lids)
- Open-top gondola railcars

Because of the potential need to store waste over several days in order to make barge transport economically feasible, it will be important to understand the requirements or potential limitations on the number of days that MSW can be stored at the Transfer Station. The Tisbury Transfer Station is

regulated by the local Board of Health, due to the fact that the average throughput is less than 50 tons per day annually. Therefore, it will be important to coordinate with the Board of Health to determine the requirements for storing MSW at the Transfer Station. We assume, however, that in order for MSW to be stored at the Transfer Station for more than 1-2 days, it will need to be stored in sealed containers or plastic-wrapped bales, in order to reduce potential odor and pest issues.

4.2 Evaluation of Port Facilities

In order to evaluate the port facilities, it is important that one first considers the types of containers that the waste would be transported in. There are several types of container systems utilized for the handling of waste, as described previously. These include closed and sealed containers or open top containers. Sealed containers can be handled either on a wheeled bases or a lift basis. For wheeled operations, the container has either an integrated wheel system or removable chassis. This system allows it to be wheeled onto a vessel and is called "RO-RO", or roll on-roll off, and generally assumes that the wheeled container is disconnected from the motive power (truck or tractor) once loaded and then unloaded by motive power at the destination point. The second type of wheeled system involves an integrated chassis where the container and wheel mechanism cannot be disconnected from each other. For the other type of handling, known as "LO-LO" or lift on-lift off, the container is separate from the chassis and is loaded and discharged from a vessel with a crane system. It should be noted however that the container is generally delivered to or taken from the crane by mounting it on a chassis so a portion of the operation is wheeled

Figure2: One Example of Waste Containers

Packer's Terminal in Vineyard Haven, MA and New Bedford, MA

At the Packer Terminal in Vineyard Haven, there are connecting ramps that provide adequate range of motion to accommodate container loading and unloading within the 18" to 2 foot tide range in Vineyard Haven and 4 foot tidal range in New Bedford. The Packer Terminals in Vineyard Haven and New Bedford both have RO-RO capabilities and are in-use currently for RO-RO service. There is sufficient room at the approximately 2 acre parcel in New Bedford to store containers on chassis or on integrated trailers awaiting transport. At Packer's Terminal in Vineyard Haven, there is limited space for storage of containers/trailers, so these units would need to be stored at the Tisbury Transfer Station and moved when ready for loading.

For this report, we have assumed that if Packer's Terminal was to be used to transport MSW or C&D, Tisbury Towing & Transport would prefer that their tugs be used to transport/handle the barges and their personnel to conduct the loading and unloading operations, rather than leasing the terminal(s) and allowing other entities to provide the transportation and loading/unloading services.

Standard truck-transported waste containers can be loaded and unloaded from barges over RO-RO ramps by using standard trucks with pick up and drop off trailer mechanisms. The trailers are equipped with slides and lifts where the waste container is loaded onto the slide with a drag wire. The trailer is lifted to receive the container and the container is winched aboard the trailer. To unload the trailer, it is lifted and the container is slid off the trailer. The container is equipped with rollers which allow the container to slide and be positioned where loaded or unloaded. To handle these units on the barge, the truck with the container is backed onto the barge and the trailer lifted allowing the container to slide onto the deck of the barge. Containers can be equipped with rollers on the bottom, and the container can be positioned easily on the steel deck of the barge. Containers not equipped with rollers can also be handled easily because the truck positions the container when it is unloaded. The reverse process is followed when unloading the barge. No special equipment besides the specially equipped truck is required. These trucks and trailers are used widely in waste transportation. No modifications are required to most RO-RO ramps (including the ones assessed in this report).

Figure3: Standard RO-RO Truck

Figure 4: Packer Terminal's (Vineyard Haven) RO-RO Ramp

New Bedford State Pier

The State Pier Terminal at New Bedford has three berths measuring 450 feet, 600 feet and 775 feet with 30 foot depth alongside. There is 125,000 square feet of covered storage for general cargo. Cargo service at the State Pier includes the movement of break-bulk cargo to Cape Verde and Angola. The facility can support freighter service and store over 135 containers. American Cruise Lines operates out of the facility bringing in a minimum of 20 ports of call on an annual basis and up to 89 passengers per trip. Ferry services also operate out of State Pier, including passenger and cargo service to Cuttyhunk Island and passenger service to Martha's Vineyard. This ferry service brings over 115,000 passengers through the Port annually. The Quick Start Ferry facility on New Bedford State Pier allows intermodal transfers of waterborne freight and freight carried by truck and rail. The terminal features a 27-foot pier depth, roll on-roll off capability, offsite cold storage, and easy access to the interstate highway system. The ramp is 100 feet long and 18 feet wide and will hold up to 200 tons. The pier could be used for both RO-RO or LO-LO operations.

The New Bedford State Pier is an adequate facility for handling of containerized waste from Vineyard Haven but would require additional cargo handling equipment. The containers would need to be handled by equipment such as a forklift, RO-RO trucks or trailer chassis. Since this equipment could be utilized for other operations at the port, the City of New Bedford may be willing to participate with cost-sharing for this equipment purchasing/leasing. We have determined that only RO RO operations, not LO LO operations, are economically feasible at New Bedford State Pier at this time. This is due to the fact that the port of New Bedford does not currently have a crane capable of handling containers. In

order to lift containers on and off the barge, a mobile harbor gantry crane or a construction crane would need to be added to the facility; the picture below shows a mobile harbor crane.

Figure 5: Mobile Harbor Crane

The capital cost for purchasing a mobile harbor crane is estimated to be approximately $3 million. Another option for LO-LO operations would be the use of a construction crane. In order to handle the containers, a 30-ton capacity construction crane would be required. The estimated capital cost of such a crane is estimated to be approximately $2 million. This is exclusive of pier modifications; in order to assess any pier modifications that would be required to handle a crane, a structural engineering assessment would have to be conducted. The primary issue with the New Bedford State Pier is the condition of the pier and the level of congestion at the berths. In regard to marine operations alone, requirements would include a designated berth at the pier. In addition to either the construction crane or mobile harbor crane, the system would also require a spreader (pictured below), which costs approximately $500,000. Due the relatively low quantity of containers that would be generated from Martha's Vineyard waste stream, the use of either a mobile harbor crane or construction crane to handle only waste containers would not be financially feasible without other types of cargo activities in place to offset the capital investment.

Figure 6: Spreader

Estimated Operations Cost at New Bedford

HDR evaluated the estimated costs at New Bedford State Pier for receiving a barge at its RO-RO ramp. The table below provides an overview of the cost elements.

Table 4: Estimated Port Costs at New Bedford for RO-RO Barge Handling

Category	Estimated Amount	Period	Remarks	Note
Dockage	$100	Per day	Barge rate based on size	2
Wharfage	$1.00	Per ton	Unit rate negotiable	3
Labor	$1,500	Per hour	Negotiable to staff level	4
Labor Differential	$600	Per hour	Overtime-staff level	5
Security Charge	$1,220	Per day	Contract security	6

Table 4 Notes:

1. Barge unloading and loading is anticipated to take between two and four hours depending on the volume aboard the barge to be discharged and return empty units.
2. Dockage is a flat fee based on the length of the barge. A minimal flat rate would apply to a barge based upon a short stay at the berth.
3. Whafage is currently based on a per ton charge. Unit rates can be negotiated as an alternative to a per ton rate for each container handled. Whafage applies to the material loaded and discharged over the ramp.
4. Labor rate is the rate for the entire vessel cargo handling personnel cost. This includes linehandlers, truck drivers, ramp handler, clerks or other personnel utilized to load and discharge the vessel. The rate is based on a minimal union contract ship's longshoring gang. In

most cases this level can be reduced depending on the staffing levels contracted. Barge staffing for longshore gangs is generally less than ship gangs. We have assumed that, for scenarios that include rail transport from New Bedford, the longshore gang would load/unload the containers from the railcars and that this operation would occur during the same shift as the barge loading/unloading.

5. Overtime differential applies to those periods before 0800 and after 1600 daily. The OT differential applies to the entire gang cost and can be reduced by smaller staffing levels.
6. Security charge is based upon a 24 hour federal requirement. In most cases, the rate can be reduced to a period prior to start up, during operations and after operations based on a minimal period including call out and on site activities.
7. All rates are negotiable based on frequency of activities, type of activities and personnel and equipment required.

Based on the above cost estimates, and considering potential negotiation items, HDR estimates the New Bedford Harbor Development cost for RO-RO operations to be approximately as follows:

Table 5: Estimated Barge Handling Costs

Category	Estimated Cost
Dockage	$100
Wharfage	$360
Labor	$4000
Labor Differential	N/A
Security Charge	$610
Total Estimated Cost per Barge Trip	**$5,070**
Estimated cost per ton (assuming 360 tons per barge)	**$14.08**

Table Notes / Assumptions

1. Assumes each barge handles 20 containers, each transporting approximately 18 tons per container
2. Barge handling/loading/unloading takes 4 hours at New Bedford
3. Assumes 4 labor hours at a negotiated $1,000 per hour rate
4. Assumes this operation would only pay 50% of the security charge (assumes this charge would be shared with other port users)
5. Assumes no overtime labor; as barges will arrive during normal working hours

In addition to the port costs described above, if Tisbury was to use a dedicated barge for this operation, there would be a cost for docking/berthing the barge while it was not in service. We have assumed that this cost would be approximately $2,400 per month at a berthing location in New Bedford (the location and terms would need to be negotiated with the New Bedford Harbor Development Commission).

SSA Terminals in Vineyard Haven, MA and Oak Bluffs, MA

The SSA Terminal in Vineyard Haven is capable of RO-RO service and is currently receiving barges in this manner. There is limited available space for storage of containers or trailers, as this area is primarily utilized for the transport of passengers. Additionally, there is a limited amount of availability of this terminal for uses other than SSA ferries dedicated to transporting passengers and goods between Woods Hole and Martha's Vineyard. However, SSA has indicated that the Vineyard Haven pier would be available for the Town of Tisbury's use between 11:00 and 12:30 on a daily basis, including in the summer months. With this window, a barge could be loading unloaded; while our report assumes that each barge would transport 20 containers, if the Town was to consider using the hour and a half window, the number of containers per barge may need to be reduced in order to be able to load/unload all containers on the barge.

The SSA's Oak Bluffs terminal facility is also primarily utilized for passenger ferries. The SSA stated that they utilize the Oak Bluffs terminal occasionally for freight service, however there are two elements that make this facility a challenge for consistent use as a freight RO-RO facility

- The pier faces open water (not a protected harbor), and is therefore susceptible to inclement winds/weather (as shown in the picture below)
- The dock connects to the roadway via a wooden pier, which is not conducive to consistent use via heavy freight trucking activity (the wooden pier is shown in the picture below)
- While it would not be infeasible to utilize the Vineyard Haven pier for RO-RO operations, the fact that the pier faces open water and consists of a wooden pier make this a less than desirable option. RO-RO operations are feasible on wooden piers, but one would expect some wear-and-tear from the heavy freight trucks handling the waste.

Figure 7: SSA Oak Bluffs Dock

Figure 8: SSA Oak Bluffs Pier

4.3 Evaluation of Barge Transportation

To evaluate the estimated capital and operating costs for barge transportation services between Martha's Vineyard and New Bedford, we obtained information from Tisbury Transportation & Towing Services, Inc. The following is a summary of the equipment owned by Tisbury Towing:

- One 160' x 40' deck barge with inside cargo space dimensions of 140' x 32' rated at 1,200 tons and capable of handling 12 trailers
- One 130' x 35' deck barge with inside cargo space dimensions of 125' x 32' rated at 800 tons and capable of handling 6 trailers. This barge is configured for modular units.
- One 130' x 35' deck barge with inside cargo space dimensions of 100' x 29' rated at 800 tons and capable of handling 6 trailers. This barge is configured for gravel.
- Tisbury Towing & Transportation would require the purchase/lease of an additional barge in order to transport waste on a consistent basis
- Used deck barges similar to the sizes owned by Tisbury Towing can be purchased in the market for approximately $150,000 to $300,000

Tisbury Transportation and Towing owns two 800 horsepower (SHP) harbor tugsBelow is a summary of the potential operating parameters and operating costs:

- Barge transit time between Vineyard Haven and New Bedford is approximately 4 hours
- For existing equipment, Tisbury Towing & Transportation's costing is as follows:
  - Daily barge rate: $750
  - Hourly tug rate: $350 (minimum of 4 hours)

In addition to Tisbury Towing & Transport, there are several other companies that could provide barge towing services. We contacted several barge towing companies that service the port of New Bedford or other ports in the area and requested approximate pricing for providing barge towing services. Several of these companies have barges that could be utilized for this service (the price for using the barge is shown in the table as well).

Table 6: Estimated Barge Towing Rates

Company	Tug Rate (per hour)	Barge Rate (per day)	Barge Size (Length x Width)
Island Barge	$300	Included	130 x 32
Mitchell Towing	$350	None	None
Tucker-Roy	$375	To be negotiated	226 x 45

We have assumed that for barge service provided by any company other than Tisbury Towing & Transportation, the tugs and barges would be docked in New Bedford, rather than on Martha's Vineyard, due to the limited availability of docking space on Martha's Vineyard.

Operational Considerations

Below are additional operational considerations for a potential barge towing service between Martha's Vineyard and New Bedford:

- Given the cost of barge and tug operations, it is desirable to transport has as many tons of waste as possible (to keep the per-ton or per-unit costs as low as possible). Given the relatively low quantities of waste generated by Tisbury and Oak Bluffs, it will therefore be necessary to store waste for several days, so as to only transport full barges (i.e., the barge would depart on an approximately once-per-week basis).
- The travel distance between the facilities is approximately 25 nautical miles through Woods Hole and transit time averages 4 hours in each direction. Assuming a 4 hour turnaround at each end, a round trip averages approximately 16 hours.

Given the above pricing and operational considerations, and given the items discussed above regarding RO-RO operations, HDR has concluded that an efficient mode of barge transport would be RO-RO operations, and each barge would handle approximately 20 containers. While the deck barges would be potentially capable of holding 24 containers (4 across and 6 deep), we have assumed that the first row of containers would need to be left empty to allow the RO-RO trucks to access the containers for loading and unloading. Additionally, it is important to note that double-stacking the containers on the barges would not be feasible, given the fact that this would require a crane. Reach stackers are also capable of stacking containers on top of each other, but reach stackers would not be able to access the barge through standard RO-RO ramps, and would be limited by the amount of space available to operate on a barge. Finally, HDR has determined that the most efficient barge transportation system would involve the transport of both MSW and C&D containers on the barge together. While C&D could be handled in open-top containers and MSW would be handled in sealed containers, both types of containers could be loaded/unloaded using RO-RO trucks, and since the origin/destination ports will be the same, there does not appear to be any significant advantages to dedicating barge voyages for MSW and C&D separately.

4.4 Transfer Station & Roadway Access

The roadways between the Oak Bluffs/Tisbury Transfer Station and the port terminal facilities in Vineyard Haven (both SSA and RM Packer) are sufficient to handle any of the truck configurations that are assessed in this Study.

4.5 Potential for Rail Service

Some municipalities and private haulers have opted to utilize rail service to transport both MSW and C&D to disposal facilities. In general, the advantage of this is to reduce the cost and congestion of truck traffic as well as the potential to access less expensive disposal facilities. New York City, for instance, uses rail to transport the MSW that is managed by the Department of Sanitation of New York (DSNY) in the boroughs of Staten Island, Bronx and Brooklyn. This rail service was implemented as part of DSNY's Solid Waste Management Plan, which recognized the potential economic and environmental advantages of transporting waste by rail rather than continuing to transport waste by truck, primarily to disposal facilities in Pennsylvania. Other examples include waste transferred at Kearney Point Intermodal Yard in Kearney, New Jersey. This facility receives containerized waste by truck and transfers

the containers onto railcars. These railcars are transported to the Apex Landfill in Amsterdam, Ohio. Cities on the West Coast, such as San Francisco and Seattle also transport MSW by rail. Up until recently, much of Boston's waste was transported by rail from the CSX intermodal yard in Brighton (Beacon Park Yard). Allied Waste, under contract to the City of Boston, delivered waste to a disposal facility in South Carolina. However, when this contract recently came up for renewal, the City of Boston selected Waste Management, who now transports Boston's waste via truck to its landfill in Rochester, New Hampshire.

There are several common drivers that a municipality would consider in evaluating whether to transport waste via rail, as summarized below:

- *Large volume of waste*: If a municipality handles a large volume of waste, there are significant efficiencies that can be obtained. The primary efficiency is the potential to transport waste via unit, or block train service, which allows for a shorter cycle time, and therefore reduced equipment requirements. The minimum number of cars that would constitute a block of cars that the railroads would provide preferential service is approximately 30 railcars. Each railcar can transport approximately 72 tons (4 containers, each containing 18 tons). Thirty (30) railcars therefore transport approximately 2,160 tons of waste.
- *Limited or high-priced nearby disposal options*: If a municipality has limited or only relatively high-priced options for disposal, rail transport can be an attractive option to access more competitive or lower priced disposal options.
- *Congested or Complex Trucking Logistics:* Municipalities in highly-populated areas with congestion on the roadways often consider utilizing rail service to transport waste in order to reduce the amount of trucks on the roadways. Removing trucks for the road reduces congestion as well as potentially reducing cost to the municipality, since congested roadways or complex logistics results in increased fuel, equipment and labor costs
- *Environmental Concerns:* Another consideration when evaluating rail versus truck transport of waste is the potential environmental benefit of rail. Transporting waste via rail can be significantly more fuel efficient, as it takes only one or two locomotives to transport dozens, if not hundreds of containers, versus one truck moving one container.
- *Infrastructure and Equipment Requirements:* Transporting waste via rail requires the leasing or purchase of infrastructure and equipment. In addition to leasing/purchasing railcars, the following need to be considered:
    - Transporting MSW requires the use of sealed containers. These containers are either top-loaded or side-loaded. If side-loaded, a compactor is often utilized, and if top-loaded, the system requires lidding and de-lidding capabilities
    - Transporting C&D does not require the use of sealed containers, since there are limited odor issues associated with C&D debris. C&D is typically transported in gondola railcars.

For estimating rail transportation costs, we have used the USRail.desktop model, which uses rail cost date provided by the railroads to the Surface Transportation Board. Many rail shippers use this model, or a similar model, to estimate potential rail transportation rates. For the two rail moves that were contemplated in this report, HDR assumed the following rates, based on date from USRail.desktop:

- Estimated rail transportation cost for transport from New Bedford to Seneca Meadows Landfill (NY): $1,812 per rail car
- Estimated rail transportation cost for transport from New Bedford to Apex Landfill (Ohio): $2,838 per rail car

Transport of C&D via Rail

When being transported by rail, C&D is typically transported in large cube gondola railcars. The gondolas are typically 60' to 65' in length. These gondolas are usually tarped or netted to minimize loss of waste while in transport. There are several disposal facilities that are currently receiving C&D by rail, including the following facilities that are located on CSX:

- BFI; Niagara Falls, N.Y
- C&D Technologies, Fernwood, Ohio; Landfill Environmental Logistics Services; North Apex, Ohio
- EnviroSolutions Inc.; Coalton, Ky
- Lafarge; Lordstown, Ohio
- Penn-Ohio; Negley, Ohio
- Preferred Management; East Newark, Ohio
- Sunny Farms; Fostoria, Ohio

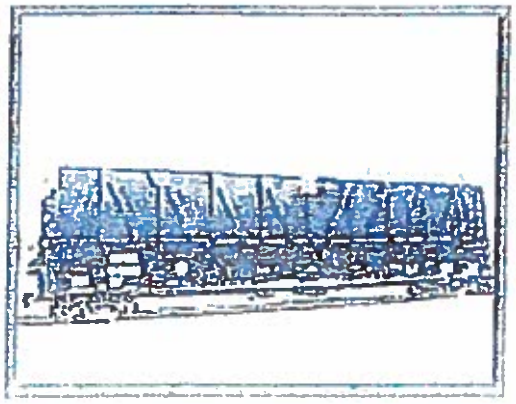
These landfills use either a rotary dumper or an overhead clam shell to unload the C&D from the gondolas. Some C&D is transported in sealed containers as well, however, due to the lower density of C&D, this is often less efficient/economical than transporting C&D in gondola railcars.

HDR considered the potential for Tisbury to transport C&D in open-top containers (tarped or netted) on a barge and then loaded onto railcars for transport to a landfill. However, to our knowledge, there are no landfills in the Northeast currently receiving C&D in open-top containers by rail. As mentioned above, the landfills in the Northeast that receive C&D by rail are set up to either rotary-dump gondola cars or to unload the C&D with an overhead clam shell from a gondola. HDR spoke to several representatives from C&D landfills in the region, and while it would be possible to unload the containers with the overhead clam shell, there are some concerns with the structural ability of the containers to handle this operation.

Given that C&D is typically transported via gondolas and the landfills in the region are set up to receive C&D via gondolas, we have made the assumption that transport of C&D in open-top containers via rail would not be feasible. C&D could be transported in sealed containers, similar to the way that MSW is transported, however due to the lower density of C&D, transporting C&D in containers is not as economical as transport in gondola cars. Given these factors, HDR has assumed that C&D would be

transported via open-top containers via truck to Transload America's facility in East Providence, Rhode Island. From this facility, the C&D could then be transferred to gondola railcars.

Figure 9: Gondola Rail Car



4.6 Transport of Waste Via Truck

There are several options for transporting waste via truck from a dedicated barge, each with pros and cons, as described briefly below

- Transport via open top trailer. Nearby disposal facilities have the capability to handle waste in this manner (i.e., Crapo Hill Landfill, ABC Waste Disposal, Bourne Landfill, Covanta SEMASS, Rhode Island Central Landfill, etc). However, given the need to hold waste for several days in order to keep the per-ton barge costs feasible, open top trailers of MSW will be problematic, given the potential for odors if stored for any extended period of time. Important to note that C&D could be transported via open top trailers, as odor issues are not as prevalent with C&D as they are with MSW
- Transport of MSW via sealed containers via RO-RO trucks. This scenario is potentially feasible, given that the trailers could utilize the existing RO-RO facilities. Note that the Tisbury/Oak Bluffs Transfer Station and the disposal facility (ies) would have to add lidding/de-lidding capabilities. One drawback to this scenario is that the number of nearby disposal facilities capable of receiving containers is limited.

Similar to the assumptions used in evaluating the current transportation system for moving the waste from the SSA terminal in Woods Hole by truck, below is an overview of the assumptions used in our estimates for the costs of waste transport via truck in this report:

- For labor estimates, we have used the Massachusetts 2011 prevailing wage for a truck driver, which is a minimum wage of $39.71 per hour. At 8 hours per day, this equates to $317.68 per

day. Depending on the scenario, we have assumed that drivers can make multiple trips from New Bedford to the disposal facility in one day. For transport from New Bedford (located at 52 Fisherman's Wharf) to Crapo Hill Landfill (located at 300 Samuel Barnet Boulevard in North Dartmouth, MA), we have assumed that one truck can make six trips in one day. For transport from New Bedford to Transload America in East Providence, we have assumed that one truck can make approximately four trips per day

- The one-way distance from the port of New Bedford at 52 Fisherman's Wharf to the Crapo Hill Landfill at 300 Samuel Barnet Boulevard in North Dartmouth, MA is approximately 11 miles. The one-way distance from the port of New Bedford at 52 Fisherman's Wharf to the Transload America Disposal Facility located at 1 Dexter Road in East Providence, RI is approximately 30 miles. We have assumed that each truck travels approximately 7 miles per gallon of fuel, and an estimated fuel price of $4.20 per gallon.
- The annual insurance, licensing and taxes per truck are estimated to be approximately $5,000.
- The annual maintenance is assumed to be approximately 25 cents per mile.

4.7 Summary of Disposal Facilities and Pricing

The following tables provide an overview of the disposal facilities that could be considered for disposal of the MSW and C&D received at the Tisbury Transfer Station. Table 3 below shows a summary of disposal facilities that received at least 100 tons per day in 2010 and are located within an approximate one-day truck haul from New Bedford (includes the states of Massachusetts, Rhode Island, New Hampshire and Connecticut). Only landfills and Energy-from-Waste facilities are included in Table 3, Transfer Stations are not included. The tipping fee charged is the average spot rate that was charged during 2010. Note that tipping fees can be negotiated, and long-term contracts are often signed at tipping fees that are lower than the spot rate. It is important to note that landfills have finite capacity. According to Mass DEP, existing landfill capacity in Massachusetts is expected to decline significantly over the next decade. Massachusetts landfill capacity is expected to decline from just under two million tons in 2009 to about 600,000 tons in 2020 as current landfills close and are not replaced.

Table 7: Disposal Facilities located within New England States

Name	Location	Volume of Primary Waste Accepted (TPD)	Tipping Fee Charged
Covanta Bristol Resource Recovery Facility	Bristol, CT	658	$65.50
Manchester Landfill	Manchester, CT	165	$73.00
Covanta Mid-Connecticut Resource Recovery Facility	Hartford, CT	2,739	$69.00
Covanta Southeastern Connecticut Resource Recovery (SECONN)	Preston, CT	848	$60.00
Wheelabrator Bridgeport RESCO W-T-E	Bridgeport, CT	2,210	$63.00
Covanta Wallingford Resource Recovery Facility	Wallingford, CT	460	$60.00
Wheelabrator Lisbon Inc. W-T-E	Lisbon, CT	544	$70.00
Exeter Energy Limited Partnership	Sterling, CT	339	$26.00
Town of Bourne Landfill	Buzzards Bay, MA	382	$86.00
Chicopee Landfill (CT Valley)	Chicopee, MA	948	$120.00
Fall River Landfill	Fall River, MA	521	$105.00
Holyoke-Granby Landfill	Granby, MA	325	$130.00
Middleboro Landfill	Middleboro, MA	142 (C&D)	$60.00
Northampton Regional Landfill	Northampton, MA	150	$70.00
Southbridge Landfill	Southbridge, MA	569 (C&D)	$71.00
Taunton Landfill	Taunton, MA	287	$90.00
Fitchburg – Westminster Landfill	Westminster, MA	847	$120.00
Springfield Resource Recovery Facility	Agawam, MA	420	$90.00
Pittsfield Resource & Recovery Facility	Pittsfield, MA	270	$83.00

Name	Location	Volume of Primary Waste Accepted (TPD)	Tipping Fee Charged
Covanta SEMASS Resource Recovery Facility	West Wareham, MA	3,229	$86.57
Covanta Haverhill Resource Recovery Facility	Haverhill, MA	1,932	$55.00
Wheelabrator Millbury Central Mass. W-T-E	Millbury, MA	1,572	$91.00
Wheelabrator North Andover RESCO	North Andover, MA	1,451	$75.00
Wheelabrator Saugus RESCO	Saugus, MA	1,404	$86.70
Crapo Hill Landfill	North Dartmouth, MA	302	$90.00[1]
Lewiston Landfill	Lewiston, ME	349 (C&D)	$95.00
Norridgewock Landfill	Norridgewock, ME	1,110	$82.00
Mid-Maine Waste Action Corp Incinerator	Auburn, ME	220	$90.74
Maine Energy Recovery Co. (MERC)	Biddeford, ME	872	$80.00
Penobscot Energy Recovery Co. (PERC)	Orrington, ME	1,203	$65.00
Regional Waste Systems Waste-to-Energy	Portland, ME	507	$88.00
NCES Landfill	Bethlehem, NH	336	$87.00
City of Lebanon Solid Waste Landfill	West Lebanon, NH	154	$68.68
Four Hills Landfill	Nashua, NH	202	$80.00
Turnkey Recycling & Environmental Enterprises (TREE)	Rochester, NH	1,277	$87.00
Mount Carberry Landfill	Berlin, NH	443 (C&D)	$70.00
Franklin Landfill	Franklin, NH	195	$44.00

[1] HDR contacted management representatives from Crapo Hill Landfill and these representatives stated that they are interested in providing landfill capacity to the Town of Tisbury on a long-term basis and that disposal rates would be approximately $70 per ton

Name	Location	Volume of Primary Waste Accepted (TPD)	Tipping Fee Charged
Wheelabrator Concord Facility	Concord, NH	587	$80.00
Wheelabrator Claremont Co., L.P.	Claremont, NH	231	$89.50
Rhode Island Central Landfill (Johnston Landfill)	Johnston, RI	3,528	$75.00
Central Vermont Landfill Transfer Station	Montpelier, VT	101	$119.00
Moretown Landfill	Moretown, VT	480	$77.50
South Hadley Landfill	South Hadley, MA	429	$100.00
Juniper Ridge Landfill	Old Town, ME	865 (C&D)	$67.45
Epping Resource Recycling Facility	Epping, NH	510 (C&D)	$90.00

The table below provides a summary of the rail served disposal facilities in the region.

Table 8: Rail-served Disposal Facilities in the Region

Name	Location	Volume of Primary Waste Accepted (TPD)	Tipping Fee Charged
Twin Bridges Recycling & Disposal Facility	Danville, IN	3,224	$38.00
Earthmovers Landfill	Elkhart, IN	999	$36.60
West Kentucky Landfill	Mayfield, KY	227	$30.00
Outer Loop Landfill	Louisville, KY	2,087	$56.43
Laurel Ridge Landfill	Lily, KY	1,112	$34.60
Southern Sanitation Landfill	Russellville, KY	738	$24.75
Chicopee Landfill (CT Valley)	Chicopee, MA	948	$120.00
Fitchburg – Westminster Landfill	Westminster, MA	847	$120.00
Covanta SEMASS Resource Recovery Facility	West Wareham, MA	3,229	$86.57

Name	Location	Volume of Primary Waste Accepted (TPD)	Tipping Fee Charged
Wheelabrator North Andover RESCO	North Andover, MA	1,451	$75.00
Turnkey Recycling & Environmental Enterprises TREE	Rochester, NH	1,277	$87.00
Seneca Meadows Landfill	Waterloo, NY	6,151	$50.00
Niagara Recycling Inc Landfill	Niagara Falls, NY	1,454 (C&D)	$100.00
Geneva Landfill	Geneva, OH	388	$63.00
SWACO Franklin County Sanitary Landfill	Grove City, OH	2,574	$36.75
Gallia County Sanitary Landfill	Bidwell, OH	136	$45.00
Lake County Solid Waste Landfill	Painesville, OH	562	$30.00
South Suburban Recycling & Disposal Facility	Glenford, OH	1,178	$50.00
Mahoning Landfill Inc	New Springfield, OH	660	$36.00
Ottawa County Landfill	Port Clinton, OH	220	$34.50
Pike Sanitation Landfill	Waverly, OH	229	$31.00
Sunny Farms Landfill	Fostoria, OH	994	$25.50
American Landfill	Waynesburg, OH	2,133	$46.00
Evergreen Recycling & Disposal LF	Northwood, OH	495	$55.00
Wyandot Sanitary Landfill/County Environmental	Carey, OH	338	$29.00
Transload America – Alliance LLC Landfill	Alliance, OH	1,035	$35.00

Name	Location	Volume of Primary Waste Accepted (TPD)	Tipping Fee Charged
Oakland Marsh Landfill	Shiloh, OH	1,345	$65.00
Tunnel Hill Reclamation Landfill	New Lexington, OH	239	$30.00
McKean County Landfill	Mount Jewett, PA	395	$48.50
Tullytown Landfill	Tullytown, PA	1,969	$83.00
Valley Landfill	Irwin, PA	544	$64.90
Pine Grove Landfill	Pine Grove, PA	835	$52.50
Arden Landfill	Washington, PA	847	$67.00
GROWS Landfill	Morrisville, PA	1,820	$83.00
Grand Central Sanitary Landfill	Pen Argyl, PA	509	$82.16
Kelly Run Sanitary Landfill	Elizabeth, PA	265	$51.50
South Hills Landfill	Library, PA	191	$75.00
Monroeville Landfill	Monroeville, PA	853	$75.00
Pellegreene Landfill	Homer City, PA	316	$60.00
Northwest Sanitary Landfill	West Sunbury, PA	270	$66.20
Conestoga / New Morgan Landfill	Morgantown, PA	1,666	$100.00
Southern Alleghenies Landfill	Davidsville, PA	245	$62.05
GROWS North Landfill	Morrisville, PA	4,193	$83.00
Charles City County Landfill	Charles City, VA	1,468	$38.00
Middle Peninsula Landfill & Recycling Facility	Glenns, VA	1,365	$45.00
King George County Landfill & Recycling Facility	King George,VA	2,423	$39.00
Roanoke Valley Regional Landfill	Roanoke, VA	700	$55.00

Name	Location	Volume of Primary Waste Accepted (TPD)	Tipping Fee Charged
Amelia Landfill	Jetersville, VA	702	$45.00
Atlantic Waste Disposal Inc Landfill	Waverly, VA	5,020	$47.00
Apex Sanitary Landfill	Amsterdam, OH	3,670	$30.00
Holyoke-Granby Landfill	Granby, MA	325	$130.00
Fitchburg – Westminster Landfill	Westminster, MA	847	$120.00

The table below provides information regarding nearby C&D transfer stations that are rail-served. This is shown since Tisbury might consider trucking C&D to a transfer station for transfer to rail in order to access rail-served C&D disposal facilities without the cost of owning/leasing its own rail equipment.

Table 9: C&D Transfer Stations in New England (that are served by rail)

Name	Location	Volume of Primary Waste Accepted (TPD)	Tipping Fee Charged
Transload America - Pond View	East Providence, RI	83	$75.00
ABC & D Recycling, Inc.	Ware, MA	45	$95.00

5.0 Estimated Capital, Equipment and Operational Costs

The following section provides an overview of the estimated capital and operational costs for the various scenarios that were considered. In order to estimate the number of containers needed for each scenario, HDR developed a model that simulated the transport of the barge, railcars and trucks throughout the system. HDR modeled the peak period of May through August, since the system will need to have sufficient equipment to handle the peak periods. The following assumptions were used for the various scenarios:

- Round-trip barge transport from Martha's Vineyard to New Bedford is approximately 12 hours
- Each barge transports 20 containers
- The barge is loaded within a 4 hour period at Vineyard Haven and unloaded within a 4 hour period at New Bedford
- The barge is loaded and unloaded via RO-RO trucks dedicated to this transportation system. Two RO-RO trucks would be dedicated at each port for this operation.

- MSW would be transported in sealed 20' containers
- C&D would be transported in open-topped 20' containers with tarping/netting

While there are numerous scenarios that could be evaluated, HDR utilized the assumptions above as a starting point for the base assumptions of an efficient system for containerized waste transport via barge, given the operating parameters described throughout this report. In order to assess potential variations of the system, HDR has developed cost estimates for the following scenarios:

Table 10: Overview of Scenarios Evaluated

Scenario	MSW Disposal		C&D Disposal	
	Location	Mode	Location	Mode
Scenario 1	Seneca Meadows Landfill (NY)	Rail	Transload America (East Providence, RI)	Truck
Scenario 2	Apex Sanitary Landfill (OH)	Rail	Transload America (East Providence, RI)	Truck
Scenario 3	Crapo Hill Landfill (New Bedford, MA)	Truck	Transload America (East Providence, RI)	Truck

Estimated Equipment Requirements

Railcars

For the scenarios that include rail, we have assumed that a set of railcars would be dedicated to the transportation system and would be transported as a block on the railroad. We assumed round-trip cycle times of 12 days for transport from New Bedford to Seneca Meadows, New York and a round-trip cycle time of 18 days for transport from New Bedford to Amsterdam, Ohio (Apex Landfill). The cycle time estimate includes rail transport as well as loading/unloading the containers at the disposal facilities.

A key factor for estimating the number of railcars required is to determine whether the number of days to generate the waste required to fill a barge and to transport that barge would be more or less than the round trip cycle time for the rail transportation. In the peak period (August) of 2010, there were 3.1 container equivalents generated per day, between MSW and C&D. At this rate, a barge of 20 containers would need to be transported approximately every 7 days. During the peak season of August, MSW is generated at a rate of approximately 3:1 compared to C&D. Therefore, we would expect that a barge transported in August would contain approximately 15 containers of MSW and 5 containers of C&D. These 15 containers would require 4 railcars. Given that these 15 containers would be generated every

7 days or so, and the cycle time to Seneca Meadows is estimated to be 12 days, HDR estimates that this system would require two sets of 4 railcars, or 8 railcars. Using similar logic, assuming an 18 day cycle time to Apex Landfill in Ohio, the system would require three sets of 4 railcars, or 12 railcars. The estimated cost per railcar is assumed to be approximately $83,000.

Containers

To estimate the number of containers required, HDR used the following methodology:

- MSW: As stated above, during the peak month of August, we would expect that a barge transported during this month would consist of 15 containers of MSW and 5 containers of C&D. To estimate the number of containers required, we would use the following calculation:
  - Number of containers on barge: 15
  - Number of containers on railcars (in transit): 32 for transit to Seneca Meadows, 48, for transit to Apex
  - Number of containers required at Transfer Station and port(s) while containers are in transit: 5
  - Total Estimated number of Containers Required for Transit to Seneca Meadows: 52
  - Total Estimated number of Containers Required for Transit to Apex: 68

For truck transport of MSW in containers (assuming that the destination is Crapo Hill Landfill in North Dartmouth, MA), we would use the following calculations to estimate the number of containers required:

  - Number of containers on barge: 15 (using similar logic as above)
  - Number of containers required at Transfer Station and port(s) while containers are in transit: 15

- C&D: In the month of April, C&D is generated at a rate of 1.2 to 1.0 compared to MSW. Given this, we would expect that a barge transported in April would consist of 11 containers of C&D and 9 containers of MSW. A conservative estimate would be to have approximately 15 containers to handle C&D. This would allow for a sufficient number of containers to be at the transfer station while containers are on the barge and in transport to the C&D disposal facility.

The capital cost for each MSW container is estimated to be approximately $13,000. The capital cost for each MSW container is estimated to be approximately $8,000.

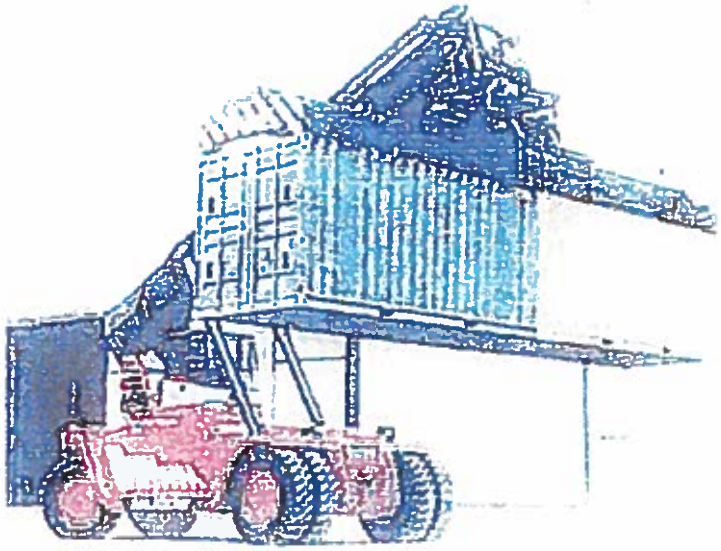
RO-RO Trucks

For all three scenarios, we assumed that the system would require two RO-RO trucks dedicated at each port in order to load and unload containers onto/off the barges as well as one RO-RO truck dedicated to the Transfer Station to move containers between the loading area and the lidding area. The purpose of having two trucks at each port is due to the desire to load or unload the barge as quickly as possible to minimize barge handling and transport costs. Two of these trucks would be utilized to bring containers back and forth between the Transfer Station and Vineyard Haven and two of these trucks would be utilized to bring containers back and forth between the port of New Bedford and Crapo Hill Landfill (under Scenario 3). The capital cost for each RO-RO truck is estimated to be approximately $125,000.

Reach Stacker

For the rail options (Scenario 1 and 2), the system would require a reach stacker, or similar container handling unit, at the port of New Bedford in order to load containers onto and off the railcars. The capital cost for a reach stacker is estimated to be approximately $500,000.

Figure 10: Reach Stacker



Below are the equipment estimates for each scenario

Table 11: Equipment Estimates for Each Scenario

Scenario	Containers (MSW)	Containers (C&D)	Railcars	RO-RO Trucks	Barge	Reach Stacker
Scenario 1	52	15	8	5	1	1
Scenario 2	68	15	12	5	1	1
Scenario 3	30	15	N/A	5	1	0

Capital Cost Assumptions

For all capital costs, we have assumed a private sector financing with mortgage-style amortization and an interest rate of 7.0%. We have made the following assumptions for the useful life of the equipment:

Table 12: Equipment Useful Life Assumptions

Equipment	Assumed Useful Life (Years)
Railcars	30
Containers (both C&D and MSW)	8
Reach Stacker	15
RO-RO Trucks	10
Barge	30

Capital Costs

Our analyses also include the following assumed capital costs:

1. Rail Rehabilitation at New Bedford State Pier: To handle containers by rail at the port of New Bedford, the New Bedford State Pier will require a rehabilitation and extension of the existing rail. The estimated cost of this rail rehab is approximately $500,000. This rehabilitation may be implemented regardless of whether Tisbury's waste is delivered to New Bedford, however we

have conservatively included this cost in our estimate for rail until it is confirmed by Mass Coastal Railroad and/or New Bedford Harbor Development Commission that there will be no cost to Tisbury for this rehabilitation.

2. Lidding/De-lidding Station: In order to handle sealed containers of MSW, the Tisbury Transfer Station will need to be upgraded to include a lidding/de-lidding station. These containers are loaded from either the top or the side. In the case of the Tisbury Transfer Station, the containers would be loaded from the top. We have assumed that the Transfer Station would have a RO-RO truck dedicated to the facility that would move the containers between the loading area and the lidding/de-lidding area. The disposal facility that these containers would be going to would also require a lidding/de-lidding station. Disposal facilities that currently receive waste by rail are assumed to have existing lidding/de-lidding capabilities. Scenario 3, which includes truck transport of MSW to Crapo Hill Landfill in New Bedford, will require the installation of lidding/delidding capabilities at Crapo Hill Landfill. The estimated cost of each lidding/de-lidding station is $500,000.

All capital cost estimates assume an interest rate of 7.0% and assumed a mortgage-style amortization, based on the useful life of the equipment being purchased.

<u>Operational Costs</u>

Our analyses include the following operational costs:

1. *<u>Barge Handling Costs:</u>* HDR assumed that the Barge Loading and Unloading Costs were identical between New Bedford and Martha's Vineyard.
2. *<u>Barge transport costs:</u>* HDR used an hourly rate of $300 for barge towing costs.
3. *<u>Rail Loading / Unloading Costs (at port of New Bedford)</u>*: HDR assumed that rail loading/unloading at New Bedford would be conducted by the same gang that would handle the barge.
4. *<u>Rail Transport Costs:</u>* HDR utilized USRail.desktop for estimating the costs of rail transport.
5. *<u>Trucking Costs:</u>* For transport from port of New Bedford to Crapo Hill Landfill or Transload America, HDR used the same assumptions as were used to calculate the trucking costs for the current transport of waste from Woods Hole, MA.
6. *<u>Disposal Costs:</u>* For the estimated tip fee at Crapo Hill, HDR used the number provided by representatives from the landfill during our interview with the. For all other tip fees, HDR used the tip fees that were reported by the Waste Business Journal Inc's Database of Disposal Facilities.

Table 13: Estimated Capital and Operating Costs for Each Scenario

	Scenario 1: MSW by Rail to Seneca; C&D by Truck to Transload America		Scenario 2: MSW by Rail to Apex; C&D by Truck to Transload America		Scenario 3: MSW by Truck to Crapo Hill; C&D by Truck to Transload America	
Component	Estimated Annual Costs	Per Ton Estimated Cost	Estimated Annual Costs	Per Ton Estimated Cost	Estimated Annual Costs	Per Ton Estimated Cost
Capital Costs						
Barge	$23,951	$1.70	$23,951	$1.70	$23,951	$1.70
Containers (MSW and C&D)	$130,229	$9.26	$164,259	$11.68	$83,438	$5.94
Railcars	$53,011	$3.77	$79,517	$5.66	$0	$0.00
RO-RO Trucks	$87,081	$6.19	$87,081	$6.19	$87,081	$6.19
Reach stacker(s)	$53,930	$3.84	$53,930	$3.84	$0	$0.00
Rail rehab	$39,918	$2.84	$39,918	$2.84	$0	$0.00
Lidding / De-lidding	$39,918	$2.84	$39,918	$2.84	$79,836	$5.68
Operating Costs						
Barge Handling Costs (MV)	$197,984	$14.08	$197,984	$14.08	$197,984	$14.08
Barge Transport Costs	$140,580	$10.00	$140,580	$10.00	$140,580	$10.00
Barge Handling Costs (NB)	$197,984	$14.08	$197,984	$14.08	$197,984	$14.08
Barge Berthing Costs	$30,000	$2.13	$30,000	$2.13	$30,000	$2.13
Rail Transportation Costs	$212,256	$25.17	$332,440	$39.42	$0	$0.00
Truck Transportation Costs	$65,749	$4.68	$65,749	$4.68	$124,319	$8.84
Tip fee (MSW and C&D)	$843,500	$60.00	$674,820	$48.00	$1,012,180	$72.00
Total Estimated Cost	**$2,116,090**	**$160.59**	**$2,128,130**	**$167.15**	**$1,977,353**	**$140.66**

Conclusions

As shown in the table above, the transport and disposal costs for the three scenarios that were evaluated range between $140.66 per ton to $167.15 per ton. In addition to the pricing considerations, one should consider market forces as well when determining whether to implement a containerized port-to-port system for transporting MSW and C&D. The primary market forces to consider would be the potential flexibility and market reach that a dedicated freight system would allow Tisbury to realize. An example of flexibility/market reach is with implementing rail service; once the railcars and containers are purchased, Tisbury would be able to access numerous disposal facilities that are served by rail, rather than only having options that are within a one-day truck haul. Another important consideration to determine the feasibility or attractiveness of this system is to consider the potential for backhaul or additional use of the barge from New Bedford to Martha's Vineyard. As outlined in this report, the barge would only be used approximately one day per week, so the barge would be available for use during days when no waste is transported by barge to/from Martha's Vineyard. Also, the barge would be traveling between New Bedford and Martha's Vineyard with 20 empty containers, some sealed and some open-topped. This would present potential back-haul opportunities as well.

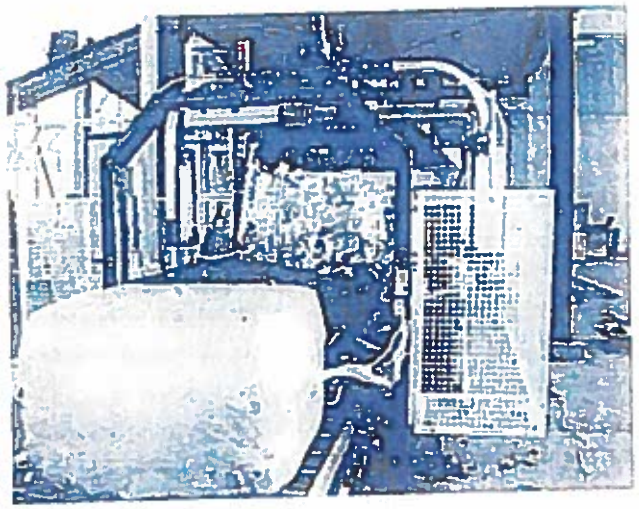
It is important to note that the three scenarios that HDR chose were based on a thorough assessment of numerous potential transportation scenarios, however, there are many variations that could be evaluated. HDR chose these three scenarios as they represent potentially efficient transportation systems and also compare rail and truck transport scenarios. It is also important to note that the cost estimates included in this report are HDR's estimates based on our industry experience as well as quotes from vendors and transportation providers. These costs are subject to change based on normal economic conditions (escalation/de-escalation) as well as market conditions. These market conditions would include the fact that companies involved in this supply chain (equipment providers, transportation service providers) may price their equipment or services differently through negotiations. As with most market dynamics, the presence of competition often leads companies to price their equipment or services more aggressively. A lack of competition can have the opposite effect on pricing behavior. Another factor to consider is that there is often a benefit to negotiating a long-term deal with service providers. Given the capital expenses required to provide the service described in this report, it would most likely be advantageous to enter into a long-term service contract (in excess of 8 years or so). Such a long-term deal could provide some negotiation leverage with transportation providers. A long-term deal such as this would also allow Tisbury to have certainty regarding costs of disposal, rather than having to negotiate short-term deals subject to spot-market pricing.

Proposed Next Steps

If the cost estimates as outlined above are determined by the Town of Tisbury to be within reasonable limits as compared to the anticipated costs of continuing the current transport and disposal system, then HDR would suggest the following next steps:

- Consider evaluating the potential for RO-RO services at the port of East Providence. There is an existing port in East Providence, and there is the potential to construct RO-RO facilities. It may be advantageous to have a competitive port option to New Bedford, as well as having a port option that would be out-of-state and therefore not subject to the SSA Enabling Act
- Consider evaluating the potential for transport of MSW via plastic-wrapped bales. Baling of MSW would require the installation of a baling system at the Tisbury Transfer Station (estimated cost of $600,000). Once baled, MSW can be stored for many days, given the fact that there are minimal odor or pest issues. Typical bales are 16 square feet (4x4), weigh approximately 1.9 tons and can be stacked three high. Approximately thirteen bales can fit on one standard flatbed trailer. Bales also have an advantage of significantly compacting waste through the baling process. Given the relatively high cost of containers and lidding/de-lidding stations, the baling system could be an attractive option worth further exploration to determine the feasibility and cost. The figure below shows an example of a baling system.

Figure 11: Plastic-wrapped Baling System



Finally, through HDR's interviews and research, it became evident that there are several companies that are interested in proposing a solution to transporting and disposing of Tisbury's waste. These include Crapo Hill Landfill, ABC Waste Disposal, EnviroSolutions, Bourne Landfill, Covanta at SEMASS, Bruno's, Island Barge and others. HDR would suggest that the Town of Tisbury consider issuing a Request for Expression of Interest (RFEI) or similar solicitation that would request that companies provide an overview of their proposed system for waste transport and disposal. HDR would expect that teaming arrangements between transportation providers and disposal companies would potentially be forged through this process, and would provide the Town with potential "all-in" transport and disposal options that would set the stage for a competition for a contract to provide long-term service for the transport and disposal of the Town's waste.

In conclusion, HDR has determined that establishing a port-to-port containerized freight system between Martha's Vineyard and New Bedford is technically feasible. We have also provided our estimates for the cost of this service, so that the Town can determine whether this service is also economically feasible compared to continuing the current transport and disposal system. We believe that the proposed next steps that we have outlined above will result in providing the Town with a potential competitive set of options for transporting and disposing of Tisbury's waste.

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Weston&Sampson

MEMORANDUM

TO:	Robert Whritenour, Oak Bluffs John Grande, Tisbury
FROM:	Michael Richard, P.E.
CC:	Steve Sayers, Steamship Authority
DATE:	January 5, 2016
SUBJECT:	Oak Bluffs/Tisbury Solid Waste Barging

Weston & Sampson is tasked with identifying the potential challenges and the associated cost savings with operating a solid waste transfer station baling facility or a compacting facility in comparison to the existing Oak Bluffs/Tisbury (OBT) transfer station. Our scope of services includes:

- Review of existing information;
- Development of two conceptual alternatives (compactor type transfer station and a baler type transfer station);
- Develop probable construction costs of upgraded transfer station facilities;
- Comparison of life cycle costs for the two alternatives as compared to current operations; and
- Develop a technical memorandum of our findings.
- Attend a meeting to present our findings.

As part of our scope, we reviewed a 2010 report prepared by HDR that evaluated the feasibility of establishing port-to-port containerized freight services between Martha's Vineyard and New Bedford as it relates to transporting municipal solid waste (MSW) and construction and demolition debris (C&D). At the time of the HDR study, Oak Bluffs and Tisbury (OBT) had a contract for disposal of their solid waste at SEMASS in Rochester, Massachusetts. Since that time, OBT has signed a new disposal contract with Greater New Bedford Regional Refuse Management District (GNBRRMD) for disposal of MSW at their Crapo Hill Landfill in New Bedford, Massachusetts. Weston & Sampson updated financials from the HDR study to present day costs using CPI Index and the new disposal location. The results are below and indicate a potential increase in costs to transport material using shipping containers via barge. We have brought our concerns of a suspected operational cost increase to the attention of OBT and the Steamship Authority and the project is currently on hold as we are waiting on additional information before proceeding any further.

Existing Transport of Open Top Trailers via SSA and Truck:

Component	2010 Estimated Cost per Trip (a)	2010 Estimated Annual Cost (a)	2015 Estimated Annual Cost
SSA Tariff [b]	$ 493.00	$ 247,979	$ 268,000
SSA Charge (Driver)	$ 15.00	$ 7,545	$ 8,550
Labor [b]	$ 317.68	$ 159,793	$ 172,690
Trailer (Amortized) [b]	$ 23.22	$ 11,680	$ 12,620
Tractor (Amortized) [b]	$ 58.05	$ 29,199	$ 31,560
Fuel [c][d]	$ 60.60	$ 30,482	$ 35,617
Insurance, licensing, taxes [b]	$ 13.69	$ 5,000	$ 5,400
Truck Maintenance [c]	$ 25.25	$ 12,701	$ 16,810
Total Estimated Cost per Trip	$ 1,006	$ 504,378	$ 551,247
Estimated Cost per Ton (Assuming 28 tons per truck)	$ 35.95	$ 36	$ 39

Potential Transport of Shipping Containers via Barge and Truck:

Component	2010 Estimated Annual Cost (a)	2015 Estimated Annual Cost (a)
Barge	$ 23,951	$ 25,880
Containers	$ 88,837	$ 96,010
RO-RO Trucks	$ 87,081	$ 94,110
Lidding / De-Lidding	$ 79,836	$ 86,280
Barge Handling Cost (MV)	$ 197,984	$ 213,970
Barge Transportation Cost	$ 140,580	$ 151,930
Barge Handling Cost (NB)	$ 197,984	$ 213,970
Barge Berthing Cost	$ 30,000	$ 32,420
Truck Transportation Costs (NB to CH)	$ 124,319	$ 134,350
Total Estimated Cost per Trip	$ 970,572	$ 1,048,920
Estimated Cost per Ton (Assuming 360 tons per barge)	$ 69	$ 75

Δ = $500,000 / year

Table Notes:

- Assumes same number of trailers being utilized as in the 2010 study.
- Proposed transport assumes one day of labor and consistent with 2010 study.
- Assumes same fuel mileage as 2010 study.
- Costs include transport fees from SSA port to disposal facility. Costs do not include island transport fees and is consistent with HDR study.
- Based on 503 trailer trips/year.

(a) 2010 costs are based on HDR study. 2010 Cost per Trip taken from HDR study.
(b) Updated cost based on Consumer Price Index (CPI), All Urban Consumers, Northeast data.
(c) Cost updated based on current disposal facility location.
(d) 2015 price of diesel is estimated to be $4.007/gal based on annual No. 2 diesel retail prices for 2014 as published by U.S. Energy Information Administration.

Solid Waste Management Consolidation Study

Final Report

Prepared for:

Martha's Vineyard Refuse Disposal District

February 2011

Environmental Partners

A partnership for engineering solutions.

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FINAL REPORT

Solid Waste Management Consolidation Study

Prepared for:
Martha's Vineyard Refuse Disposal District

Funded by:
The Martha's Vineyard Commission with financial support from the Massachusetts Department of Housing and Community Development District Local Technical Assistance Program.

February 10, 2011

Paul F. Gabriel, P.E.
Principal

Mark N. White
Principal

Environmental Partners
A partnership for engineering solutions.
Quincy, MA www.envpartners.com

TABLE OF CONTENTS

EXECUTIVE SUMMARY II

1 INTRODUCTION 1

1.1 Background and Purpose 1
1.2 Previous Studies 2
1.3 Purpose and Scope of the Study 2
1.4 Report Organization 3

2 REGULATORY STATUS 4

2.1 Site Assignment 4
2.2 DEP Authorization to Construct Permit 4
2.3 New Statutory Provisions Regarding Site Assignment and Transfer Stations 5

3 SOLID WASTE AND RECYCLING VOLUMES 7

3.1 District Solid Waste Trends 7
3.2 2009 Solid Waste and Recycling Tonnage 8
3.3 Solid Waste Tonnage for Island-Wide District 9

4 EVALUATION OF EXISTING FACILITIES 11

4.1 District Facilities 11
4.1.1 Site Access Road and District Office 11
4.1.2 Local Drop Off Area 12
4.1.3 Gatehouse and Scale Operations 13
4.1.4 Transfer Station and Solid Waste Processing 15
4.1.5 Leaf and Yard Waste Composting 17
4.1.6 Container Storage Area 18
4.2 Constraints of the District Facility 18

5. PROPOSED OPERATIONS APPROACH FOR ISLAND-WIDE DISTRICT 20

5.1 Overview Assessment of an Island-Wide Operation at the District Facility 20
5.2 Recommendations for Initial Operations Phase 21

Appendices:

Appendix A – MVRD Facility Site Assignment and Authorization to Construct Permits

Appendix B – Aerial Photos of Martha's Vineyard Solid Waste Facilities

Appendix C – Concept-Level Site Plan of Island-Wide District Facility (From the Report "Master Planning Initiative for Martha's Vineyard, Environmental Partners Group, January 2008

EXECUTIVE SUMMARY

The Marthas Vineyard Refuse District (MVRD) that serves Edgartown, West Tisbury, Chilmark and Aquinnah have been in ongoing discussion over the last two years with the Tisbury and Oak Bluffs of becoming an Island-wide District serving all of the Island communities. This study reviewed the existing regulatory permits held by the District and the implications on expanding to an Island-wide District, defined the solid waste tonnage that it would receive, the condition of MVRDs existing facilities at Edgartown and constraints these facilities would if they were to manage the additional waste and recycling streams, from Tisbury and Oak Bluffs, and provides a proposed concept for MVRD operations that could be used during the initial operating years.

MVRD currently holds a Site Assignment from the Edgartown Board of Health that allows the facility to accept up to 125 tons per day (tpd) of solid waste on an annual average day basis. The Department of Environmental Protection (DEP) Authorization to Construct and Operate permits redefine this 125 tonnage to be a maximum day threshold. The Massachusetts legislature made changes to the Solid Waste statutes that immediately shifts the regulatory authority from DEP to local Boards of Health for performing all Site Assignment permitting and, as of 2012, for transfer stations that receive up to 50 tons per day (annual daily average basis).

During 2009 MVRD received 11,934 tons, 33 tpd, of solid waste. During the peak summer season this average daily tonnage increases to 58 tpd. The Oak-Bluffs transfer station received 13,742 tons of solid waste, equivalent to an average of 38 tpd and a summer season daily average of 66 tpd. An Island-wide District would therefore manage an average 71 tpd of solid waste, which is within the Site Assigned threshold. This increase in tonnage would, however, require a modification to the DEP Authorization to Operate permit.

MVRDs existing facilities at its Edgartown complex consist of a District office, residential drop off area, gatehouse and weigh scale, transfer station building, leaf and yard waste collection area and container storage. Constraints associated with the drop off area, gate house/scale operations, transfer station and compost area were identified. The drop off area is in immediately adjacent to the gate house with very limited area for parking and maneuvering. This, in addition to the activities performed at the gate house – checking stickers, performing the weighing operations and cash transactions – results in queuing of traffic and vehicle congestion that is at times severe during busy operating periods and can present a public safety concern as users of the facility move around their vehicles.

The transfer station is used for processing of solid waste, construction debris and mainstream recyclables. Residents deposit their loads through side windows that are located within the travel lane for trucks that need to access the building, creating another potential safety concern. The tip floor has limited space that makes it difficult at best to process these various stream simultaneously and needs to be sequenced when time and room allow. The area used for collection of leaf and yard waste is too small to allow for windrowing and production of a good loam product, and is now used essentially as a storage area for brush, leaves and yard waste.

Recommended modifications to these facilities that should be considered as part of an Island-wide operation are:

- Relocating the drop off area to a separate area that provides more adequate room for these activities and reduces conflicts at the gatehouse area. The drop off should include containers for both recycling and solid waste
- Install a second weigh scale to promote improved traffic flow. In conjunction with this, adjust the method for assessing fees that places less reliance on the weigh scale
- As part of a long-term management program, construct separate building areas for C&D and recyclables processing
- Additional room for the leaf and yard waste composting that would allow for production of a good loam product
- Expansion of the container storage area

Developing a long-term vision and decisions on the specific facilities desired for an Island-wide District operation will likely take several years to define, permit and construct. An initial concept for how the District could operate during its first phase as an Island-wide operation was developed that relies on existing facilities and equipment at the District's facility in Edgartown, the Oak Bluffs transfer station and in Tisbury. It consists of allocating the operations in the following manner:

District Facility	*Oak Bluffs Transfer Station*	*Tisbury*
Edgartown Local Drop-Off Solid Waste Processing Recyclables Processing Recyclables Container Storage HHW Collection	C&D Processing Recyclables Container Storage Solid Waste Trailer Storage	L&Y Waste Composting

This approach is intended to allow for an efficient operation while at the same time taking advantage of facilities that are available to minimize the District's startup costs during these first years of operation on an Island-wide basis. This concept has been developed with the District staff, but has yet to be discussed with the governing bodies for the District, Oak Bluffs and Tisbury. Operations can be shifted as appropriate and as decided by the all-Island District, and these decisions will provide needed direction on assessing the Districts resource and equipment requirements during this initial phase.

1 INTRODUCTION

1.1 Background and Purpose

Municipal solid waste management on Martha's Vineyard is currently being performed by two entities: the Martha's Vineyard District (MVRD) serving the towns of Aquinnah, Chilmark, Edgartown and West Tisbury; and the Oak Bluffs and Tisbury Department of Public Works that jointly manage their solid waste together. The MVRD communities are served by local drop off facilities for solid waste and recyclables at each of ttheir Towns, and by a regional facility located off of the Edgartown-West Tisbury Road in Edgartown. This regional facility is also the location of Edgartown's local drop off. Similarly, Oak Bluffs and Tisbury have local drop offs in each of their Towns and these are served by a transfer station facility located off of Pennsylvania Avenue in Oak Bluffs.

Over the last fifteen years the costs of solid waste management have progressively escalated in response to higher tipping fees at disposal facilities and increasing requirements to remove material from the waste stream to achieve higher recycling rates. MVRD, Tisbury and Oak Bluffs have had common experiences in this regard, and are especially concerned about potential tip fee increases at the SEMASS facility in Rochester, MA that will come into effect in 2015. The perceived benefits of a solid waste management system that serves all of the Island communities are that it would allow for greater efficiencies of scale in the processing and disposal of solid waste and recyclables, and better position the Island communities for the future introduction of sustainable practices such as improved recycling, processing and reuse of building materials, organics composting, or other beneficial methods of managing solid waste and recyclables. For these reasons, all of the Vineyard communities together with the Martha's Vineyard Commission have been considering a possible merger of these two solid waste management groups into a single, Island-wide District. This merger would effectively consist of Oak Bluffs and Tisbury joining the Martha's Vineyard Refuse District under a revised Agreement that defines the governance, administration and cost sharing for the member communities.

A key consideration with regard to consolidation is the capacity of the District's existing property and facilities in .Edgartown to accommodate all of the Island's solid waste and recyclables, and whether facility improvements and new operational approaches would be needed to meet the increased volumes of solid waste and recyclables that would be received there. This is particularly important during the initial operating years, where existing facilities would be utilized to the greatest extent possible, and capital

costs would be minimized until the longer-term solid waste management needs and the corresponding support facilities and equipment for the Island-wide District can be identified.

1.2 Previous Studies

In the fall of 2007 Environmental Partners Group completed an initial feasibility evaluation of an Island-wide District for MVRD and the Towns of Tisbury and Oak Bluffs. The study, *Preliminary Solid Waste Management Master Planning Initiative for the Island of Martha's Vineyard* dated January 2008, provided an assessment of the existing solid waste management programs and facilities, and characterized specific issues that would need to be addressed if Island-wide consolidation was to be pursued.

The study concluded that consolidation offers solutions at a number of levels for achieving the goal of optimizing recycling, promoting environmentally sound practices and minimizing off-Island shipping and disposal costs. The study also identified challenges that would be posed by consolidation, but that these challenges could be overcome through an Island-wide commitment to a shared set of solid waste management goals and values. The long-term potential use of the District's central facility as a location for providing comprehensive solid waste and recycling management facilities was also evaluated. Environmental Partners prepared conceptual site plans of an expanded District facility that include a solid waste transfer station, construction and demolition debris (C&D) building, residential drop off facilities, household hazardous waste collection, leaf and yard waste composting, and provisions for other miscellaneous waste streams. The study demonstrated that insufficient space is available on the District's Edgartown parcel and within its currently Site Assigned area to accommodate all of these facilities, and recommended pursuing purchase of the 11-acre property adjacent to the District that is under a Purchase and Sale Agreement with Tisbury and Oak Bluffs.

1.3 Purpose and Scope of this Study

The overall purpose of this study is to identify an initial concept-level approach for how the District would serve as an all-Island entity during its initial operating years. The study evaluates the following issues:

- The regulatory status and current restrictions in the District's Site Assignment and Department of Environmental Protection (DEP) Authorization to Construct and Operating permits, and whether modifications to these permits should be anticipated;
- The tonnage of solid waste and recyclables currently managed by the District and Oak Bluffs facilities, and the overall tonnage that an Island-wide facility would need to handle;

- The current condition of the District facilities, and constraints to an Island-wide operation presented by them;

- Modifications to operational approaches and recommendations for additional facility needs that should be considered as part of the long-term concept for an Island-wide District;

- A proposed operations approach for the Island-wide District to be followed during the initial operating years that utilizes existing facilities, including local drop offs, the Oak Bluffs transfer station and the District facility,

As part of this planning effort, work sessions were held with the District staff and the Tisbury Department of Public Works on September 23, October 22, and December 7, 2010 where all of the above issues were discussed. In addition, meetings were held with the Vineyard Commission on December 7 and with the Department of Environmental Protection on December 9, 2010, at which the findings and initial recommendations of the study were discussed.

1.4 Report Organization

This report is organized into the following Sections:

Section 2 Regulatory status of the District facility, providing a review of the existing Site Assignment and DEP permits, conditions and limitations associated with them, and a summary of recent changes to the regulatory authority over these permits.

Section 3 Solid waste and recycling volumes, summarizing long-term solid waste tonnage trends at the MVRD facility and current solid waste and recycling tonnage received at the MVRD and Oak Bluffs transfer stations.

Section 4 Evaluation of the existing District facilities, highlighting present constraints on current operations and related operational complexities for an Island-wide operation.

Section 5 Proposed operations approach for the initial operating phase of an Island-wide District, and operational approaches to be considered for the longer-term.

2 REGULATORY STATUS

2.1 Site Assignment

The Martha's Vineyard Refuse Disposal District was granted Site Assignment approval in accordance with the provisions of MGL, Chapter 11, Section 150A and the Massachusetts Site Assignment Regulations (310 CMR16.00) by the Edgartown Board of Health on March 21, 1996. A copy of the Site Assignment is provided in Appendix A. As part of this permitting the Department of Environmental Protection and the Board of Health determined that the Edgartown property met the required site suitability criteria. The facility was approved with a disposal capacity of 125 tons of solid waste per day, based on an annual daily average (e.g., tonnage at the facility can exceed 125 tons on any given day so long as the annual average is less than this threshold).

The following conditions accompanied the Site Assignment approval:

1. A fifteen-foot high berm was to be constructed along the southerly and western perimeters of the operating area to mitigate noise from the facility.
2. The berm is to be planted with vegetation that will not attract birds or nesting.
3. A 200-foot buffer from the property boundary is to be provided and there can be no operations in the buffer zone with the exception of the primary access road. This is twice the usual statutory buffer zone of 100-feet.
4. A chain link fence is to be installed on the north and eastern perimeters of the property for litter control.
5. A network of monitoring wells was prescribed for monitoring groundwater quality.
6. The operating hours for the facility (seven days per week between the hours of 8:00 AM and 5:00 PM) were accepted.

The District has met these conditions and we understand it has operated in accordance with them since the facility began operations in 1999.

2.2 DEP Authorization to Construct Permit

The District received an Authorization to Construct permit from the Department of Environmental Protection on November 19, 1997, a copy of which is provided in Appendix A. This permit set a maximum daily tonnage of 125 tons per day that can be accepted by the facility, thereby being more

restrictive than the Site Assignment approval which established this threshold as an annual daily average. The permit states that this annual daily tonnage is expected to be 30 tons per day with a peak summer tonnage of 62 tons per day.

Several conditions were issued with the permit, including the requirement that a one-year study of bird movements and patterns be conducted and that controls be constructed to discourage birds from being attracted to the facility , consisting of grid wires over the transfer station and the trailer storage area.

2.3 New Statutory Provisions Regarding Site Assignment and Transfer Stations

Revisions to the Massachusetts Solid Waste statute (MGL, Chapter 11, Section 150A) were recently made by the State legislature during 2010 that make the following changes:

- Site Assignment permitting is to be performed solely by the local Board of Health. Previously DEP was responsible for issuing a Site Suitability Report that determines whether a proposed site meets the siting criteria established under the Site Assignment Regulations, and that this Site Suitability Report was to be considered as part of the Board of Health's decision making on the application. This revision eliminates DEP's role in preparing the Site Suitability Report and places this responsibility on the Board of Health.

- The regulatory authority for small transfer stations, being transfer stations that handle an average daily tonnage (annual basis) of less than 50 tons per day, will become the responsibility of the local Board of Health, shifting this responsibility from DEP.

These revisions were to become effective as of July 1, 2010, however the Permit Extension Act (Section 173 of Chapter 240 of the Acts of 2010), signed into law by Governor Patrick on August 5, 2010 automatically extends the permits for existing small transfer stations until July 2012. By July 1, 2012 all operating small transfer stations will require a permit from the local Board of Health. Thereafter the Board of Health will have regulatory oversight of these facilities rather than by DEP. Over the next several months DEP will be issuing guidance on how this transfer of regulatory responsibility is to be performed and specific actions local Boards of Health will need to undertake. The Permit Extension Act does not change the Board of Health's role in Site Assignment permitting, and effective July 1, 2010 Site Assignment permitting or existing permits are to be handled by the local Board of Health without the participation of DEP.

The effect these regulatory revisions have on an Island-wide District facility at Edgartown is reviewed in the context of the solid waste volumes that this facility would receive, presented in Section 3.

3 SOLID WASTE AND RECYCLING VOLUMES

The solid waste and recycling tonnage received by MVRD and the Oak Bluffs-Tisbury transfer stations were collected and summarized to determine the quantities that would be managed by an Island-wide facility. Tonnage records from the MVRD facility and the Oak Bluffs transfer station and the DEP Solid Waste Facility Report from each community were used as the basis of this summary.

3.1 District Solid Waste Trends

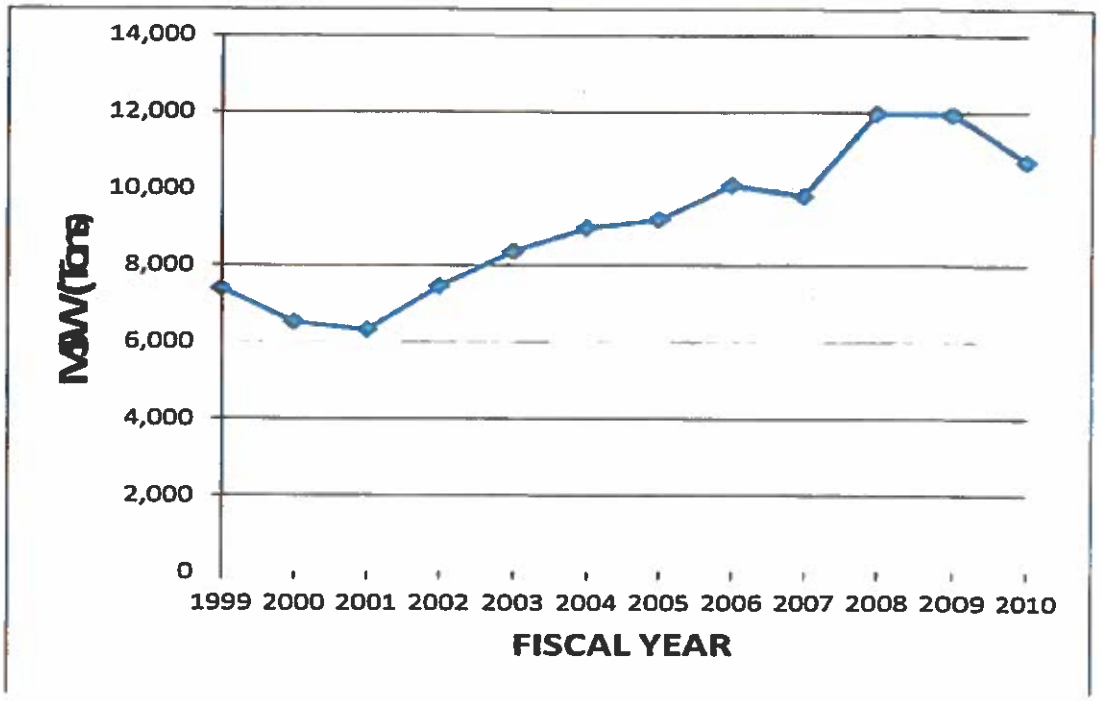
The solid waste tonnage received by the District between 1999 and 2010 are summarized in Table 1 and Figure 1. The solid waste tonnage reported includes both municipal solid waste and construction debris, both being waste streams that are classified by DEP as being solid waste. This tonnage data is reported on a Fiscal Year (July – June) basis.

Since 2001 the annual solid waste tonnage has progressively increased from 6,311 tons to 11,934 tons. In 2010 this tonnage decreased slightly to 10,704 tons, likely in response to the economic recession and the drop in construction activities. Over the last five years the solid waste quantities have generally ranged between 10,000 and 12,000 tons.

Table 1. Solid waste tonnage received by MVRD Transfer Station: 1999 – 2010.

Fiscal Year	Solid Waste (Tons)
1999	7,381
2000	6,514
2001	6,311
2002	7,449
2003	8,360
2004	8,973
2005	9,184
2006	10,088
2007	9,805
2008	11,968
2009	11,934
2010	10,704

Figure 1. Solid waste tonnage received by MVRD Transfer Station: 1999 – 2010.



3.2 2009 Solid Waste and Recycling Tonnage

The solid waste and recycling tonnage that were handled by the District during 2009 are summarized in the DEP Solid Waste Facility Reports, shown in Table 2 and are reported on a calendar year basis (January – December). The report for Edgartown includes tonnage received at the Edgartown local drop off and the District, which receives waste and recyclables from the Chilmark, West Tisbury and Aquinnah local drop offs as well as from commercial sources.

The category of General Recyclables includes the main recycling streams of cardboard, newspaper, glass, plastic and metal containers. The local drops off facilities served by the District do not accept C&D. The Solid Waste Facility Reports did not provide tonnage were for tires or brush.

The District transfer station received 7,093 tons of municipal solid waste, 4,430 tons of C&D and 1,696 tons of General Recyclables during 2009.

Table 2. 2009 Solid Waste and Recycling Tons Received at MVRD Facilities.

Item	Edgartown	Chilmark LDO	West Tisbury LDO	Aquinnah LDO
MSW	7093	173	417	71
C&D	4430			
General Recyclables	1696	106	328	76
Tires	16			
Metals	291	15	13	
Brush	411			

The Oak Bluffs transfer station received 8,289 tons of municipal solid waste during 2009, the majority of which was collected and delivered to the transfer station by the curbside collection trucks serving both communities. The small volumes of solid waste received at the Tisbury and Oak Bluffs Local Drop Offs were delivered to these facilities by residents. The same pattern exists for the general recyclables, the large majority of which are collected curbside and delivered to the Oak Bluffs transfer station.

Table 3. 2009 Solid Waste and Recycling Tonnage Received at Oak Bluffs Transfer Station and at Tisbury and Oak Bluffs Local Drop Offs.

2009			
Item	Oak Bluffs TS	Tisbury LDO	Oak Bluffs LDO
MSW	8289	438	981
C&D	5453		3
General Recyclables	762	138	11
Newspaper	112		8
Cardboard	101		4
Tires		2	
Metals	13	50	
Leaf & Yard Waste		320	
Bulky Waste		9	

3.3 Solid Waste Tonnage for Island-Wide District

The solid waste tonnage that would be handled by an Island-wide District, based on the 2009 tonnage reports, are summarized in Table 4 for the annual total, annual average daily and summer season (June through August) average day. The solid waste tons include both the municipal solid waste and construction debris streams in accordance with DEP's solid waste categories.

Table 4. 2009 solid waste (municipal solid waste and construction debris) tonnage received by the District and Oak Bluffs transfer stations.

Solid Waste Tons (MSW and C&D)	Transfer Station		Combined
	District	OB-Tisbury	
Annual Total	11,934	13,742	25,676
Average Day, Annual Basis	33	38	71
Average Day, Summer Season	58	66	124

An Island-wide District, based on the 2009 data, would receive 71 tons per day of solid waste on an annual average day basis, which would increase to 124 tons per day during the summer season. The peak day tonnage, being the maximum single day tonnage received during the year, would be in excess of this summer average day and would likely exceed 150 tons based on peaking factors experienced by communities on Cape Cod.

The relevance of these tonnage quantities is both to characterize the operating and equipment needs for an Island-wide facility, as well as to determine the status of an Island-wide District with respect to the limits within the existing Site Assignment and DEP Authorization to Construct and Operate permits. As described in Section 2, the Site Assignment allows the facility to accept up to 125 Tons Per Day of solid waste on an annual average day basis, while the Authorization to Construct Permit sets a maximum threshold that the District facility can accept of 125 tons per day. An Island-wide District would therefore be able to operate within the tonnage allowed under the Site Assignment, but would need to request from DEP an increase in the tonnage thresholds under the Authorization to Operate permit.

4 EVALUATION OF EXISTING FACILITIES

4.1 District Facilities

The District operates out of central facilities on a 23-acre site on West Tisbury Road across from the Martha's Vineyard Airport. These facilities, constructed in 2000, include a District office building, a weigh scale and attendant shack, a local drop off area for recyclables, a pre-fabricated metal transfer station building for commercial haulers, a container storage area and an area for leaf and yard waste. A description of each of these components of the facility is provided below. The present limitations on current operations and their associated constraints for serving as an Island-wide facility are also described.

4.1.1 Site Access Road and District Office

The District facility is accessed by a single access road off of the West Tisbury Road for all incoming and outgoing traffic. An orthophoto of the property and access road location is show on Figure 2. After crossing the 200' perimeter buffer zone, the roadway remains outside the buffer zone in the interior of the property. The District office is located at the entrance of the facility in a separate building with a small parking area.

Figure 2. Orthophoto of MVRD facility in Edgartown.

4.1.2 Local Drop Off Area

In addition to its central receiving point status, the facility also serves as Edgartown's local drop off station. The local drop off area is also available for use by any resident that is from a member community of the District. The drop off area was reportedly designed to accommodate a traffic flow of only 50 cars per day. Detailed traffic count data is not available for the facility, but according to the operations staff the facility sees 250 vehicles or more on busy days. This traffic volume results in extensive queuing and vehicle backups that, during peak use periods, can extend the full length of the access road to West Tisbury Road.

The drop off area, shown on Figure 3, consists of a low retaining wall with roll-off containers placed at the base of the wall into which residents place their mainstream recyclables (paper, cardboard, plastic, glass and metal) from above. The area has a canopy roof to provide some measure of protection from weather.

Figure 3. Local Drop off area at District Facility

The primary constraint associated with the local drop off is its location immediately adjacent to the gatehouse, shown on Figure 4, and the limited parking available, resulting in vehicle congestion and excessive queuing even during average operating days. The close proximity of the gatehouse to the drop off area substantially restricts vehicle maneuvering. Room is only available for parallel parking with capacity for up to three or four vehicles. If vehicles double park to use the drop off, it blocks access roadway to the gatehouse and the rest of the transfer station facility, contributing further to the congestion

and queuing. The need for users of the drop off to move about their vehicles presents a public safety concern.

The average use time of the drop off, being the amount of time typically required to perform the recycling drop off activities, is about four minutes/vehicle. During the busier days when 250+ vehicles are using the drop off area a vehicle is arriving an average of every two minutes over the operating day. During peak usage hours this can increase to two or three times this amount, resulting in the extensive queuing that is a major source of frustration for all users of the facility.

Figure 4. Proximity of Local Drop off to Gatehouse at District Facility

4.1.3 Gatehouse and Scale Operations

The gatehouse and weigh scale, located immediately adjacent to the drop off area, is a focus of the District operations where vehicles are weighed, stickers are checked and cash transactions take place.

The scale is used to weigh all solid waste loads incoming from the other District facilities, commercial and some residential solid waste loads, as well as outgoing containers of solid waste, C&D and recyclables. Because there is only one scale and each vehicle needs to be weighed before and after they deposit their loads, vehicles queue on both sides of the gatehouse area as they wait their turn to be weighed. Extensive queuing is frequently experienced from the access road to the gatehouse for incoming vehicles and from the gatehouse around the transfer station for outgoing vehicles. During some

periods, this queue line for the outgoing vehicles creates a conflict at the overhead door entrance into the transfer station, preventing trucks from depositing their loads inside the transfer station.

Because cash transactions and receipt exchanges take place at the gate house, users of the facility typically need to leave their vehicles to make these transactions. This activity contributes further to traffic congestion and queuing.

The weigh scale is 30 years old and the load cells were rebuilt and other repairs were made two years ago. It is still in need of a new deck, and it is uncertain what the remaining life of the scale is. The software that supports the scale system is ten years old and outdated.

Figure 5. Gate house and weigh scale.

Figure 6. Vehicle queuing at gatehouse/weigh scale.

4.1.4 Transfer Station Building and Solid Waste Processing

The transfer station building was constructed in 2000 and is of open-top trailer design, with a concrete tipping floor and transfer pit for 115-yard open top trailers. Packer truck and all of the large commercial loads are deposited directly onto the concrete tipping floor. A front end loader ten transfers refuse into the open top trailers.

The transfer station is used to process solid waste, C&D and some recyclables (newspapers and comingled glass, plastic and metal containers). Loads are crushed on the tip floor by a front end loader and placed into the open top trailers. The continuous wearing of the tip floor eventually exposes rebar, and the rear portion of the tip floor was resurfaced last year. The front portion of the tip floor near the open-top trailer will likely need to be replaced within the next couple of years.

The interior side walls of the station are unprotected building and frame skin, and a concrete push wall is needed to allow the front end loader operations to crush and pile material without damaging the side walls. The staff has therefore added precast concrete blocks along the interior north face of the building. Eight foot cast-in place walls along the north and south interior walls would provide greater operational usage of the tip floor.

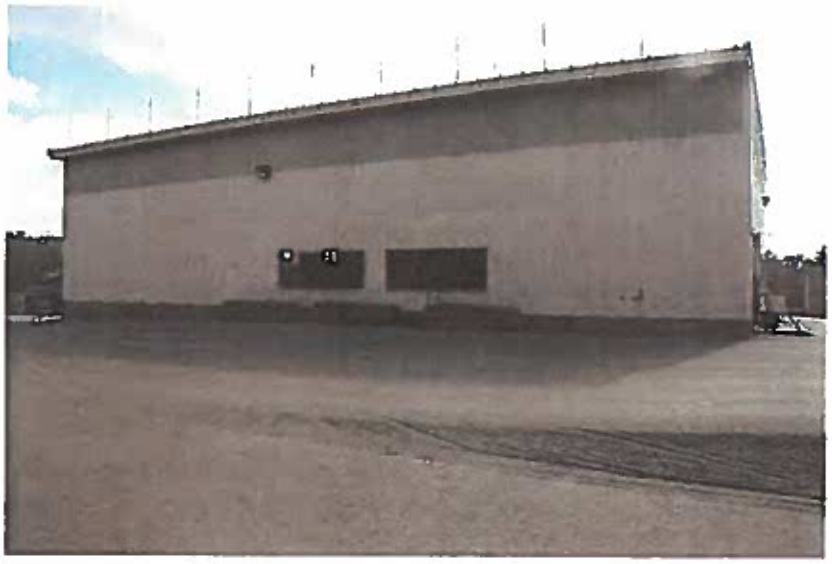
Figure 7. Transfer station tip floor area.

One of the additional constraints of the transfer station is that the vertical opening of the overhead doors are too low to accommodate tilt frame rigs, packer trucks and dump trucks when their dump bodies are extended. Trucks therefore need to be careful to drop their dump bodies before exiting the building or they will hit the door frame.

Figure 8. Overhead Doors at Transfer Station

Residents deposit their loads onto the tip floor through windows on the north side of the building (shown in Figure 9). This location of the drop off window is within the traffic lane for trucks and other vehicles that need to access the transfer station tip floor, causing a vehicle conflict and potential pedestrian safety concern. The residential windows and the roof above it are not equipped with gutters, resulting in wet conditions during rain events and icing during the winter season.

Figure 9. Residential drop off windows at transfer station.



4.1.5 Leaf and Yard Waste Composting

The leaf and yard waste composting area is located in the front, east area of the facility. It has very limited room and is essentially used for storage of the compostable material and brush. Adequate area is not available for proper windrowing and turning of the leaf and yard waste, and therefore good compost product cannot be produced.

Figure 10. Leaf and yard waste composting area

Figure 11. Leaf and yard waste composting area

4.1.6 Container Storage Area

The container storage area is located adjacent to the compost area and behind the local drop off area. It is used for storage of empty and full roll-off containers that are either fully enclosed boxes or tarped open top boxes.

Figure 12. Container storage area.

4.2 Constraints of the District Facility

The existing District facility has substantialconstraints associated with its current buildings and operations that must be addressed if it is to become an Island-wide facility. These are:

- The close proximity of the gatehouse/weigh scale to the residential drop off area is a source of major congestion and vehicle queuing, even on average operating days. During peak summer use periods queuing sometimes extends all the way to West Tisbury Road.
- Inadequate parking capacity and vehicle maneuvering area at the drop off area. Access to this area is limited to only three or four vehicles at a time in parallel parking. The traffic congestion and vehicle movements in this area, coupled with the need for pedestrians to walk among their vehicles to the drop off containers, are a public safety concern.
- The single scale system and the number of vehicles that need to be weighed both into and exiting the facility is a major source of congestion on either side of the gate house and scale area.
- The multiple duties of the gate house staff, including checking stickers, performing the scale operations, cash transactions and exchanging receipts, is overwhelming and contributes further to vehicle congestion.

- The transfer station building is used for receiving all truck loads, as well as for processing of other solid waste and recycling streams, including municipal solid waste, construction debris, newspaper, cardboard and comingled containers. The tip floor area is limited in size and is often overly congested. Heavy use of the tip floor has required recent resurfacing. The tip floor has push walls on only one side of the building.
- The windows on the north side of the transfer station through which residents throw trash constitutes a hazard to the public from truck traffic.
- The area used for collection of brush, leaf and yard waste is very limited and does not provide adequate capacity for appropriate composting activities. The area is essentially used for storage rather than for composting.
- The weigh scale and supporting software is old and will likely need replacement in the near future.

5. PROPOSED OPERATIONS APPROACH FOR ISLAND-WIDE DISTRICT

5.1 Overview Assessment of an Island-Wide Operation at the District Facility

Average annual solid waste tonnage at the Island-wide District facility is projected to double from 33 tpd to 71 tpd day. The average summer season tonnage will increase from 58 tpd to 124 tpd, with peak operating days being higher.

From a regulatory perspecirtve, our interpretation is that increased throughput will not require modification to the Site Assignment permit ,which sets an average annual operating limit of 125 tpd. At 71 tpd, an Island-wide facility would still be well below this threshold. This increased throughput may require a revision to the Authorization to Operate permit, which under the 2010 revisions to the Massachusetts Solid Waste statute would continue to be controlled by DEP .

Multiple challenges exist for the District facilities to serve as an Island-wide facility, as described in Chapter 4. Facility improvements that should be considered if MVRD is to receive the Oak Bluffs and Tisbury waste streams are:

- Relocating the recycling drop off area away from the weigh scale and transfer station. This would allow for one-way traffic flow to and from the drop off points that minimize traffic crossover and turning movements. A separate access roadway that serves this relocated drop off area would serve to improve traffic flow and reduce vehicle congestion. A separate entrance off of West Tisbury Road could be considered, but would require modification of the Site Assignment.
- Installation of a second scale to better allow for the movement and processing of incoming and outgoing vehicles.
- Alternatively, the District could reduce the reliance on the scale to assess charges. This can be accomplished through a variety of methods such as setting fees for various vehicle sizes and waste stream volumes, tickets that are pre-purchased for use of the facility, similar to the pay-as-you-throw concept, or stickers for residential vehicles. This would potentially allow one scale to be used for commercial vehicles, especially if tare weights are logged, eliminating the need to weigh outgoing vehicles
- The transfer station is inadequate for all of the solid waste and recyclable processing demands for an Island-wide operation. A separate building is recommended so that the solid waste processing operations can be performed independently from the C&D and recycling processing. It is recognized

that construction of a second building for this purpose represents a significant capital cost, and this should be considered in the context of long-term planning for the facility.

- The residential solid waste drop off area should be relocated away from the transfer station building and combined with the recyclables drop off area, thereby segregating residential users from large vehicles and truck traffic areas. A small roll-off system that is emptied at the transfer station building could be provided for this purpose.
- Designation of substantial additional space is necessary to accommodate an Island-wide leaf and yard waste composting operation. This would require Site Assignment modification and possible purchase of the abutting parcel to the south in order to maintain appropriate buffers to abutters. This parcel is currently under a Purchase and Sale Agreement with Tisbury and Oak Bluffs.
- Designating additional space for container storage, since the number of containers onsite will likely double.

Conceptual layouts of an expanded District facility, serving as an Island-wide facility, was developed as part of the 2008 planning study and represents a long-term vision for the District facility. It includes dedicated areas for a solid waste transfer station, C&D processing building, a recycling center, household hazardous waste collection and storage, leaf and yard waste composting and future incorporation of alternative technologies. It assumes that the buffer zones are reduced to 100', which would require modification of the Site Assignment, and purchase of the adjoining 11-acre parcel. Copies of these concept site plans are provided in Attachment 3.

5.2 Recommendations for Initial Operations Phase

Development of the long-term vision and decisions on the specific facilities needed for an Island-wide District operation will likely take several years to define, permit and construct. The District therefore needs to identify an operations approach that will provide for the management of the Island-wide waste and recycling streams during the initial operating years while this longer-term program is developed. This initial operating phase will need to rely on the existing facilities and equipment that are available, while maintaining as efficient an operation as possible and minimizing startup costs. Because the District's current facilities are incapable of handling an approximately doubling of the waste tonnage that will result from becoming an Island-wide operation, the only method for achieving these goals is to perform some of the processing and shipping operations at some of the other existing facilities that are available within the District communities together with Oak Bluffs and Tisbury. The Oak Bluffs transfer station has inherent value in its transfer station building and paved surfaces and its site assigned status.

Tisbury has an existing leaf and yard waste composting area, with other areas that could potentially be used for this purpose.

While this concept has been discussed with the District staff as part of this planning effort, it has not been reviewed with Oak Bluffs, Tisbury or any of the other communities. It is recommended that this approach be discussed and agreed to in concept so that decisions can be made on what specific operations are to be performed at each facility. Following this, layout and design alternatives for each area can be developed.

A conceptual operations approach that uses the Oak Bluffs transfer station and Tisbury for leaf and yard waste composting in conjunction with the existing District facility is provided for consideration and as a basis for further discussion. The allocation of the operations between these facilities is summarized in Table 5.

Table 5. Potential allocation of District operations during initial operating years.

District Facility	*Oak Bluffs Transfer Station*	*Tisbury*
Edgartown Local Drop-Off Solid Waste Processing Recyclables Processing Recyclables Container Storage HHW Collection	C&D Processing Recyclables Container Storage Solid Waste Trailer Storage	L&Y Waste Composting

Under this scenario the District facility would continue to serve as the location of the Edgartown drop off, but that function would be relocated to another area of the site to encourage more uniform and safer traffic movement. The existing transfer station would continue to be used for receiving and processing solid waste from all of the Island local drop off centers and commercial traffic. The transfer station would also continue to be used for processing of the mainstream recyclables of newspaper, cardboard, and comingled glass, plastic and metal containers. Finally, the transfer station would also serve as a common location for household hazardous waste collection.

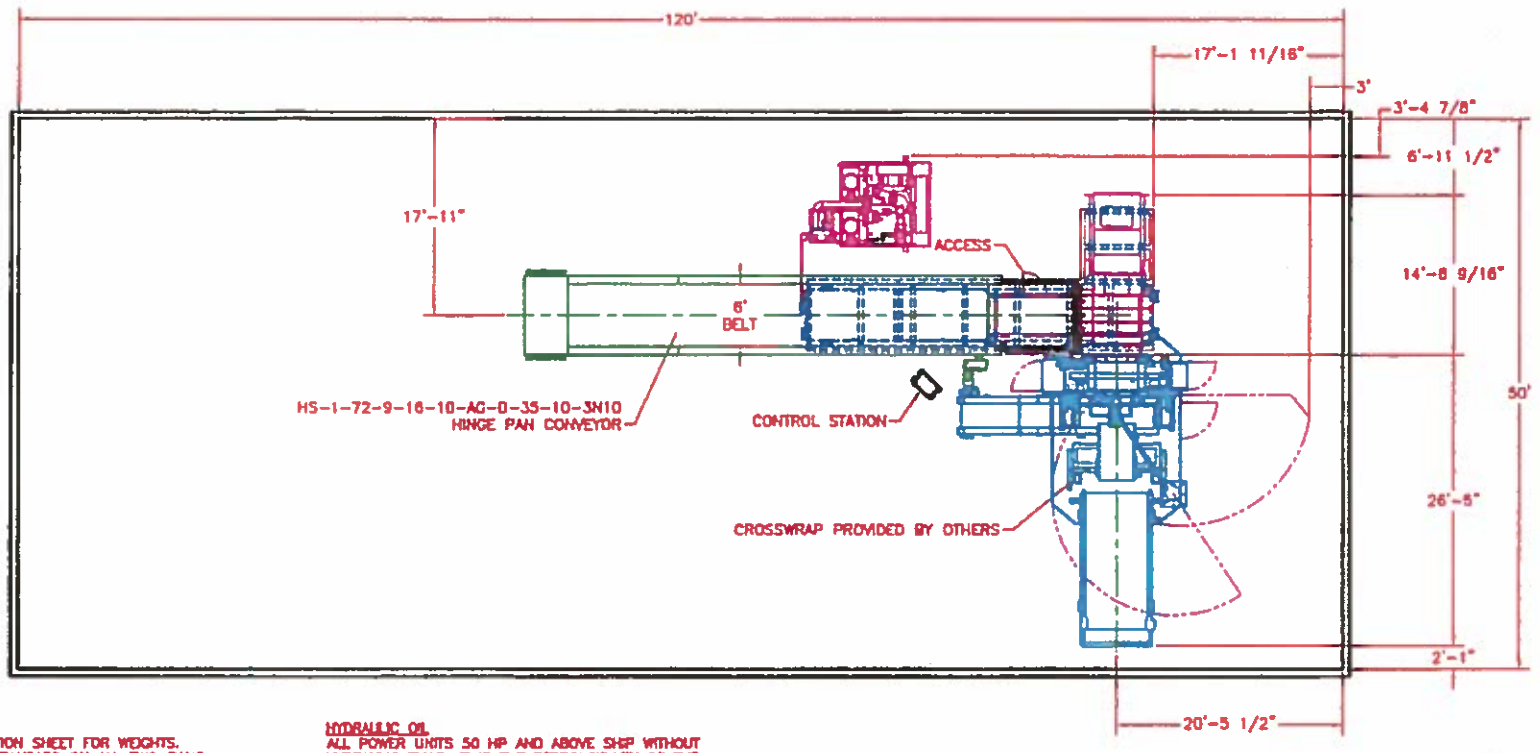
The Oak Bluffs transfer station facility would be used for C&D processing in the same manner that is performed today where incoming loads are placed inside the transfer station in a designated area, crushed on the tip floor by front-end loader and placed into open top wheeled trailers for shipment. In addition, the paved area at the station currently used for container storage would be used for temporary storage of

filled solid waste and recycling containers awaiting shipment. Tisbury currently has a registered leaf and yard waste operation adjacent to the local drop off area on High Point Lane. The available area at this location would need to be evaluated to confirm that sufficient room exists to serve as a District-wide facility. Alternatively, there may be other areas in the vicinity of the closed landfill that could be used for this purpose.

This approach is intended to allow for an efficient operation while at the same time taking advantage of facilities that are available to minimize the District's startup costs during these first years of operation on an Island-wide basis. This concept has been developed with the District staff, but has yet to be discussed with the governing bodies for the District, Oak Bluffs and Tisbury. Operations can be shifted as appropriate and as decided by the all-Island District, and these decisions will provide needed direction on assessing the Districts resource and equipment requirements during this initial phase.

Appendix C

Baler Schematic



NOTES:
>SEE SPECIFICATION SHEET FOR WEIGHTS.
>BALEDOOR IS STANDARD ON ALL TWO-RAMS.
>STAMPER IS OPTIONAL.
>OPERATOR PLATFORM IS OPTIONAL.
>LEFT HAND EJECT IS ALSO AVAILABLE.

*-BALER FOUNDATION REQUIREMENTS: MINIMUM 6" STEEL REINFORCED 3000 PSI CONCRETE SLAB WITH MINIMUM 3/4" STEEL FOUNDATION PLATE PER FOUNDATION DETAIL**.

**-3/4" STEEL FOUNDATION PLATE IS RECOMMENDED TO PREVENT POSSIBLE FLOOR DAMAGE TO THE CONCRETE SLAB. MARATHON EQUIPMENT COMPANY WILL NOT BE RESPONSIBLE FOR ANY FLOOR DAMAGE IF THE RECOMMENDED 3/4" MIN. STEEL FOUNDATION PLATE IS NOT USED. PLATE SHOULD BE ANCHORED TO SUBFLOOR USING ANCHOR BOLTS OR OTHER EQUIVALENT MEANS.

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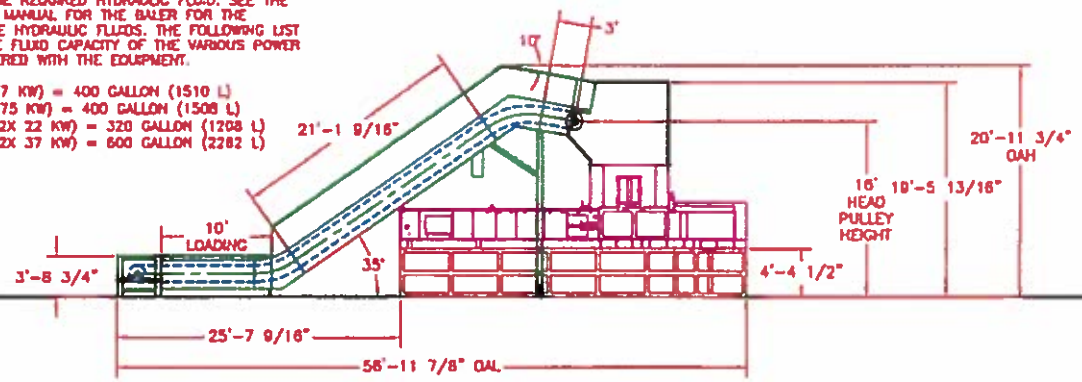
>50 HP (37 KW) = 400 GALLON (1510 L)
>100 HP (75 KW) = 400 GALLON (1508 L)
>T30 HP (2X 22 KW) = 320 GALLON (1208 L)
>T50 HP (2X 37 KW) = 600 GALLON (2282 L)



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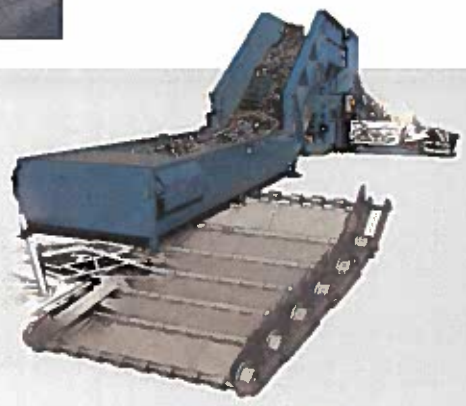

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GPM	73 and 137	137 and 128	137 and 128
Cycle Time (no load averages)	11.9 to 19.1 sec.	16.0 to 16.9 sec.	18.4 to 19.5 sec.
Compression force	150, 800 LBF	190,850 LBF	254,470 LBF
Feed opening (L x W)	40 3/4" x 57" 1035 x 1448 mm	40 3/4" x 70" 1035 x 1778 mm	40 3/4" x 84" 9601 x 5334 x 1118 mm
Baler size (L x W x H)	28'7" x 17'6" x 44" 8712 x 5334 x 1118 mm	31'6" x 17'6" x 44" 9601 x 5334 x 1118 mm	35'4" x 20'1" x 48 1/2" 10770 x 6121 x 14643 mm
Compressing cylinder bore	8" 203 mm	9" 229 mm	9" 229 mm
Compressing cylinder rod	6" 152 mm	6" 152 mm	7" 178 mm
Compressing cylinder stroke	120" 3048 mm	133" 3378 mm	153" 3886 mm
Bale Weight Data			
OCC	up to 1,200 lbs. 544 kg	up to 1,300 lbs. 590 kg	up to 1,450 lbs. 658 kg
SOP	up to 1,200 lbs. 544 kg	up to 1,300 lbs. 590 kg	up to 1,400 lbs. 635 kg
ONP	up to 1,400 lbs. 658 kg	up to 1,500 lbs. 680 kg	up to 1,500 lbs. 680 kg
PET	up to 800 lbs. 363 kg	up to 900 lbs. 408 kg	up to 1,100 lbs. 490 kg
HDPE	up to 900 lbs. 408 kg	up to 1,000 lbs. 454 kg	up to 1,200 lbs. 544 kg
UBC	up to 700 lbs. 318 kg	up to 850 lbs. 386 kg	up to 950 lbs. 431 kg
Steel cans	up to 1,100 lbs. 490 kg	up to 2,000 lbs. 907 kg	up to 2,200 lbs. 998 kg
MSW	up to 1,500 lbs. 680 kg	up to 1,800 lbs. 816 kg	up to 2,000 lbs. 907 kg
AL extrusions*	up to 900 lbs. 408 kg	up to 1,100 lbs. 490 kg	up to 1,200 lbs. 544 kg
AL siding	up to 1,100 lbs. 490 kg	up to 2,000 lbs. 907 kg	up to 1,500 lbs. 680 kg
AL/CU radiators	up to 1,200 lbs. 544 kg	up to 1,400 lbs. 658 kg	up to 1,500 lbs. 680 kg
Misc. AL*	up to 1,400 lbs. 635 kg	up to 1,600 lbs. 726 kg	up to 1,800 lbs. 816 kg
Cycle time calculated based on 1/2 penetration into bale chamber			

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