Analysis of Waste Management Practices in Gustavus, Alaska

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Executive Summary

The Gustavus Disposal and Recycling Center (DRC) was first permitted by the Alaska Department of Environmental Conservation (ADEC) in 1994[1]. The Manager / Operator of the facility since its inception has been Mr. Paul Berry, and he continues in this capacity today. Under the direction of Mr. Berry, and with support from the City of Gustavus, the DRC has become a recognized model for how to conduct an environmentally sound waste management operation in small remote, rural Alaskan communities. Gustavus is certainly in this category given its location, geographical circumstances, and year-round population of about 500 residents.

The DRC is permitted as a Class III Landfill, however landfilling is one of several functions performed at the approximately 12 acre site. Refuse is baled in one of two small down stroke balers prior to being placed in a largely horizontal manner in the landfill cell. Construction and demolition (C & D) waste and inert debris is also landfilled but not baled. There is a main processing and storage building 28 feet wide by 50 feet long. This is where a full range of source separated recyclable materials from residential and commercial / institutional generators is baled and in some cases stored. This includes ferrous and non-ferrous scrap metals. Inside a Quonset building food waste composting is carried out. A thrift store – the Community Chest – while not located at the DRC is viewed as part of the DRC operation.

The DRC Annual Report for Fiscal Year 2014 documented that 134 tons of material were handled on a yearly basis and of that amount 70 percent was diverted from disposal through recycling, reuse, and composting while the remaining 30 percent was landfilled.

Bell & Associates, Inc. was engaged by the City of Gustavus to perform a Solid Waste Management, Facility Planning, and Landfill Closure Plan Project (the project). The comprehensive set of topics anticipated to be covered by the project are portrayed in a scoping document included with this report as Appendix A. However, after considerable discussion between Bell & Associates and the DRC Manager / Operator it was agreed that the initial priority focus of the project should be to determine how to dispose of refuse in the future. The reason for this is that the resolution of the disposal issue will impact the other facets of Gustavus' solid waste management program that are supposed to be addressed by the project such as: updating and revising the Landfill Closure Plan; feasibility of incorporating the Community Chest into the DRC; modified or alternative method for food waste composting; review of DRC operations to evaluate best use of space and revised material handling procedures.

[1] This was before the incorporation of the City of Gustavus in 2004. Before incorporation the DRC, named the Gustavus Landfill, was operated as a working committee of the Gustavus Community Association.

Preliminary results from the disposal options analysis are presented in this report. The analysis is based on a thorough understanding of the regulatory, operational, and economic context of the DRC which is also detailed in the report. The sections of the report are as follows:

- 1 – Introduction
- 2 – Site Description
- 3 – Regulatory Framework
- 4 – Operations
- 5 – General Infrastructure, Site Development, and Equipment
- 6 – Recycling Operations
- 7 – On-Site Waste Disposal
- 8 – Food Waste Composting
- 9 – Evaluation

Eight questions were identified by Bell & Associates and the DRC Manager / Operator as being important discussion items. They are noted below along with the report section that concerns them:

1. Where could waste from Gustavus be taken? Section 9 – Evaluation
2. How would it be stored prior to shipment? Section 9 – Evaluation
3. How would it be shipped? Section 9 – Evaluation
4. What is the cost of exporting waste? Section 9 – Evaluation
5. Can or should the landfill be expanded, and if so how? Section 7 – On-Site Waste Disposal and Section 9 – Evaluation
6. What Alaska Department of Environmental Conservation requirements would have to be met for a landfill expansion? Section 7 – On-Site Waste Disposal and Section 9 – Evaluation
7. What would be the cost of landfill expansion? Section 7 – On-Site Waste Disposal and Section 9 – Evaluation
8. Under either the export or landfill expansion scenario, what operational changes at the DRC would have to be implemented? Section 7 – On-Site Waste Disposal and Section 9 – Evaluation

The main conclusions of this report are as follows:

- There is no immediate, urgent disposal capacity crisis at the DRC. An on-site engineering assessment determined that space at the landfill can be conserved by altering the refuse burial method so that trash is sloped or mounded. Given the existing diversion level due to recycling, reuse, and composting, and modest population growth, there is enough disposal capacity to last 10 years.

- There are other two disposal options. One is exporting waste to the landfill in Juneau operated by Capitol Disposal / Waste Management or to Roosevelt Regional Landfill in Klickitat County, Washington operated by Republic Services. The transport logistics for either site entail multiple modes and parties plus necessitating storage of baled trash at the DRC for considerable periods of time. The other option is modular incineration for volume reduction (not energy generation) using a technology similar to the one utilized at Glacier Bay National Park. While this is a proven technology it is one that Gustavus personnel are not experienced in operating[2].
- The present approach to recycling emphasizes separation of materials into discrete commodities to maximize their sale value. Yet this approach means a great deal of storage space and labor is devoted to small quantities of individual items that cannot be moved until a sufficient amount has accumulated to justify shipment. There are costs associated with receiving, handling, baling, storing, and transporting recyclables in this manner and it is unclear what the benefits are and whether they are worth those costs. An alternative strategy is to commingle materials. An evaluation could be made to present the advantages, disadvantages, operational and financial impacts of commingling.
- All the space in the Recycling Building is fully utilized. The building and storage areas are undersized for the amount of materials processing / storage involved, and there is minimal separation between the public and daily operations.

[2] Incineration was also considered by the Community Association during planning in 1993-94 but was rejected in favor of mechanical baling.

1 Introduction

The City of Gustavus, Alaska (Gustavus) contracted with Bell & Associates, Inc. (Bell) to undertake a planning project for the Gustavus Disposal and Recycling Center (DRC). The project was commissioned primarily based on a concern that the DRC is running out of landfill disposal capacity without the creation of an artificial mound and therefore it was necessary to plan for future management of DRC operations.

This report has been prepared based in part on the following:

- Multiple verbal and written communications with Mr. Paul Berry, DRC Manager / Operator;
- Documents provided by Mr. Berry, including:
  - Set of six proposed landfill drawings, including topography and water level contours (John Scott, October and November 1993);
  - Solid Waste Disposal Permit #SW3A017-15, Gustavus Disposal and Recycling Center (July 29, 2010);
  - Closure Plan (DRC, July 2010);
  - General Operating Plan (DRC, July 2010);
  - Food Waste Composting Operating Plan (DRC, July 2010);
  - Groundwater Monitoring Plan (DRC, 2010);
  - Draft Groundwater Monitoring Report (DRC, 2010);
  - Fiscal Year 2013 and Fiscal Year 2014 DRC Annual Reports of Waste Processing, Income and Expenses;
  - Five Year Comparison of Waste Processing, Income and Expense Data / Information – Fiscal Years 2009 to 2013;
  - Quarterly Staff Report (DRC, August 2014);
  - Quarterly Staff Report (DRC, November 2014).
- Visit by Mr. Roger North, Project Engineer to DRC on April 22 and 23, 2015;
- On-site discussions with Mr. Mike Taylor, the current Mayor of Gustavus;
- Meeting with Ms. Sandra Woods of the Alaska Department of Environmental Conservation (ADEC) at DRC on April 23, 2015;
- Conversations and other communications with representatives of Republic Waste and Waste Management to discuss options and pricing estimates for transport and disposal of municipal solid waste at other facilities; and,
- Republic Services managers spoke with AML on shipping waste from Gustavus to Seattle and the potential use of a skid craft to move the intermodal containers, and,

- Conversations and other communications with representatives of ACS Inc. (Advanced Combustion Systems) regarding options and pricing estimates for installation / operation of a modular incineration unit at Gustavus.

2 Site Description

The Gustavus Disposal and Recycling Center or DRC is located in Gustavus, Alaska. DRC is located at approximately longitude W135.729 degrees and latitude N58.404 degrees, and is designated as Lot 6 in Section 18, Township 40 South, Range 59 East, Copper River Meridian. DRC is approximately 100 yards directly east of the Gustavus small boat harbor at 2 Boat Harbor Road. The DRC property is owned by the City of Gustavus; previously the land was owned by the State of Alaska.

The DRC has an area of about 12 acres and is trapezoidal in shape. The property is bordered as follows:

- On the north by Boat Harbor Road [3] which is a City of Gustavus road that serves as public access to the small boat harbor and launch ramps into the south flowing Salmon River;
- On the east by Dock Road, which leads to the public dock and low-density private residences;
- On the south by undeveloped land and a dirt road that leads from Dock Road to the Salmon River; and
- On the west by the public access easement, boat launches, uninhabited beach lands and the Salmon River.

The DRC property is relatively flat with typical ground surface elevations varying from 23 to 25 feet above mean sea level (amsl), and general sloping from the north to south and west. A ditch, which is estimated to be about 4 feet deep, is located in the south part of the property. This ditch provides stormwater discharge from the east side of Dock Road to the Salmon River.

The DRC site lies on the isostatically uplifted, former intertidal margin of a nearly flat glacial outwash fan[4]. The fan's surface was constructed during the last maximum of the Little Ice Age, about 250 years ago, by streams issuing from ice in Glacier Bay. Sediments consist of about an eight-foot thick stratum of well-sorted permeable river sand overlying less permeable sandy marine silt. Due to excellent surface percolation through the upper sand stratum and the deeply entrenched Salmon

[3] Boat Harbor Road, which has a 60 foot right of way easement, is located within DRC property limits. In addition, a 60-foot wide public easement, which connects to Boat Harbor Road, is located within the west property limit.

[4] The geologic information presented is largely taken from the 2010 Groundwater Monitoring Report Original source Greg Streveler.

River immediately to the west, standing storm water is rarely present at the site. The lower permeability marine silt, at a depth of about eight feet, impedes downward percolation, and consequently ground water is located above the silt at shallow depth in the upper sands.

Six groundwater monitoring wells (named MW-1 to MW-6) have been constructed at DRC Two of these wells, MW1 & MW5, were installed by Alaska Village Safe Water in their 1991 Gustavus Solid Waste Engineering Study. The other four wells were installed by local personnel in 1993. Of these, four monitoring wells (MW-1 and MW-6 – down-gradient wells, and MW- 3 and MW-4 – up-gradient wells) are used as part of DRC's environmental monitoring program[5]. Groundwater flows are to the south and west, toward the Salmon River. The water table can come to within 4 to 5 feet of the ground surface during heavy rains; however, the normal ground water surface is nearer the base of the sand layer. Groundwater at the site is designated by the Alaska Department of Environmental Conservation as part of an aquifer of resource value. The site is not underlain by permafrost.

3 Regulatory Framework

The DRC is regulated by ADEC in accordance with Alaska Statute (AS) 46.03, Title 18, Chapter 15 of the Alaska Administrative Code (18 AAC 15), and the Solid Waste Regulations (18 AAC 60). The DRC is designated a Class III municipal solid waste landfill (MSWLF)[6]. DRC was first permitted in

[5] These monitoring wells were typically constructed by pushing slotted pipes directly into the ground; they were not constructed inside a boring with screens and filter media in accordance with modern well standards. Consequently this may affect the quality of the groundwater samples (particularly unfiltered samples) collected for laboratory analysis, and the value of the data for detecting releases from the facility. For instance, a brief review of data suggests that some apparent background constituent concentrations are higher than down-gradient concentrations. In addition, site records do not indicate the tops of the wells have been surveyed to provide reference elevations for computing ground water elevations from the measured depths to groundwater. However, since the site is relatively level, general groundwater flow directions can be reasonably inferred from the measured depths to groundwater.

[6] According to 18 AAC 60.300 (Purpose, Scope, and Applicability; Classes of MSWLF) a Class III MSWLF is a landfill that is not connected by road to a Class I MSWLF or, if connected by road, is located more than 50 miles from a Class I MSWLF, and that accepts for disposal (A) ash from incinerated municipal waste in quantities less than one ton daily on an annual average, which ash must be free of food scraps that might attract animals; or (B) less than five tons daily of municipal solid waste, based on an annual average, and is not located in a place (i) where public access is restricted, including restrictions on the right to move to the place and reside there; or (ii) that is provided by an employer and that is populated totally by persons who are required to reside there as a condition of employment and who do not consider the place to be their permanent residence.

1994[7]. Currently DRC operates under Solid Waste Disposal Permit (SWDP) Number SW3A017-15, which was issued by ADEC on September 1, 2010 and expires on September 1, 2015.

The SWDP authorizes the operation of a baler, compost facility, and the disposal of an annual average of less than 5 tons per day of domestic and commercial refuse. In addition, the SWDP includes the following provision:

> *Pollution Prevention - In order to prevent and minimize present and future pollution, when making management decisions that affect waste generation, the Permittee shall consider the following order of priority options: source reduction; recycling of waste; waste treatment; and waste disposal.*
>
> *The permittee shall not expand the part of the disposal facility that is circumscribed by the chain link fence as it appeared in August 1994 any farther to the east or south. If expansion is needed, the facility shall expand to the west. If bales are placed at the facility, a back-wall berm shall be provided along all southern and eastern aspects of the facility where bales are placed.* [8]

As part of the regulatory framework ADEC has approved the following DRC-prepared plans:

- General Operating Plan (GOP) – dated July 1, 2010;
- Food Waste Composting Operating Plan (FWCOP) – dated July 1, 2010;
- Closure Plan (CP) – dated July 1, 2010.
- Groundwater Sampling Plan dated July 22, 2010.

[7] However, waste operations at the site occurred prior to this date and may date back to World War II (conversation with Mr. Taylor and Mr. Berry on April 21, 2015).

[8] Ms. Sandra Woods (ADEC) during the site visit on April 22, 2015 confirmed that the entire 12-acre property is permitted for disposal (subject to easements, buffers, and other conditions) and the term “expansion” refers to additional disposal cells within the existing permitted boundary. ADEC will simply require the submittal of engineering documents (e.g. drawings, design report) to approve new cells. In addition, the limitation on locating additional disposal areas to the east or south of the location of the chain link fence may have been attributable to objections raised by a neighbor across Dock Road who has since died.

4 Operations

- Consistent with the SWDP, the primary operational goals of the DRC are to:
- Maximize the reuse and recycling potential of the waste;
- Recover as much value as possible from the waste received; and
- Minimize the amount of material that must be landfilled.

Table 1 summarizes waste materials that are accepted and not accepted at the DRC.

Table 1 – Waste Materials

ACCEPTABLE WASTES	UNACCEPTABLE WASTES
▪ Municipal solid waste (MSW). ▪ Fish processing waste from local charter operations / lodges. ▪ Yard or green waste. ▪ Construction / demolition (C & D) debris. ▪ Incinerator ash from Glacier Bay National Park. ▪ Burn barrel ash from local residents. ▪ Food waste. ▪ Vegetable oil for food waste composting. ▪ Used oil for reuse in local oil heaters. ▪ Refrigerators, freezers, and items containing CFC's.	▪ Liquid wastes. ▪ Asbestos. ▪ Radioactive material. ▪ Untreated medical wastes. ▪ Polychlorinated biphenyl fluids (PCBs). ▪ Hazardous wastes as defined in 40 CFR 26. ▪ Acids, corrosives, flammables, toxics. ▪ Car tires that will not fit in the baler. ▪ Automobiles or any scrap metal item that is too big for the baler or otherwise cannot be palletized for shipment to a recycling facility.

Of the acceptable wastes, the DRC reuses or recycles the following:

- Ferrous and non-ferrous scrap metals including appliances;
- Tin cans, aluminum cans, aerosol cans;
- Glass bottles and jars;
- Ceramics (tiles, plates, cups);
- Food waste and green waste;
- Type 1 (PETE), Type 2 (HDPE) plastics and mixed plastics types 1 - 7;
- Cardboard;
- White paper, mixed paper and newsprint;

- Batteries: dry-cell alkaline, all rechargeable batteries, including lead-acid batteries;
- Computer monitors and TVs;
- Non-commercial used oil;
- Vegetable oil / deep fryer oil;
- Fluorescent tube lamps and compact fluorescent bulbs; and
- Compostable grease trap waste.
- The primary infrastructure development at the DRC site includes:
- A drop-off recycling building, indoor and outdoor storage areas / containers for recyclables, and equipment for processing materials;
- An active landfill disposal area of approximately 0.81 acres; and
- A food waste composting operation.

5 Infrastructure, Site Development and Equipment

General infrastructure at the DRC includes:

- Recycling Building – 50 feet long by 28 feet wide metal-sided building with a 14-foot long and 24-foot wide addition, set over a 4-inch thick concrete slab. The building is used for most waste processing activities. The building is unheated and uninsulated.
- Compost Building – A Quonset structure with wooden side walls and a fabric roof and dirt floor used to process compost piles. Perforated high-density polyethylene (HDPE) aeration pipes are set in the floor for passive ventilation. According to the DRC Manager / Operator, the size of this building was limited by concerns about visibility from Dock Road.
- A small, 420 sq. ft., heated office area and attached employee changing area was constructed in 2014. This is located close to the west side of the Compost Building.
- Fuel and Universal Waste Storage Van – Movable, 20-foot long and 8-foot wide retired shipping van used for the storage of diesel fuel (15 gallons or less), gasoline (5 gallons or less) and universal wastes.

Additional site development includes:

- The permitted municipal solid waste landfill disposal area. This disposal area, which was permitted in 1994 and has been used exclusively since, covers approximately 0.81 acres (about 215 feet north-south and 165 feet east-west) and is defined by the alignment of a chain link fence as it appeared in August 1994. To provide visual buffering, earth berms, approximately 4-feet high, have been constructed along the north, east and south sides of the area, and a

wooden fence has been constructed on top of the east and south berms to provide additional visual screening from Dock Road.

- Compost processing area outside the Compost Building.
- Electrified 8-foot high chain link fence around the perimeter of the compost Quonset building, compost area, and the landfill disposal area (including berms and wooden fence screen), to deter animals (bears). Two sets of gates provide access to the landfill disposal and compost areas.

Equipment at DRC includes the following:

- 1995 Bobcat 763 skid steer loader, which is used as part of most DRC operations, including placement of baled and non-baled waste into the disposal area.
- GPI Model M30HD baler, manufactured in approximately 1994, and located inside the Recycling Building. This is the principal machine used for baling disposed waste and also used for baling some recyclables. The machine produces bales that measure 30 inches by 24 inches by 30 inches and weigh approximately 250 to 350 pounds (i.e. baled density of 28 to 36 pounds per cubic foot [pcf]). The bales are secured using wire and plastic ties.
- CRAM-A-LOT model DHR-42-LU down-stroke baler, manufactured in approximately 1999, and located inside the Recycling Building. This baler is owned by the National Park Service, Bartlett Cove and is used as part of the waste handling contract with the Park Service. It is used to bale recyclable materials and produces bales that measure 42 inches by 30 inches by 48 inches and weigh approximately 400 to 1,400 pounds. The bales are secured with wire ties.
- Glass Aggregate Systems (GAME) model H-100VT glass pulverizer, manufactured in 2002, which can process up to 1,000 pounds of glass bottles and jars per hour. This is located inside the Recycling Building.
- Bell Recycling Equipment “bottle buster”. This is a conveyor fed machine used for ceramics and as backup for the GAME glass pulverizer. It is located inside the Recycling Building.
- JMC Recycling Systems model 320 alligator shear cutter for metal recycling. This is located inside the Recycling Building.
- Two Avery Weigh-Tronix model DSL 484805 platform scales, located inside the Recycling Building. These scales are routinely certified by the State of Alaska and are used for all weighing activity associated with the DRC.
- Screen USA model Trom 406 wheeled trammel compost screener. Manufactured in approximately 2004. This is located in the compost processing area.
- Gardner Equipment Company model truck pneumatic oil filter crusher.

- Burn box located near the entrance to DRC. This is permitted to be used semi-annually but is used once a year to burn clean, dry wood and paper. The ashes are placed in the landfill disposal area.

In addition, the DRC participates in the operation of a local thrift store (Community Chest) to market directly donated household items and appropriate materials recovered from recycling operations at DRC, principally construction materials. The Community Chest is located near Gustavus airport, across the street from the Post Office.

6 Recycling Operations

Most waste accepted at DRC passes through the Recycling Building as part of the waste weighing, screening, sorting and handling processes. Additionally, DRC has established additional areas (temporary structures and open areas) outside the Recycling Building for the processing of some waste streams (e.g. refrigerant removal from fridges, cutting of large scrap aluminum objects such as skiffs and camper shells) and storage of materials diverted for recycling. All the space in the Recycling Building is fully utilized. From a practical logistical and operational perspective, the building and storage areas are undersized for the amount of materials processing / storage involved, and there is minimal separation between the public and daily operations.

DRC has achieved a diversion rate of approximately 70 percent. However, there is a lag between waste receipt and shipping diverted materials from DRC due to the need to maximize loads and obtain favorable market prices. Some of the diverted materials such as copper and brass are separated into specific waste streams to increase the economic benefit to DRC. All materials have to be transported by ferry to Juneau for further shipment to the Seattle area (a small amount of reusable material is taken to the Community Chest to be sold). Therefore, in most instances sufficient quantities of processed materials have to be accumulated for economic transport. However, some diverted materials are used as support for other materials (e.g. an aluminum skiff is used to support other materials, rather transported as whole units) and thus have also accumulated at the DRC rather than being removed for sale. Consequently, a lot of accumulated materials are stored at the facility, and the fenced landfill area is used extensively for this purpose.

7 On-Site Waste Disposal

7.1 History and Regulatory Background

As noted above, waste operations at DRC predate the time since it was first permitted by ADEC in 1994. Prior to May 1995 the burning of waste was the primary method of achieving volume reduction. Prior to the first permit there are no records of where burning or associated waste disposal was performed. However, Mr. Berry and Mr. Taylor noted the following:

- These activities likely included waste incineration and below-grade disposal of ash and residuals, and direct disposal below-grade of intact wastes.
- No systematic exploration has been performed to determine the locations and limits of such areas.
- The main recycling building is likely constructed over waste.
- Excavation for a water line on the west side of the main recycling building encountered waste, including batteries.
- Historical burning, and ash burial, is suspected near the facility entrance.
- Waste may be present under and to the north of Boat Harbor Road.
- None of these potential disposal areas have a direct impact on current disposal operations. However, the areas may impact the siting of additional disposal areas and operations facilities and may represent a future liability.
- Since the first SWDP was issued in 1994 all disposal has taken place within the permitted 0.81-acre landfill cell. The landfill has been prepared incrementally by excavating small areas (approximately 40 feet by 20 feet) to a depth of about 3 to 4 feet below existing grade, in the native sandy soils, before placing waste. No additional site preparation is performed prior to beginning waste placement.
- It is understood this approach is consistent with, and grandfathered by, the regulations in effect in 1994, which required a minimum 2 feet of separation between an unlined landfill and the ground water elevation[9]. Additionally, direct disposal without both a composite liner and leachate collection system is consistent with current 18 AAC 60.330 (Design Standards), which exempts Class III MSWLFs from design standards unless ADEC "*(1) has evidence that*

- [9] The regulations have since been revised and 18 AAC 60.217 (Separation From Groundwater) now requires that a "*new unlined landfill or a lateral expansion of a landfill may not be located closer than 10 feet above the highest measured level of an aquifer of resource value unless the landfill is constructed two feet or more above the natural ground surface.*" However, Ms. Woods (ADEC) indicated the development of a new disposal area(s) would be subject to the same 2-foot standard, not the newer standard, provided the additional disposal area(s) are located within the 12-acre limits of the facility as it was initially permitted in 1994.

leachate from the site is polluting an aquifer of resource value; or (2) finds that a liner and leachate collection system of appropriate design is necessary to protect public health or the environment." ADEC has not made such findings at DRC; therefore, DRC is not subject to the liner and leachate design standards that apply to Class I and Class II MSWLFs.

7.2 Operating Procedures

DRC uses the following typical disposal procedures:

- Inert construction and demolition (C & D) waste, sheet rock, and ash from the operation of the burn box are placed directly in the waste disposal area above grade because all the below grade area has been exhausted.
- Most other wastes are baled (although the permit does not require baling), using the GPI Model M30HD baler, prior to disposal. The bales are placed as tightly as practicable. Other wastes that are not baled, such as diapers and material containing rotten food waste, are placed in the gaps between bales.
- A heavy-duty geosynthetic bird- and weather-proof tarpaulin is used to cover the waste in active areas. In addition, a 6-inch thick layer of soil is used to cover inert waste when a significant quantity has accumulated. When waste placement is stopped in each incremental area, the waste is covered with intermediate cover consisting of a layer of plastic and an 18-inch thick layer of soil.
- The intermediate cover used at DRC is consistent with 18 AAC 60.243 (Intermediate Cover), which states "(a) … *the owner or operator of a landfill shall apply an intermediate cover to any inactive portion of a landfill within seven days after the waste is last deposited in that area, using a soil material at least 12 inches thick, graded to prevent water from ponding. (b) For purposes of this section, "inactive portion" means an area of a landfill that does not receive waste for a period of 90* days or more."
- With the exception of a small area near the gated entrance to the landfill disposal area, which is the current active disposal area, the landfill disposal area has been bordered on the north, east and south sides with an earthen berm, has been filled with waste to a depth of two bales, and has been covered with intermediate cover. The surface of the landfill is approximately 3 to 4 feet above surrounding grades.
- No areas of DRC have been closed. The applicable requirements for the final cover per 18 AAC 60.390 (Closure Standards for a Class III MSWLF) are "*The final cover on a Class III MSWLF must be soil or another material approved by the Department. The final cover must be at least 24 inches thick, or another thickness approved by the Department, must be graded to promote drainage without erosion, and must be revegetated or otherwise treated in a manner appropriate to the anticipated, future long-term use of the facility.*"

7.3 Disposal Capacity Assessment

The Closure Plan assumes a landfill capacity of approximately 10,000 cubic yards (representing a waste profile of about 8 feet, the depth of two bales plus intermediate cover soils), and that this capacity would be exhausted in 2015, with final closure activities to follow. Ms. Woods (ADEC) confirmed that the permit does not impose a site-specific restriction on the maximum height to which the landfill can be constructed. The maximum height would be limited by general AAC (Alaska Administrative Code) design guidelines, engineering considerations, and self-defined limitations DRC might impose for local considerations (such as the visual impression of a mound if not adequately screened, by say planting coniferous trees near the property line along Dock Road).

Reasonable engineering limits, consistent with AAC, would result in a constructed final cover that slopes at between 5 percent (the minimum to allow for settlement resulting over time in a minimum long-term slope of 2 percent) and 33 percent (typical maximum slope). At the center of the landfill these would represent waste disposal heights of approximately 5 and 28 feet above the existing waste. Steeper slopes provide additional capacity and more efficient stormwater runoff (less infiltration), which may be an issue if only relatively permeable sandy soils are available.

A site topographic survey will be required to: (i) develop an engineered cover plan, (ii) compute reliable capacity estimates, and (iii) provide control, based on an engineered cover plan, to guide landfill disposal operations. However, it is estimated that a 10 percent final cover slope would provide approximately 3,600 cubic yards of additional capacity. At current rates of disposal (approximately 250 cubic yards per year) this volume would represent over 10 years of additional capacity.

As discussed previously in this report, it is difficult to specifically determine the operational cost per ton for waste disposal versus waste diversion due to the frequent interchangeable use of labor and equipment for these DRC functions. The DRC Annual Report for Fiscal Year 2014 (July 1, 2013 to June 30, 2014) provides the following statistics:

- DRC accepted 134 tons of waste (excluding 143 cubic yards of C & D debris that was not weighed);
- 40.8 tons of waste (plus the 143 cubic yards of C & D debris) were landfilled and 93.6 tons of materials were recovered for recycling, representing a diversion rate of 70 percent.
- DRC was open for 142 days; therefore, on average approximately 575 pounds of waste were generated for disposal on each of the 142 days, representing less than two bales per day.
- According to the FY 2014 Annual Report Financial it cost an average of $0.35 per pound or $700 per ton to process material for the disposal / recycling / diversion operations at DRC.

In many regards disposal is somewhat ancillary to the other waste processing / diversion activities functions performed at the DRC facility. Only those materials that cannot be recycled or repurposed are set aside for disposal.

8 Food Waste Composting

DRC has operated an aerobic food waste composting program since 1996. The composting area consists of the Quonset compost building and outside processing yard located adjacent to the landfill within the limits of the electrified perimeter chain link fence.

Food waste is mixed outdoors with wood chips and amendments (such as grass clippings and horse manure when available). After mixing, the material is moved inside the Quonset building for composting. There is room for two static piles measuring approximately 10 to 15-feet wide, 20 to 30-feet long, and 3 to 5-feet high inside the building. Static piles are initially capped with about 2 inches of wood chips to control odors and flies. The static piles are then covered with Compostex® covers, which allow carbon dioxide to escape and oxygen to enter and retain moisture in the pile. Depending on the season, each static pile can hold from three months to three weeks of material (approximately 10-12 yards). Typically while one static pile is being built the other older pile is ready for secondary processing. Passive venting of the piles is the normal method of operation; however aeration pipes and a blower are available to aerate the piles if needed.

If more food waste is delivered than can be composted within the Quonset building, outdoor static piles built upon a 2 to 4-inch thick base of wood chips are used. These outdoor static piles are approximately 20-feet long, 8-feet wide, and 4 to 4.5-feet tall. Finally a bird barrier made up of chain link fencing and plastic bread trays is placed around the base and atop the static pile to keep ravens, crows and other birds from scavenging. Because of bird prevention measures the outdoor static piles are labor-intensive and are avoided whenever possible. Additionally, during wet weather the outdoor area becomes muddy and consequently operations are difficult to conduct.

DRC processes approximately 30 tons of food waste annually, producing about 14 cubic yards of marketable compost. The DRC Manager / Operator has estimated several years ago an overall processing cost of about $0.16 per pound.

9 Evaluation

The prior sections of this report provide background information about the DRC site, including the setting, regulatory framework and current operations. This facility planning project was initiated with the permit renewal date approaching and with concern that the landfill disposal area may be reaching capacity. However, as presented above, technical engineering analysis has demonstrated that significant additional disposal capacity is available within the existing landfill disposal area for at least 10 years. It is emphasized that the additional disposal capacity is based on modifying the existing landfill operation to the slope standards and ranges put forth in Section 7 of between 5 percent and 33 percent. It is also assumed that recycling / diversion activities will remain at their current level. This disposal capacity analysis and estimate has been confirmed during on-site discussions with the appropriate ADEC representative.

The evaluations presented below present options for future management of waste streams. They are not presented with specific recommendations, but with the intent to enable Gustavus to consider alternatives and decide upon approaches that best suit its future needs. [10] In addition, regardless of the decisions made, development of the facility has reached the stage when a professional survey should be performed to determine such factors as site topography, facility locations, and right of ways to establish upgraded site management, monitoring, and control protocols, and to enable engineered closure drawings to be prepared and above-grade waste placement to be undertaken.

9.1 Disposal Option 1: Cease Waste Disposal in the Short – Term

There may be issues that make continued waste disposal at the DRC undesirable, even though additional disposal capacity is available. These issues include:

- Operational and management resources associated with disposal, running the landfill and complying with regulatory requirements, which could be more effectively deployed on other activities;
- Unknown future liability of buried and capped waste in an unlined landfill close to groundwater;
- Visual and other constituent concerns;
- Future engineering requirements.

- The short-term context in this option does not mean an immediate cessation of disposal but means that Gustavus decides to cease landfill disposal while disposal capacity still exists and

[10] Mike Taylor estimates that Gustavus has grown steadily from a population of about 100 in 1977 to 500 in 2015, which represents a compounded annual growth rate of about 9 percent.

probably within the timeline of DRC's next 5-year permit cycle. Even if this decision is taken, the timeframe involved would allow for further review and decision changes. This option would result in DRC having to use borrow soil, instead of waste, to complete the profile needed for the final cover.

9.2 Disposal Option 2: Phase out Waste Disposal in the Medium – Term

This medium-term context in this option means a timeline of more than one permit cycle. The intent would be to use the capacity available within the existing landfill disposal area and use waste to create the profile needed for the final cover (i.e. grades up to 33 percent). At noted earlier it is estimated at least 10 years of existing capacity remains under such a scenario. Similar to Disposal Option 1, if Disposal Option 2 is pursued the timeframe involved would allow for further review and decision changes.

9.3 Disposal Option 3: Continue Waste Disposal in the Long – Term

The long-term context of this option means that on-site waste disposal would continue into the foreseeable future. The capacity available within the existing landfill disposal area would be used and additional disposal areas developed. In this case, consideration would need to be given to the location of additional disposal areas to assure that conflicts do not arise with any additional permanent infrastructure development at the landfill. However, it is generally most efficient to develop new areas immediately adjacent to existing ones to "piggy back" waste and maximize the disposal capacity from a new area.

Again, similar to Disposal Options 1 and 2, if Disposal Option 3 is pursued the timeframe involved would allow for further review and decision changes.

9.4 Disposal Option 4: Ship Waste to a Distant Landfill in Washington

The shipment of waste out of the Southeast Alaska region by barge, truck, and train to an environmentally secure landfill in Washington (Roosevelt Regional Landfill, Klickitat County) has been an established practice since 1995 (see article in Appendix A). This is due to a pioneering partnership between Alaska Marines Lines (AML) and Republic Services, which operates the landfill along with a materials recovery facility (MRF) for processing / marketing separated and commingled recyclables in Seattle. This is a proven system used by Ketchikan, Sitka, and the eight communities that comprise the Southeast Alaska Solid Waste Authority (SEASWA).

A major impediment to participation by Gustavus in this system is the lack of regular AML barge service. Further, this option would require Gustavus to store refuse at the DRC until a sufficient amount had been accumulated for shipping out. Despite these obstacles, initial research by Bell & Associates indicates the following logistical, operational, and cost elements for consideration

by Gustavus based on a variety of communications with representatives of AML and Republic Services:

- Assume between 50 and 75 tons per year of waste (to account for future growth).
- Waste to be transported in 20 foot closed containers.
- Weight not to exceed 20 tons or 40,000 pounds per container.
- AML cost to transport a container to Seattle is approximately between $ 7,000 and $ 8,000. This includes periodic rental of a chassis from AML for storing the transport container at the DRC and return of an empty chassis / container to Gustavus (NOTE: only the chassis is provided by AML, the containers are rented from Republic Services or acquired by Gustavus; see discussion below). In reality there are two shipping segments to the operation: Gustavus to Juneau, which would be performed by a subcontractor to AML using an appropriately sized vessel that could land at Gustavus; and transfer of the container to an AML barge at Juneau for the trip to Seattle. About half of the total cost is for the Gustavus to Juneau segment according to an AML representative.
- In addition, there is a fuel surcharge payable to AML that varies regularly. At the time this Report was prepared, the fuel surcharge on the full transport cost from Gustavus to Seattle was 9 percent. In recent years it has varied between 7 percent and 25 percent.
- Once the container of waste arrives in Seattle, Republic Services is responsible for trucking the container to a train which then transports it to Roosevelt Regional Landfill for ultimate disposal. The cost for this intermodal journey plus actual disposal at the landfill is $1,250 per container or $62.50 per ton assuming 20 tons of trash per container.
- In addition there is a $ 45 per container Washington State Refuse Tax.
- Republic Services can rent a 20 foot container to Gustavus for an annual fee of $ 1,100 per container. Gustavus may also choose to purchase its own containers.
- Table 2 on the following page is a summarization of the costs previously noted to transport waste from Gustavus to the Roosevelt Landfill in Klickitat County, Washington. For the calculation, it is assumed 60 tons of waste, which would require three shipments of 20 tons each, would be transported and disposed.

Table 2 – Disposal Cost to Roosevelt Regional Landfill in Washington

Description	Low	High
Transport Container to Port of Seattle	$7,000	$8,000
Fuel Surcharge @ 9%	$630	$720
Rail Transfer and Landfill Disposal	$1,250	$1,250
WA state refuse tax (3.6% of Transfer and Disposal)	$45	$45
Container Rental ($1,100 pro-rated over 3 trips)	$367	$367
Total Disposal Cost	$9,292	$10,382
Cost per Ton	**$465**	**$519**

- It should be noted that the fuel surcharge is difficult to predict. Also, all AML transport costs would be billed by Republic Services to Gustavus on a "pass-through" basis and not marked up.
- Similar to the contractual arrangements in place with the Southeast Alaska Solid Waste Authority communities, under the scenario described above Gustavus would engage in a long-term contract with Republic Services as the prime service provider.
- As well, under this scenario waste would continue to bale at Gustavus and preferably enclosed in shrink wrap or another suitable material to control odors. Bales would have to be stored at the DRC, either in a container that is purchased or rented, or alternatively inside the main building or outside near the landfill area.
- Assuming 50 tons of disposed waste per year and 20 tons per container it is estimated between two and three containers would be shipped out annually.

9.5 Ship Waste to Juneau Landfill Operated by Capitol Disposal / Waste Management

The Lemon Creek Landfill in Juneau operated by Capitol Disposal / Waste Management is available to Gustavus based on conversations with the facility manager. However, the "tipping" or disposal charge is $ 180 per ton. Transport costs for the Gustavus to Juneau segment noted above would prevail at around $ 3,500 to $ 4,000 per container, plus the fuel surcharge. The following table details the costs of this option.

Table 3 – Disposal Cost to Lemon Creek Landfill in Juneau

Description	Low	High
Transport to Juneau	$3,500	$4,000
Fuel Surcharge @ 9%	$315	$360
Disposal @ $180 per ton	$3,600	$3,600
Total Cost	$7,415	$7,960
Cost per Ton	**$371**	**$398**

9.6 Disposal Option 5: Modular Incineration

Another disposal option that could be further investigated by Gustavus is the purchase, installation, and operation of a modular incineration unit. This is a developed technology that has previously been researched by Bell & Associates. For information purposes related to this report, and based on that research, an established firm in the Northwest that manufactures, installs, and services such units was contacted to introduce the technology to Gustavus – Advanced Combustion Systems or ACS, Inc. (http://www.acs-acs.com/).

ACS has modular incineration units at several public and private sector locations in Alaska including Akutan, Ketchikan, Illiamna, Nome, Pedro Bay and perhaps most importantly Glacier Bay National Park (reference contacts provided upon request). ACS identified its model CA – 100 as the most appropriate for the size and type of waste stream presently being disposed by Gustavus. The primary purpose of this unit is volume reduction; there is no energy generation resulting from the combustion of refuse. The cost of CA – 100 is $ 36,752; the same unit in a containerized configuration (called PC – 100) for protection from weather is $62,000. That is probably the best choice for Gustavus given its location.

Technical Appendix C has five documents related to the CA – 100 modular incineration unit, as follows:

- C 1: Waste Types
- C 2: Incineration Models, Specifications, and Costs
- C 3: Batch Loads and Burn Rates
- C 4: Fuel and Electricity Use
- C 5: Operating Instructions

Briefly stated, normal operating procedure is to start a load first thing in the morning after cleaning out the ash from the previous day. The maximum batch load for the incinerator will take just over four hours to combust. After the initial load has burned down an operator will put in another load of trash into the machine while it is still at operating temperatures, thereby avoiding the overhead of a warm-up and burn-down cycle, thus improving operating efficiencies.

With two combustion cycles, the CA – 100 could burn around 1,000 to 1,500 pounds of refuse per day. This is twice what Gustavus produces on an average day. Diesel fuel consumption is estimated at 1.5 gallons per hour and 67 gallons per ton; electricity usage is 1.5 kW per hour or 69 kW per ton. For installation, an ACS representative on-site costs $ 1,500 per day plus expenses. According to ACS installation, training, supervision, start-up, curing, and testing typically happen over a five-day visit with a travel day on both ends.

Table 4 – Cost for On-Site Incineration

Description	Annual Cost	Cost per Ton
Unit Cost ($69,500 / 7 year life)	$9,929	$165
Fuel Cost (Diesel @ $3.50)	$14,070	$235
Estimated R&M Cost	$5,000	$83
Total	$28,999	$483

It is our understanding that the DRC is currently accepting ash from the incinerator at Glacier Bay National Park. It is the best judgment of Bell & Associates at this point that modular incineration is a viable disposal option for Gustavus and should be given the same level of consideration as the other disposal options presented in this section. In this regard it would be desirable to contact references for ACS, especially those in Alaska, and conduct a more detailed projection of the costs to operate a modular incineration unit in Gustavus. These activities were beyond the budgetary limits of this report.

The three alternatives are summarized in Table 5 below

Table 5 – Comparison of Alternative Disposal Costs

Option	Low Cost	High Cost
Ship to Washington Landfill	$465	$519
Ship to Juneau Landfill	$371	$398
Incineration	$483	$483

9.7 Recycling Options

It is assumed that continued recycling and other forms of waste diversion will be part of the long-term strategy guiding the Gustavus DRC. Currently recyclables from the DRC are shipped to Seattle and processed / marketed by Seattle Iron and Metals, International Paper, All Battery Sales, Total Reclaim and Eco Lights. These materials are received, handled, stored, baled, and shipped as separate commodities.

This approach necessarily entails and consumes a great deal of DRC labor and space. The motivation for maintaining this high level of materials separation is to maximize the sales value of the various items. While this is laudable, it must be noted that in Fiscal Year 2014 total material sales were $5,160 (rounded) while shipping expenses were more than double at $11,650 (rounded). As well, payroll was nearly 70 percent of the DRC budget in FY 2014; the next highest expense category was freight, that is, shipping of recyclables, at 13 percent.

Further, in contrast to the significant effort, cost, and facility property being devoted to recycling source separated materials, sales of those materials only accounted for 9 percent of DRC income for FY 2014. User fees paid by DRC customers and on-site sales contributed 60 percent of the income; Community Chest was 10 percent; and subsidy from the City of Gustavus was 20 percent.

It is not unreasonable to conclude there is an imbalance between the cost of this recycling approach and the benefits. As well, based on consultant observation of DRC operations, considerable room both inside and outside the main building is being taken up by accumulations of separated recyclable material. The scope for the Solid Waste Management, Facility Planning, and Landfill Closure Plan Project (see Appendix A), written by the DRC Manager / Operator and adopted by the City Council, discusses various potential initiatives including physical integration of the Community Chest into the DRC; improving materials handling procedures, the operational layout, and space utilization of the DRC; and modifying food waste composting methods. It is difficult to see how these initiatives can be considered without first addressing the issue of how recycling should be carried out at the DRC.

The operational constraints imposed by multiple stockpiles of separated recyclables is heightened by the limitations of the two vertical, down stroke balers, which are small, old, and do not produce dense bales. Time is expended in creating many small bales which then have to be moved to their specific storage area. A larger horizontal baler (new or used) would produce larger, more compact bales of both trash and recyclables (the same baler could be used for both), thus reducing the number of bales handled and stored at the DRC.

Therefore, in order to reduce the volume of materials that are being stored at the DRC (either under cover, or in the open) and the associated holding times, it is suggested that all the waste streams be evaluated to determine the economic benefit of segregation and if the time that materials need to be held on site could be reduced by commingling some of the waste streams. Virtually all of the residential and commercial / institutional recyclables could be commingled. The trade-off for the operational savings resulting from such an approach would be a reduction in material value. However, under its long-term contract with Republic Services, Petersburg (a founding member of SEASWA) has received between $65 and $85 per ton (rounded) for commingled recyclables.

Further, it may be unrealistic to expect that the DRC will reach a level of sustained financial self-sufficiency, given that in the solid waste management industry, favorable economies of scale and efficiency are achieved through the aggregation of large quantities of material – both refuse and recyclables – in order to keep per unit (per ton) costs under control. The extremely small amounts of material generated in Gustavus are thus at odds with the fundamental financial dynamics of how the solid waste industry operates. At the DRC, time-consuming methods are applied to a small waste stream, further subdividing it into even smaller components. The revenue from these separated recycled materials are not enough to cover the operating costs associated with such an approach. Only with a substantial, and likely unacceptable, increase in user fees, accompanied by consistently high material sales revenues, could possibly yield a funding level to provide self-sufficiency. This is not a realistic set of circumstances. A City subsidy is therefore probably a predictable and essential part of the DRC's operating income.