ORDOT DUMP
ORDOT-CHALAN PAGO, GUAM

Action Report

Prepared for
Department of Public Works, Government of Guam
542 North Marine Drive
Tamuning, Guam 96911

January 2008

Prepared by
Duefias, Bordallo, Camacho & Associates Project Team (Duefias, Bordallo, Camacho & Associates, Inc. and URS Corporation)

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ORIGINAL

IN THE DISTRICT COURT OF GUAM
TERRITORY OF GUAM

UNITED STATES OF AMERICA Plaintiff, vs. GOVERNMENT OF GUAM, Defendant.	CIVIL CASE NO. 02-00022 **GOVERNMENT OF GUAM ACTION REPORT**

In the Court's Order of December 14, 2007, the Court ordered the Government of Guam to file an Action Report that would provide an estimate of the remaining airspace at the Ordot Dump and set forth a detailed explanation of the steps GovGuam intends to take concerning municipal solid waste disposal when the Ordot Dump is closed and the new landfill is not yet operational. Attached hereto as **Exhibit A** is GovGuam's Action Report.

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Respectively submitted this 22nd day of January 2008.

OFFICE OF THE ATTORNEY GENERAL
ALICIA G. LIMTIACO, Attorney General of Guam

By: _____
J. PATRICK MASON
Deputy Attorney General

EXHIBIT
A

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ABBREVIATIONS

ADC	Alternative Daily Cover
cy	cubic yards
cy/d	cubic yards per day
DBCA	Dueñas, Bordallo, Camacho and Associates, Inc.
DDC	Deep Dynamic Compaction
DPW	Department of Public Works
EIS	Environmental Impact Statement
GCA	Guam Code Annotated
GEPA	Guam Environmental Protection Agency
ISWMP	Integrated Solid Waste Management Plan
lb/cy	pounds per day
LFG	Landfill Gas
MRF	Materials recovery Facility
MSW	Municipal Solid Waste
PERMIT	GEPA issued Waste Management Permit #05-060LFL
SOP	Standard Operating Procedure
tpd	tons per day
UOG	University of Guam
USEPA	United Stated Environmental Protection Agency

1. Introduction

This document presents the Action Report for the Ordot Dump (the Dump) as required by Court Order (document 177-2) for case CV 02-00022. Section 6.A of the Court Order States:

GovGuam shall file an Action Report by January 21, 2008. The report shall provide an estimate of the remaining airspace at the Ordot Dump and set forth a detailed explanation of the steps GovGuam intends to take concerning municiple solid waste disposal when the Ordot Dump is closed and the new landfill in not yet operational.

At the time the court order was issued, the original scheduled date for closure based on the Consent Decree document (September of 2007) had come and gone. Further, the previously prepared closure design was based on this closure date. Public comments had been made that the Dump had less than 4 months of capacity. Based on these conditions, there was much concern that DPW's continued operation of the Dump was placing more waste in the Dump than it could handle. However, the original closure design, as well as more recent calculations made to determine the remaining useful life of the Dump, were all based on best available data and conservative assumptions of waste stream volumes, compaction rates, and in-place densities. This Action Report, in addition to presenting the information required by the Court Order, also presents updated waste stream information based on actual field measurements, more accurately estimates of remaining useful life and an action plan that is based on such additional information. What should be noted is that this new information illustrates that actual fill rates at the Dump have been much less than design assumptions, and as such, the remaining life of the Dump is greater than previously reported.

- Section 4 provides an estimate in cubic yards and days for the remaining airsapce at the Ordot Dump
- Section 5 provides information on operational modifications that can be utilized to enhance the useful life of the Dump
- Section 6 provides information on actions considered for Pre-Closure
- Section 7 provides information on actions considered for Post Closure (including court ordered closure)
- Section 8 provides recommendations for Actions presented

2. Current Site Conditions

Ordot Dump (Dump) remains in operation as Guam's only civilian municipal solid waste (MSW) facility. The current operating conditions of the Dump consist of the following:

1. One operable scale measures the weight of both inbound and outbound commercial and residential haulers. The outbound weight of a vehicle is subtracted from the inbound weight of that same vehicle to determine the weight of the waste tipped at the Dump.

2. One compactor, two dozers and three excavators are presently operating at the Ordot Dump according the DPW Solid Waste Superintendent, Dominic Muna.

3. Daily cover is currently being transported to the Ordot Dump from DPW's Quarry at a rate of 200 cy/day.

4. DPW is currently placing waste at the Ordot Dump and using the area fill method depicted in the 2004 Operations Manual.

5. DPW's Waste Management Permit has expired as of October 23, 2007. As such the Ordot Dump is operating without a valid Waste Management Permit.

Revisions to current operations will be undertaken based on the recommendations section of this report.

3. Waste Stream Estimates

In January 2008, a survey of the Dump's active areas was completed. Areas that have been historically inactive were not included in the survey limits of this most recent effort to define the Dump's topography. These inactive areas include the southern and eastern limits of waste. Topographic mapping and profile development of these areas were recently performed to confirm that filling has not occurred in these areas since the previous site survey (October 2004).

The results of the January 2008 survey were used to determine the following:

- in-place waste (and soil cover) volume between October 2004 and January 2008 in cubic yards (cy); and
- The remaining airspace of the Dump based on the 2005 Ordot Dump Closure design final filling topography (see Section 4).

The in-place waste volume was determined by determining the volume difference between the October 2004 and January 2008 topographic surfaces. The volume difference is **465,787 cy (fill).**

The approximate number of days between the October 2004 and January 2008 surveys is:

October 31, 2004 to January 12, 2008 =	1168 days
Total =	**1168 days**

The number is approximate because the actual number of days between the October 2004 and January 2008 surveys is unknown, as each survey included two weeks of field activities. During the field activities, waste continued to be placed and these volumes may or may not have been captured by the field survey crew. Therefore, the total number of day between October 2004 and January 2008 of 1168 may have an error of plus or minus thirty days. The total, 1168 days, will be used. The actual incoming waste stream (in tons) will be determined once the scale is in continuous operation.

The in-place daily incoming waste stream rate between October 2004 and January 2008 is: 465,787 cy ÷ 1168 days = **399 cy/day (say 400 cy/day)**

This volume rate includes waste and daily cover (soil).

An in-situ waste density range of 800 to 1,200 lb/cy will be used as the basis for determining the daily incoming waste stream range in tons:

(400 cy/day × 800 lb/cy) ÷ (2,000 lb/ton) = **160 tons/day**
(400 cy/day × 1,200 lb/cy) ÷ (2,000 lb/ton) = **240 tons/day**

Incoming Waste Stream Tonnage Rate Range = 160 to 240 tons/day

Below are daily incoming waste stream rate estimates (based on previous studies and forecasts):

1991 Daily Tonnage*:	302 tons/day (993 cy/day)
1995 Daily Tonnage:	316.1 tons/day (wet season)
1995 Daily Tonnage:	210 tons/day (dry season)
2000 Daily Tonnage*:	426 tons/day (1,400 cy/day)
2007 Daily Tonnage**:	397 tons/day (886 cy/day)
2010 Daily Tonnage*:	585 tons/day (1,923 cy/day)

*based on an in-situ waste density of 600 lb/cy
** based on an in-situ waste density of 1,000 lb/cy

The values presented above are estimates, and only the 1995 data is based on site-specific investigation. The daily incoming waste stream rate varies based on the in-situ density of waste used to determine the rate in tons. The daily tonnages of 316.1 tons/day (wet season) and 210 tons/day (dry season) are the only values computed using actual field measurements.

When the daily incoming waste stream rate (in cy), determined by the 2004 and 2008 surveys, is coupled with the 1995 daily incoming waste stream rate (in tons), the in-place waste density range is calculated to be:

(316.1 tons/day ÷ 400 cy/day) × (2,000lb/ton) = 1,580 lb/cy (wet season)
(210 tons/day ÷ 400 cy/day) × (2,000lb/ton) = 1,050 lb/cy (dry season)

The waste density calculation is better determined with updated values of incoming waste stream (in tons), which will be collected with the recent provision and start-up of an on-site scale. The information gathered from the use of the scale in 2008 will be used with the volume determined in the most recent survey to calculate a more accurate waste density that can be used to refine the final filling topography of the Dump.

The daily incoming waste stream for this report will be **400 cy/day.**

4. Remaining Air-space Estimate

The remaining airspace at the Dump is dependent on several different variables, such as the final filling topography, incoming waste stream weight or mass, compaction and daily soil cover volumes. As any one of these variables can change or be changed, the remaining airspace (and the resulting time required to utilize such airspace) as determined at any given time is valid as long as the variables remain relatively unchanged.,. Numerous claims have been made as to the expected life of the Dump, some of which have indicated that we are beyond the useful life already. To date, the Dump remains open despite such claims. The Dump, under the Consent Decree, was ordered to close in September 2007. The Department of Public Works has not been successful in opening a new landfill, which would allow for the Dump closure activities to be completed.

In May 2004, a pre-final closure design was submitted to DPW. This closure design called for a geomembrane closure capping system which took into consideration the anticipated volume of waste expected based on the best available data for solid waste generation and certain assumed waste characteristics, such as in-situ density and compaction rates. This closure cap will, for this exercise, be used as the final topography of the Dump. It should be noted, however, that an Ordot Dump Assessment is currently being performed to analyze the Dump's current site conditions, analyze the feasibility and cost-effectiveness of proposed value engineering measures, and to respond to any relevant, unresolved comments provided by the United States Environmental Protection Agency (USEPA) and the Guam Environmental Protection Agency (GEPA). The final closure cap design will likely be revised as a result of the findings of the Assessment Report, and has the potential to further extend the remaining useful capacity of the Dump.

The following equation will be used to determine the remaining air space:

Closure topography – January 2008 topography = available airspace (cy)

Available airspace (cy) – daily cover (cy) – relocated waste (cy) – Final Closure Cap (cy) - improperly placed waste (cy) = Available Airspace for Solid Waste (cy)

Daily cover will be estimated using the following ratio of 4:1 (solid waste: daily cover). This ratio is quoted in various engineering references namely, *Michael Lindeburg, Civil Engineering Reference Manual.* Improperly placed waste is waste that has, as of January 2008, exceeded the 2004 closure cap topography.

- Available Airspace = **652,960 cy**
- Daily cover = 652,960 – 135,450 – 98,210 = 419,300 × ¼ = **104,825 cy**
- Relocated Waste: **135,450 cy**
- Final 2004 Closure Cap: **98,210 cy**
- Improperly Placed Waste: **26,364 cy**

Available Airspace for Solid Waste (cy) = 652,960 – 104,825 - 135,450 – 98,210 – 26,364 = **288,111 cy**

Appendix A provides supporting information on the values presented above.

Using the daily incoming waste stream rate (in volume) determined above of 400 cy/day, the estimated number of days until the Dump reaches the 2004 Design Closure surface is as follows:

288,111 cy ÷ 400 cy/day = 720 days

The following must be noted:

1. The 2004 design cap is based on an eastern expansion of the Dump. This expansion is critical and without it the remaining airspace is limited. Section 7.3.1 provides additional discussion on this topic and potential options for Dump Operations.

2. There are outstanding comments to the 2004 design by both USEPA and GEPA. The final closure design has not been accepted. In the absence of an accepted closure cap the 2004 design was used.

5. Operation Modifications

5.1. Daily Cover

Daily cover material must be placed over the active face at the end of each day. The purpose of daily cover is to prevent rodents, flies, and other vectors from feeding on and breeding in the waste, and to control odors and blowing debris. The daily cover material consists of earthen-fill from the Government of Guam-owned quarry in Dededo, various on-going road construction projects, and select C&D waste. Coarse-grained soils are the preferred daily cover material, especially in wet-weather conditions. Their free-draining

characteristics do not confine leachate or landfill gas (LFG) movement within the waste. Finer-grained soils may also be used, but should, to the extent possible, be limited to dry-weather operations. In accordance with the Guam Code Annotated (GCA) Title 22, Division 4, Chapter 23, Section 23304, disposed solid waste shall be covered with six (6) inches of earthen material at the end of each operating day, or at more frequent intervals, if necessary.

The Revised 2008 Closure Report determined that 200 cy/d of daily cover will be required. In order to minimize volume of materials placed within the Dump and still meet the requirements of operations and permit conditions, this value can be reduced by operational approaches to reduce daily cover consumption during waste placement and with the use of alternate daily cover (ADC) materials. ADCs are discussed further in this document.

5.2. Approaches for Reducing Daily Cover Usage

Two general approaches can be used to reduce daily cover consumption during refuse placement operations:

- Modification of current cover-soil placement practices; and
- Use of ADC materials, other than soil.

5.3. Modified Soil Cover Placement Practices

In accordance with the regulations, daily cover shall be placed over the active face of the landfill at the end of each day. The soil is placed at a loose thickness of greater than 6-inches and compacted to a minimum thickness of 6-inches. It should be noted, however, that operational realities, such as uneven refuse surfaces, wet fine grained cover material, difficult working areas, and equipment limitations, may often result in a compacted cover thickness that is greater than the prescribed minimum.

Within the constraints of regulatory requirements, the quantity of soil used to cover the surface of a given lift is largely a function of geometry. That is, the surface area of the lift and the cover thickness. Soil cover quantities are also impacted by the soil quality and weather conditions.

With respect to the top surface of a given lift, the principal factors impacting cover quantities are the area of the refuse fill and the thickness of cover required for vehicle access. Both of these parameters are essentially fixed. However, with respect to the sloped, working face of the refuse, only the minimum thickness prescribed by the regulators is fixed. Therefore, the working face presents more opportunities for reducing daily cover quantities. As above, the quantity of soil used to cover the working face depends on geometry, that is:

1. The area of the refuse placement at the working face; and
2. The thickness of the soil placed over the working face.

The following sections discuss various options for varying the geometry of daily cover placement in order to reduce the quantity of daily cover used to manage the working face.

5.4. Reducing the Working Face Area

Reducing the width of the working face will not necessarily reduce the overall cover soil usage, because for a given refuse volume, if the width of the active face strip is reduced, the length of the strip might have to be increased. The optimum configuration, from the perspective of daily cover consumption, is to place the refuse in a square. Notwithstanding these considerations, the dimensions of the working face are limited by: the number of trucks tipping at any one time; and the equipment available to place and compact the refuse.

A reduction to the area of the working face that requires daily cover can only be achieved by increasing the slope of the working face. If refuse is currently placed at a maximum slope of 4 (horizontal) to 1 (vertical) and the slope was increased to 3(h) to 1(v), the quantity of daily cover required would be reduced by approximately 23%. However, increasing the slope will reduce the refuse compaction that is achieved and therefore reduce the quantity of refuse that is placed in the landfill. Further, increasing the slope would increase the difficulty of cover material placement and probably increase the cover thickness, effectively negating the benefit of the area reduction.

5.5. Reducing the Daily Cover Thickness

Reducing the thickness of daily cover would have a direct effect on the quantity of daily cover consumed during filling operations. For example, reducing the loose thickness of uncompacted daily cover from 12-inches (if that is the current practice) to 8-inches will reduce the quantity of daily cover consumed by 33%.

Reducing the daily cover thickness may require additional refuse preparation, to ensure a relatively smooth and firm surface. Further, depending on the quality of the cover material and the weather conditions, the completeness of the cover may be reduced. GCA Title 22, Division 4, Chapter 23, Section 23304 requires that the minimum thickness of daily cover be 6-inches. Therefore, regulatory authority acceptance of modifications to the daily cover thickness will be required.

5.6. Reclaiming Daily Cover

Refuse is typically placed directly on daily cover placed over the previous day's working face. Therefore, if a portion of this cover material was removed prior to placement of the overlying refuse, the net quantity of soil consumed could be reduced. The material removed would then be stockpiled near the working face and available to reuse as part of that day's covering operations. It is estimated that between 30% and 50% of daily cover placed on the working face could be removed and reused. Removal of any additional cover material beyond the 50% would probably impact the underlying refuse.

The recovery of cover materials can result in the conservation of a significant quantity of valuable soils. In addition, it allows refuse-to-refuse contact between lifts, which creates a more homogeneous refuse area. The benefit of a homogeneous refuse area is that the

cover soil barrier between lifts is nearly eliminated. This enables efficient movement of leachate downward towards the landfill base, rather than toward the outside, where it may weep out of the sideslope.

This approach would require revision of current operations practices. Refuse placement each day would need to be preceded by cover removal. Cover removal would then continue progressively through the refuse placement operations. Cover removal would require careful and skilled operation to avoid disturbing the underlying refuse. As above, acceptance by the regulators would be required.

5.7. Soil Separation (Screening)

Approximately 25% of the volume available, as determined in Section 4, is allocated for soil cover. An effective measure in reclaiming this valuable airspace is screening out daily cover from inactive cells. This method uses a trammel or vibrating screen and an excavator. Waste and soil cover from an inactive cell is excavated and placed on the screen and the soil is sifted out. The waste is placed back onto the waste mass, compacted and covered. The volume which was once occupied by daily soil cover is made available for waste. The sifted soil could be used for soil cover once again. This process has been accepted by the USEPA for use in landfills in other jurisdictions, and would be an effective means of volume reduction for wastes in the Ordot Dump.

This option could potentially expose hazardous material, increase gases and odors and potentially cause collapse of excavated areas. Should this process be implemented, it is recommended that it be used on areas where placed waste has been properly spotted and soil cover has routinely been used. New lifts created between January 2008 and June 2008 may be good candidates for this action.

Action

- Conduct Site Characterization Study
- Implement Spotter training (as required in Closure report)
- Assess project cost

The estimated cost for hauling daily cover is $37,100 per week. The benefits to this action include a reduction in the soil cover cost.

Documentation on this action is provided in Appendix B.

5.8. Daily Cover Monitoring

A critical element of any modified soil cover placement approach will be monitoring the actual daily cover consumption. Monitoring will confirm that the theoretical reductions in daily cover usage are being realized and will allow adjustments to be made to achieve the daily cover usage goals.

It is recommended that the practice of measuring daily cover consumption be continued and if necessary, refined.

5.9. *Alternative Daily Cover Materials*

The second approach to reducing daily cover consumption during refuse placement operations is the use of materials other than soil for daily cover. The following sections discuss various ADC materials that are used at landfills elsewhere. Note that in some instances, specific products have been considered. It is intended that these products are representative of the particular advantages and disadvantages of the respective alternative daily cover technology. Other products, employing a similar technology, may be equally applicable.

5.9.1. Soil Cover

For the purpose of comparison, the continued use of soil cover is described in Table 1.

Table 1 – Soil Cover

	Soil Cover
Company	Government of Guam
Product Description	Quarried limestone fill and other sources
Application Method	Haul from quarry to working face Spread material over working face using refuse placement equipment
Application Rate	Greater than 6-inch uncompacted / 6-inch compacted cover over refuse
Advantages	• Application method is familiar to Operations • Weather conditions managed by using different material types available • No direct material costs or start-up costs • Consistent with current regulatory authority approvals
Disadvantages	• Uses airspace that could be used for refuse • Occasional insufficient available quantity of material or lack of operable equipment for placement to maintain continued application rate
Start Up Cost	Nil
Material Cost	Nil
Shipping Cost	Nil
Weekly Cost	• $37,100 • Assumes 200 cy of daily cover applied 7 days per week • Assumes loading at quarry by pay loader ($60/hour) for 8 hours per day • Assumes using 5 rented dump trucks ($50/hour/each) for 8 hours per day • Assumes placement by dozer ($120/hour) for 3 hours per day • Assumes $45/hour for operators for total of 51 hours per day

5.9.2. Hog Fuel

Hog fuel consists of recycled wood waste, stumps, etc. A detailed description of the alternative, including estimated costs and primary advantages and disadvantages, is presented in Table 2.

It is understood that Operations may have difficulty in importing sufficient quantities of hog fuel for use as ADC. An alternative to importing hog fuel is to produce it. This is production alternative is discussed further in Section 6.1.2 Yard Waste Diversion.

Table 2 – Hog Fuel

	Hog Fuel
Company	Not Available on Guam Commercially. May potentially be created by diverting and chipping select yard and wood waste, by procuring a tub grinder and creating on-site.
Product Description	Recycled wood waste (hog fuel) and 100% recycled wood (stumps)
Application Method	• Haul directly to working face, or stockpile on-site • Spread over working face using refuse placement equipment
Application Rate	• Average 9-inch cover over refuse • 12-inch thickness required in areas where traffic is expected
Advantages	• Application method is familiar to Operations, because it is similar to placing soil cover • Material will degrade with time, providing additional airspace for refuse • No weather constraints • Material can be imported to the site using Government refuse trucks, at a potential cost saving from that shown
Disadvantages	• Uses short term airspace that could be used for refuse (similar to on-site soil cover) • Requires import to the site, increasing traffic on local roads or requires production of material on-site • May require a stockpiling area • May increase settlement rates by increasing the quantities of organic materials decomposing in the landfill • Susceptible to market price changes and ability of the supplier to provide required quantities. It is understood that operations may have difficulty obtaining the quantities they need commercially.
Start Up Cost	• $150,000 (Peterson Pacific 2400 Horizontal Grinder) to $200,000 (BEAST 2880 Horizontal Grinder)
Material Cost	• $0.00/cy – yard waste and untreated wood already incoming to the site
Shipping Cost	• $10,000 to ship either grinder (includes ship and trucking cost)
Weekly Cost	• $9,030 for production of hog fuel • $2,500 for placement • Production per day: $90/day for running grinder for 2 hours, $720/day for two operators at $45/hour for 8 hours each day to produce hog fuel, $480/day for equipment ($120/hour at 2 hours). • Assumes cover is applied to a 0.5 acre area, 7 days per week • Excludes stockpile preparation

Action

Hog Fuel is a feasible option for daily cover and may be used as a daily cover source. The following actions will be required:

1. Obtain formal approval from GEPA for use of hog fuel as ADC. A field demonstration of the hog fuel's effectiveness as an ADC may be required. A pilot trial should be conducted.

2. If the ADC is approved a dependable source of hog fuel will be required. A potential source could be select yard waste and wood waste, as discussed in Section 6.1.2 Yard Waste Diversion.

3. In order for GovGuam to produce hog fuel for use as ADC, the purchase of a grinder, a method to separate select yard waste and untreated wood waste from the incoming waste stream, a staging area, and a stockpiling area would have to be identified (on-site or near site).

4. The use of soil as daily cover will still be required where vehicle traffic is required.

The approximate capital cost is: $150,000 to $200,000 for grinder
Monthly operating costs is: $46,120

Information on

5.9.3. Soil Equivalent Foam

Soil Equivalent Foams as alternative daily covers consist of a foam material that is spray applied over exposed refuse surfaces at the end of daily filling operations. For the purpose of this comparison, a specific product, supplied by Rusmar Incorporated, was considered. The product is applied using a proprietary applicator that travels over the working face applying a foam layer of between 3 and 4 inches thick. A detailed description of the alternative, including estimated costs and primary advantages and disadvantages, is presented in Table 3.

Table 3 - Foam

	Soil Equivalent Foam (AC-667-SE)
Company	Rusmar Incorporated
Product Description	• Liquid concentrate comprised of a starch modified hydrolyzed protein surfactant • Concentrate is delivered in bulk quantity and diluted with water prior to application • Product has a cinnamon scent
Application Method	• Concentrate is delivered and stored in a Bulk Storage and Dilution System (BSD) which is provided as part of the system. • BSD is connected to an on-site water supply (60 gpm) and power supply. BSD automatically controls dilution of the concentrate and filling of the Pneumatic Foam Unit (PFU) used to apply the foam • The operator does not need to calculate dilution ratios, and once the procedure has started, the system does not need to be monitored. Time to fill the PFU at 60 gpm is 42 minutes

	• Foam is applied via the Pneumatic Foam Unit (PFU), which is a self-propelled unit, built with Caterpillar components, and designed to be driven over the working face • PFU deploys a twelve-foot wide foam blanket via a patented bi-directional manifold • PFU is operated by one individual and does not require any additional personnel or support equipment • Upon completion of foaming, compressed air automatically removes any foam left in the lines and no further cleaning is required. This step takes 1 to 2 minutes. It is not necessary to use all of the product that has been diluted.
Application Rate	• Recommended coverage depth is 3 to 4 inches, provided the working face has been properly compacted and groomed • Coverage depth can vary depending on weather conditions and surface preparation • PFU application rate is approximately 667-square feet per minute (at a 3-inch foam depth) • One 2500-gallon fill of dilute will cover approximately 27,000-square feet with a foam depth of 3-inches
Advantages	• Automated system for diluting and filling PFU and one person operation reduce application costs • No support equipment required (e.g. for towing) • No clean-up is required • It is not necessary to use all the diluted material in the PFU, therefore progressive covering is possible; however, it is recommended that dilute material not be stored in the PFU for more then 2 -3 days. • Equipment is built for outdoor storage year round • Thicker coverage and direct application over the refuse is less susceptible to inconsistent coverage and spray shadow than other application methods • Foam will consume minimal airspace. When additional waste is dumped on top of foam blanket the following day, the blanket collapses, leaving biodegradable trace solids similar to soap scum. • Foam will not interrupt the drainage of leachate through the refuse • Foam blanket is reportedly unaffected by temperature, moderate wind, or moderate rain
Disadvantages	• GovGuam required to supply water and electrical power to the BSD and fuel for the PFU • GovGuam required to prepare an area for BSD and PFU storage • Travel time for the PFU between the BSD and the working face may slow application time, particularly if refill of the PFU is required • Not suitable for heavy rainfall, therefore an alternative daily cover method must be available • Additional surface preparation may be required to ensure a good surface cover is achieved • Not suitable for vehicle traffic, therefore additional material required where vehicle access is necessary • Regulatory authority approval required • Susceptible to strong winds
Start Up Cost	• Typical Trial Period Agreement: • For a three load trial, mobilization / freight charges for the PFU are partially paid by Rusmar Inc. • If equipment returned after the three-load trial, GovGuam is liable for return freight only (approximately $8,000 per piece) GovGuam would be responsible for all freight charges from West Chester to Guam. Freight $ 16,000. • Typical leasing agreement includes all capital equipment costs and all major service and maintenance. Rusmar will include major service, provided a contractor can be secured locally in Guam. Rusmar will send a technician to Guam for start-up and training. • Product will ship in 55 gallon drums. Water will be needed to dilute the concentrate, but no electrical. It is possible that leachate could be used to dilute the concentrate, depending on pH and solids present. • Proposed equipment is a PFU1600/40 trailer mounted unit, with AC-667SE concentrate to ship in drums - lots of 40 or 80. One fill of the PFU1600/40 can cover approximately 18,000 square feet.
Material Cost	• $0.62/lb plus $0.15/lb for freight and tax, if applicable, total = $0.77/lb • Equivalent unit rate = $0.08 per square foot (assume 333 gallons of concentrate per 2500 gallons of solution). Per square foot cost remains the same, regardless of foam unit used for application.
Shipping Cost	• $0.15/lb for concentrate (transported in 55-gallon drums) • Freight to ship PFU1600/40 = $16,000
Weekly Cost	• $14,720 • Assumes cover is applied in a 3-inch lift to a 0.5 acre area, 7 days per week • Excludes fuel costs

References	• *"We are really happy with the product. We've been using the product at the site for 10-12 years. We receive 2350 tons/day of incoming daily refuse. It is important to prepare surface by compacting and smoothing the surface with tracks. We use two Pneumatic Foam Units onsite. The product is applied in a 6-inch thick foam layer. Rusmar Inc. offers great customer service. We do not suggest using the product if heavy rain is expected. Berms are constructed down slope of the area where foam is applied, in case heavy rains come after application. There have been no problems with the use of this product."* (URS personal communication with Tommy Liuzzo, Commonwealth Landfill, Hegins, PA) • *"We've been using the product for 3-5 years now. There have been no problems in using the product. The PFU experiences some normal wear and tear. When the PFU needs repair, Rusmar sends a mechanic out the next day to fix the problem. The PFU is single person operated. We use the SE Foam to cover 1200-1500 SF/day, using 1000-1500 gallons. There is not much rain outside of the 3-month monsoon season. When precipitation heavier than a drizzle is expected, a thicker layer of foam is applied. The product is great and Rusmar Inc. is a great company to work with."* (URS personal communication with Larry Anduaga, City of Glendale Landfill, Glendale, AZ)

Action

Soil equivalent foam is a feasible option for reclaiming airspace that would otherwise be occupied by soil daily cover. The following actions will be required:

1. Obtain formal approval from GEPA for use of foam as ADC. A field demonstration of the foam's effectiveness as an ADC may be required. A pilot trial should be conducted.

2. If the ADC is approved a detailed specification will need to be prepared. The specification shall cover at minimum the following: performance guarantees, operating cost guarantees, fuel requirements, product consumption, mobilization requirements, and site training.

3. The ADC, Rusmar Incorporated, and at least two similar companies (if any) will need to be solicited once the specification is completed.

The approximate capital cost is: $16,000 (shipment of foam applicator)
Monthly operating cost is: $58,880 (excluding cost of water)

5.9.4. Sacrificial Geosynthetics

Sacrificial geosynthetics as alternative daily covers consist of a relatively thin geosynthetic membrane/film that is spread over exposed refuse surfaces at the end of daily filling operations. The next day's refuse is placed directly over the sacrificial geosynthetic, which subsequently breaks down due to mechanical and biological degradation. The advantage of sacrificial geosynthetics over conventional temporary tarping is that they can be mechanically applied, they do not require personnel to walk over the refuse and they do not require removal prior to the start of refuse placement.

For the purpose of this comparison, Enviro® Cover, supplied by EPI Environmental Products Inc., was considered. The product is applied using a proprietary applicator that is attached to / or towed by a dozer that travels over the working face. In addition to deploying the cover, the applicator also deposits ballast to hold the cover in place. A

detailed description of the alternative, including estimated costs and primary advantages and disadvantages, is presented in Table 4.

Table 4 – Sacrificial Geosynthetics

	Enviro® Cover (1.5 mil)
Company	EPI Environmental Products Inc.
Product Description	• Categorized by the ASTM as a "non-reusable geosynthetic" • Degradable polyethylene film that is not retrieved once deployed • Available in 10-foot width rolls by 1.2-mile length
Application Method	• The RK810 deployer is connected to a dozer or front end loader to dispense the cover over the working face. A variety of deployers are available. Deployers are wither connected to the dozer blade, requiring the dozer to reverse over the refuse while applying the cover, or being towed behind the dozer. • As the cover is laid over the refuse, material from a ballast drum is poured on top of the cover to weigh it down • An overlap of 6-12 inches is suggested between panels • The ballast drum capacity is 2.6 cy. Ballast drum has a screen at the top restricting ballast to 6-inch minus. • An area of between 7,500 to 10,000-square feet can be covered with a full ballast drum. The area covered is dependant on speed of deployment, wind conditions and type of ballast material • Cover can be cut with safety knives • Care must be taken to ensure adequate soil cover (6-inches minimum) over the cover at the edges. If edges are unprotected, vectors can access under the cover
Application Rate	• 10,000-square feet per hour • Application rate is dependent on the applicator used, roll width, speed of application and wind conditions • Application rate excludes placement of additional ballast at the cover edges.
Advantages	• Material consumes minimal airspace • Material will degrade, therefore: will not interrupt the drainage of leachate through the refuse; and does not require removal prior to placement of additional refuse • Relatively simple application method, utilizes equipment already available on site • No additional mechanical equipment required • No additional consumption of utilities such as power and water • Material is reportedly unaffected by temperature, rain, or moderate winds • Less susceptible than other alternative daily covers to the quality of the underlying refuse surface • No cleanup required
Disadvantages	• Construction of a storage area for unused rolls is required • Not suitable for high winds (greater than 50 mph), therefore an alternative daily cover method must be available • Vulnerable to birds picking at the cover, especially at edges • Requires ballast material (i.e., soil) to weigh the cover down, additional effort is required to properly secure the edges • Requires someone working on the ground to manually cut material during deployment • Not suitable for vehicle traffic, therefore additional cover material required to provide for vehicle access • Regulatory authority approval required • Requires use of on-site equipment that could be used for other operations activities
Start Up Cost	• Initial mobilization = $2,000 for shipment of deployer and 3 rolls of cover • Material cost for three rolls = $4,620 • Equipment cost for RK810 Deployer = $1,450 • Additional costs associated with preparation of a storage area
Material Cost	• $0.28/SF (based on 1.5 mil thickness, 16-foot wide by 1.5 mile long rolls)
Shipping Cost	• $500/roll • Shipping costs may be reduced if more rolls are shipped.
Weekly Cost	• $8,100

	• Assumes cover is applied to a 0.5 acre area, 7 days per week • Assumes placement by equipment used for refuse placement, at $120/hour for dozer and $45/hour for operator • Includes shipping cost of rolls. • Excludes preparation of a storage area
References	*"EPI is a great company to work with. They've done everything we've asked of them. The Enviro® Cover is the cheapest ADC that we have onsite."* (Habib Kharrat, Puente Hills Landfill, Whittier, CA) *"We've been using the Enviro® Cover to cover an area approximately 120' x 60'. The area covered with the Enviro Cover is not the active face, but a temporary dumping area at the landfill. The material requires the use of ballast (wood waste and sand). We've had to modify the deployer by welding on new feet. The deployer is heavy duty. It has been a good product for us. We've used it for 2 years."* (URS personal communication with Wende Hitchcock, Short Mountain Landfill, Eugene, OR) *"We've only been using the product (1.5 mil) for 4-5 days, and are using it on a pilot program. We use it to cover a working face of approximately 40' x 60'. Instead of using the ballast dispenser, we are using a 5 cy loader with clam shell. One load of soil can cover an area of 40-50' long. Birds sit on top of the enviro® cover, but don't seem to be able to break through. The coverage rate of the enviro® cover is higher than that of the conventional soil daily cover. We have not experienced high winds yet, so we don't know how it will perform. EPI has offered great customer service thus far."* (URS personal communication with Jim Parvey, City of Tacoma Landfill, WA.)

Action

Sacrificial geosynthetics are a feasible option for reclaiming airspace for waste that would otherwise be occupied by soil daily cover. The following actions will be required:

1. Obtain formal approval from GEPA for use of sacrificial geosynthetics as ADC. A field demonstration of the sacrificial geosynthetic's effectiveness as an ADC may be required. A pilot trial should be conducted.

2. If the ADC is approved, procure the deployer and rolls. Acquire training for Operations Staff from EPI-Global personnel. Modify dozer or loader bucket to accommodate dozer.

3. At least three similar companies (if any) will need to be solicited.

The approximate capital cost is: $8,270 ($1,450 deployer, $4820 for three rolls, $2,000 for shipping)
Monthly operating cost is: $32,400

5.9.5. Spray Applied Covers

Spray Applied Covers consist of a substance that is sprayed over the exposed refuse surfaces at the end of daily filling operations. The next day's refuse is placed directly over the sprayed cover, which subsequently breaks down due to biodegradation. Both of the products considered include a curing agent that causes the cover to form a crust over the refuse, enhancing the resistance of the cover to damage by vectors and weather. The advantage of spray applied covers is that they can be applied without driving over the refuse (depending on the size of the working face).

For the purpose of this comparison, two products were considered:

1. Waste Cover, supplied by EPI Southwest Environment Services, Inc.
2. Posi-shell, supplied by Landfill Service Corporation.

Both products are applied using proprietary supplied applicators that are towed to the working face by a dozer. The Waste Cover applicator is essentially a spray mulch applicator and can also be used for seeding, hydro-mulching and watering. A detailed description of the two alternatives, including estimated costs and primary advantages and disadvantages, are presented in Tables 5 and 6.

Table 5 – Spray Applied Cover (Waste Cover)

Alternative 6	***Waste-Cover***
Company	Southwest Environment Services, Inc. and HMI Worldwide
Product Description	• An alternate daily landfill cover manufactured from recycled paper and wood, polymers, enzyme complex, biological stimulants, and other proprietary ingredients • Product has an orange peel scent
Application Method	• Product is applied using the Enviro-seeder (Kincaid 1200 LS or Easy Lawn C125) • Enviro-seeder is a standard hydro-mulching machine with a 1,200-gallon capacity. Equipment comes standard with pneumatic tires, but foam filled tires can be supplied for an additional charge • Enviro-seeder is loaded with 16 x 50-pound bags of Waste-Cover and 1,120 gallons of water. Potable water or pond water can be used. The product is mixed in the Enviro-seeder • Enviro-seeder is towed to the working face by a compactor, dozer or equivalent • Product is sprayed, from the deck of the Enviro-seeder, onto the working face, at a minimum thickness of ¼-inch. The product can be sprayed a distance of 100 feet from the nozzle • Curing reportedly takes approximately 30-minutes in warm dry weather (longer in cooler damp climates) • Cleanup of the equipment is required after use because the product will harden
Application Rate	• 1200-gallons of waste cover can cover approximately 7,200-square feet at a thickness of ¼-inch • Filling the 1200-gallon tank and mixing takes approximately 20 minutes (assuming 60 gpm water source). Application takes another 15 minutes, and cleanup takes another 15 minutes • Application rate is estimated to be 8,640-square feet per hour, including mixing, application, and cleanup
Advantages	• Material consumes minimal airspace • Material is non-toxic and biodegradable, and therefore will not interrupt the drainage of leachate through the refuse • Simple application in a variety of weather conditions • Only requires 1 or 2 employees to mix and apply • Non-flammable • Hydro seeding equipment can be used for other things at the landfill. For example: hydro seeding for erosion control, watering newly seeded areas, fire fighting, dust control, and washing tracked equipment
Disadvantages	• Application control is dependent on operator. Spray shadow is possible and may require spraying from opposite angles to get complete coverage • Application is not recommended in heavy rainfall, therefore an alternate daily cover method must be available • Requires water supply • Material curing time is dependent on temperature and rainfall • Requires post-use clean up of equipment • The bags of Waste-cover need to be kept dry, therefore, a storage area protected from the elements is advised • Manual handling of 50-pound bags is required as part of product mixing • Equipment must be towed from the water source to the active face. At least three batches will be required to cover the working face at the Dump. Time to place daily cover will be significantly increased • Requires the use of onsite equipment that could be used for other activities • Additional surface preparation may be required to ensure a good surface cover is achieved • Not suitable for vehicle traffic, therefore additional cover material required where vehicle access is

	required • Regulatory authority approval required
Start Up Cost	• $36,000 for Kincaid Pro Series 1200 LF purchase (does not include shipping cost) • $42,900 for Easy Lawn C125 Landfill Machine purchase (does not include shipping cost) • An undetermined cost for bag storage area, if desired
Material Cost	• $28.06 per bag ($19 for material and $9.06 for shipping per bag)
Shipping Cost	• Equipment Shipping Cost = $10,000 (for Easy Lawn C125 Landfill Machine) • Shipping is included in the material cost • Bags are supplied on pallets of 40 bags each. A truckload is 900 bags •
Weekly Cost	• $10,065 • Assumes cover is applied to a 0.5 acre area, 7 days per week • Does not includes water supply for 3 batches per day • Excludes preparation of a storage area and fuel
References	• *"We've been using the waste cover for 6 months. The product has a good odor. We apply it at a ¼" thickness. When it looks like it will rain significantly, we will use soil as a daily cover instead. Besides heavy rain, there are no other concerns."* (URS personal communication with Jackie Darter, Wise County Landfill, Norton, VA) • *"Waste cover is the only product we've used as ADC. We have not encountered any problems in applying the product. I recommend using the one bag system, because the two bag system gets dusty. It takes us a total of 1 hour to mix and apply the product on a 100' x 100' active face. We use a fire hydrant to fill the hydro-seeding machine tank. If it looks like the rain will be heavy, we don't apply the waste cover. During the rainy season, we use re-usable tarps in place of the waste cover. The product does not contain fire retardant material; therefore, we use a product called Top Fiber from Central Fiber during the summer months."* (URS personal communication with Mark Melancon, City of Irving Landfill)

Table 6 – Spray Applied Cover (Posi-shell)

	Posi-Shell
Company	Landfill Service Corporation
Product Description	Fibrous, stucco-like, 'cementitious' product
Application Method	• 15-lb bags of Posi-pak® fiber material and 50-lb bags of setting agent (finely ground bentonite with polymers and adhesive agents) and optionally portland cement are mixed in a spray applicator • A liquid base is pumped into the applicator. The liquid base can be either pond water or leachate • The Posi-pak® setting agent/ Portland cement mixture is introduced into the applicator and the three-material mixture are mixed to create posi-shell • The applicator is a pull-behind machine that is hitched to a dozer. Applicator comes with steel wheels, but is available with foam-filled rubber tires for an extra charge. Also, common hydroseeding equipment can be used. • The product is sprayed from a spray tower mounted on the applicator deck, while being pulled over the refuse area. The product can be sprayed up to 150-feet from the applicator • Thickness for daily cover is anywhere from 1/8 to 3/16 inches • Curing reportedly takes approximately 24-hours in warm dry weather and longer in cooler damp climates. Curing times can be decreased with the addition of Portland cement. • If Portland cement is used, cleanup of the equipment is required after use because the product will harden
Application Rate	• The material is sprayed on at a rate of 6- to 10-square feet per gallon • 1-man crew will take 60-90 minutes to mix and spray 2,000 gallons of posi-shell • 2-man crew will take 50-70 minutes to mix and spray 2,000 gallons of posi-shell • 2000 gallons of posi-shell will cover approximately 12,000 to 20,000-square feet
Advantages	• Material consumes minimal airspace • Material is friable, and therefore will not interrupt the drainage of leachate through the refuse • Simple application • Suitable for a variety of weather conditions, including moderate rainfall and high wind • Multiple uses possible, including use where erosion control is needed
Disadvantages	• Application control is dependent on operator. Spray shadow is possible and may require spraying from opposite angles to get complete coverage

	• Application is not recommended in heavy rainfall, therefore an alternate daily cover method must be available • Requires water supply and provision of Portland cement • Material curing time is dependent on Portland cement content, temperature, and rainfall • Requires post-use clean up of equipment • Additional equipment and staging area required • Potential longer curing time makes suitability for daily cover questionable • Equipment must be towed from the water source to the active face • Requires the use of onsite equipment that could be used for other activities • Additional surface preparation may be required to ensure a good surface cover is achieved • Not suitable for vehicle traffic, therefore additional cover material required where vehicle access is required • Regulatory authority approval required
Start Up Cost	• $42,900 for Easy Lawn C125 Landfill Machine purchase (does not include shipping cost)
Material Cost	• $19/bag (setting agent), $38/bag (fiber), $12/bag (Portland cement) (shipping cost included) • Cost excludes liquid base (water or leachate)
Shipping Cost	• Equipment Shipping Cost = $10,000 (for Easy Lawn C125 Landfill Machine)
Weekly Cost	• $7,500 • Assumes cover is applied to a 0.5 acre area, 7 days per week • Does not include water supply • Excludes preparation of a storage area and fuel
References	*"I've been in the solid waste industry for 30 years, most of that as a manager. The great thing going for Landfill Service Corporation (LSC) is their service record. We broke an axle on the applicator. LSC had a new axle on a truck and brought it to site the following day. We receive 2400-2500 tons/day of refuse and have an active working face of 150'x80'. The required area for the silo and loading area is 100'x50'. We use kiln dust as the mineral binder, which LSC orders for us. We use a D6 dozer to pull the applicator around the site. The applicator is on solid rubber tires. Rubber tires are suggested, because the steel tires cause the equipment to take a beating when traveling on rough solid ground. A 1/8 to ¼-inch layer is applied on the working face. The working face covered with Posi-shell is left for 7 days, because of the tipping sequence. Product does a good job at odor suppressing and the birds don't like it. If the product is applied prior to the rain and allow curing for 1 hour then it will hold up against the rain. It takes approximately 1 hour to mix, spray, and clean the applicator."* (URS personal communication with Jerry Johnson, Sampson County Landfill, Roseboro, NC)

Action

Spray applied covers are a feasible option for reclaiming airspace that would otherwise be occupied by soil daily cover. In order to implement at the site, the following actions will be required:

1. Obtain formal approval from GEPA for use of spray applied covers as an ADC. A field demonstration of the spray applied cover's effectiveness as an ADC may be required. A pilot trial should be conducted.

2. If the ADC is approved a detailed specification will need to be prepared. The specification will have t cover at a minimum the following: performance guarantees, operating cost guarantees, fuel and power requirements, cover performance, and site training.

3. At least three similar companies (if any) will need to be solicited once the specification is completed.

The approximate capital cost is: $52,900 (applicator and shipping cost)
Monthly operating cost is: $30,000 to $40,000 (excluding cost of water)

5.10. Daily Cover and Alternative Daily Cover Recommendations

None of the ADC options considered are applicable to all daily cover applications at the Dump. Specifically, the ADC options considered are generally susceptible to particular weather conditions, for example heavy rain or high winds, and are not suitable for vehicle traffic. Therefore, the use of soil for daily cover will always be required at the Dump. Further, the objective of this investigation was not to replace soil for daily cover. Rather, the objective was to find ways by which the quantity of soil used for daily cover can be reduced to a level that is effective in extending the life of the Dump. Therefore, the following recommendations are made in the context of daily cover application that uses both soil and ADC materials.

Of the options discussed above, the only alternatives likely to reduce daily cover consumption without compromising the quantity or quality of refuse placement are, reducing the thickness of daily cover and reclaiming daily cover. It is recommended that both these options warrant further consideration. However, reclamation and reuse of the previous day's daily cover is preferred because:

- it is most easily adapted to different material quality and weather conditions, that is, the quantity of material reclaimed can be adjusted to suit the prevailing conditions;
- the quality of cover left exposed overnight will be consistent with current practices;
- the need for additional refuse surface preparation will be minimized; and
- while regulatory authority approval will likely be required, the method is consistent with the requirements of the regulations.

In general terms, **it is recommended that daily cover applied to the top of refuse lifts and to the long side of refuse strips continue to consist of soil.** But the method of soil daily cover placement should be modified based on the above recommendations. The use of ADC materials, as recommended above and if approved by the regulators, should be focused on the working face.

For many of the proprietary products, the rental cost of the equipment necessary to store and apply the product is built into the material costs. This cost structure is typically based on the assumption that a minimum quantity of material is purchased annually. The estimated costs calculated for this investigation are based on typical cost structures and agreements. Specific agreements and contracts would need to be established for use at the Dump. Depending on the actual details and terms of the individual agreements, this cost structure may not be suitable for a situation where the particular product will be used in parallel with soil. The unit or weekly costs of the alternative daily cover materials may therefore be higher than those estimated herein.

Specific products recommended for additional consideration and field trials are as follows:

- Sacrificial Geosynthetic - Enviro-cover. This option requires no additional mechanical equipment and no specific storage requirements (except for deployer). The applicator rental can be included as part of the material purchase price or paid separately. The application method is relatively simple and would not require significant training.
- Spray Applied Cover - Waste Cover. This option requires purchase of a hydroseeding machine, which can also be used for a variety of other applications at the Dump or the new landfill. The material price does not incorporate equipment rental. The application method is relatively simple and would not require significant training.
- Spray Applied Cover – Posi-shell. This option requires purchase of an applicator. The product requires Portland cement be purchased separately. The application method is relatively simple and would not require significant training.

It is anticipated that ADC, if used, would be used to cover the working face when the prevailing weather conditions are compatible with the cover method. For time periods when prevailing weather conditions do not suit the ADC, soil would be used.

6. Pre-Closure Action Plan

6.1. Waste Diversion Measures

Waste diversion is the implementation of certain measures to redirect certain materials in the waste stream away from an MSW landfill. These select materials shall be commodities in a market ready to receive them. Such commodities include recyclable materials (paper, aluminum, plastics, cardboard, metals) and compostable materials (yard waste, wood, and paper). By removing these commodity materials from the waste stream, less waste will have to be transported to the Dump for disposal. A decrease of the waste stream into the Dump can increase the life of the Dump, thereby allowing more time for the Government of Guam to construct and begin operating the new landfill.

6.1.1. Cardboard Recycling

The 1995 GSWC&RF Study determined that 46.8 tons per day of corrugated paper (US) waste is generated by the civilian population of Guam. This is approximately 15% of the waste stream. Recycling the waste product could remove corrugated paper (US) from the waste stream entering the Dump.

There are three companies on Guam who recycle corrugated paper (US). The companies are:

- Aliron Far East
- Guahan Waste Recycling LLC
- Guahan Waste Control

There is a market in Asia for corrugated paper (US). Local companies are able to collect and package corrugated paper (US) and ship the material off-island. Currently, it is not feasible to collect corrugated paper (US) at no charge. The logistical costs for collection, preparation, and off-island transport is more than the revenue that can be generated for the recycled product. However, the net cost when compared to the tipping fees charged by DPW to dispose of this material at the Dump are larger than the cost to recycle.

The process of recycling corrugated paper (US) is, in general, as follows:

- purchase a compactor and bailer to be placed at the site of disposal;
- compact and bail corrugated paper (US) on-site;
- vendor collects bailed/binned material;
- material is stockpiled at the vendor's lot; and
- the stockpiled material is shipped off-island to a recycling vendor (typically once a month).

Local establishments separate and bale cardboard that fill up approximately ten 40-foot containers per month.

Action

Cardboard recycling is recommended as a waste diversion method. The following actions will be required to implement this action:

1. Identify regional locations of the placement of cardboard waste bins. Controlled locations such as schools and mayors office provide a village to village point of disposal.

2. Secure bins for cardboard disposal. Public awareness of the bins, bin location and acceptable material must be implemented prior to the placement of the bins.

3. Secure a location(s) for the placement of the compactors and bailers. Two models may be used.

4. Place several compactors and bailers at the regional sites. This will have a higher capital cost and require a larger area.

5. Place a single compactor and bailer at a central location to where collected bins are transported. It is recommended that this site be located as close to the point of shipping as possible.

6. Initial government support and subsidizing will be required.

The approximate costs are as follows:

$50,000 capital cost (bailer and compactor)
$75 per 20 cy container (include transportation and shipping)

Documentation on this action is provided in Appendix C.

6.1.2. Curbside Recycling/Source Separation

Curbside recycling/source separation refers to a program in which the waste generator (hotel, residential, commercial, retail, and restaurant) take it upon themselves to separate their waste, recyclable from non-recyclable materials.

A number of materials typically found in the waste stream can be recycled, but the materials that should be separated from the waste stream is dependent on whether there is a local market for the collection, management, and recycling of the material (on- or off-island). Recycling activities on Guam include the recycling of aluminum and corrugated paper (US). Aluminum and corrugated paper (US) represent 3% and 16%, respectively, of the total waste stream (by tons). Not all of these recyclable materials are currently being separated for recycling. Recycling of these materials is performed at a relatively small scale compared with communities in the U.S. mainland.

In order to implement a meaningful recycling program that would translate to an extended life of the Dump, several actions items would need to occur, including:

- create a desirable market for companies to recycle other materials;
- develop and implement a comprehensive island-wide recycling program;
- educate the public about the recycling program, which should stress reducing consumption;
- provide recycling bins for the various waste generators;
- develop the collection infrastructure (i.e., obtain automated collection trucks);
- develop a "clean" materials recovery facility (MRF) to receive, separate and prepare recyclable materials for marketing to end-user manufacturers; and
- if not privatized, provide staging areas for the collected recyclable materials prior to off-island transport.

The costs associated with implementing a comprehensive recycling program are dependent on the market development for these commodities. Start-up of such a program can be costly, but more importantly, the development and implementation could take anywhere from 3-5 years. For the objective of this Action Plan, 3-5 years may be too long to wait to get a program implemented that can divert waste from the Dump. In the long-term, an island-wide comprehensive recycling program should be implemented so that the challenges experienced by operating the Dump can be avoided.

6.1.3. Yard Waste Diversion

Yard waste is the portion of the waste stream composed of grass clippings, leaves, twigs, branches, and other garden refuse. Yard waste is approximately 9.3% of the total waste stream (by tons). Diversion of these materials from the Dump would occur in the same manner as recyclable materials mentioned in Section 6.1.1, except that yard waste would have their own separate collection bin.

The contents of this bin would be collected in the same manner, but would be taken to a composting facility or a chipping facility, where it would be made into mulch or wood chips.

In order to implement a meaningful yard waste recycling program that would translate to an extended life of the Dump, several actions items would need to occur, including:

- create a local market for mulch, wood chips, or compost;
- include yard waste recycling in the comprehensive island-wide recycling program;
- educate the public about yard waste recycling;
- provide yard waste bins for the waste generators likely to have yard waste in their waste stream;
- develop the collection infrastructure (i.e., obtain automated collection trucks); and
- develop the composting/wood chipping facility(ies) to compost/chip yard waste.

The development and implementation of this program should be included as part of the comprehensive island-wide recycling program.

The 2006 Integrated Solid Waste Management Plan (ISWMP) provides additional information on composting. The simplest method of composting as presented in the ISWMP is passive composted which consists of stockpiling the yard waste.

The Aerated method which introduces oxygen to the yard waste produces increases the decomposition rate and is not much more complicated then the passive method. This aerated method is recommended for the initial startup of the yard waste site.

An alternative to a full-scale yard waste diversion program, as mentioned above, would be to separate select yard waste and untreated wood waste at the Dump and to chip these materials into a useful commodity, hog fuel. The hog fuel can be used as an ADC, pending approval by the local regulators. Select yard waste would have high wood content and low green (leaves) content. Action items that would be required to implement an alternative yard waste diversion program would include:

- obtain approval of the regulators to use hog fuel as an ADC;
- identify and prepare a location at the Dump where wood chipping can be performed, including a stockpile area;
- purchase a grinder; and
- acquire training for Operations personnel in the separation of select yard waste, wood chipping, and wood chip placement on the active face as an ADC.

The capital and operating costs for hog fuel is discussed in Section 5.4.2 Hog Fuel.

Action

The following actions may be required if a separate yard waste processing facility is desired:

1. Additional on island research. The Department of Agriculture and the University of Guam have conducted many studies and experiments on this topic. The experience and information gained by local individuals should be used in developing the yard waste site

2. An EIS may be required as the site will serve as a yard waste dump site and could potentially see 37.2 tons/day (peak) of yard waste. It is presumed that this facility will include a:
   - tipping area;
   - Grinder(s);
   - composting area (if end-product is not used as ADC at the Dump or new landfill);
   - hog fuel stockpile area; and
   - fire suppression control system.

Construction documents for this site will need to be prepared. It is recommended that a performance specification be generated as well to allow for a private operator to design, construct, and operate the facility.

Citing of this facility is critical. It is recommended that the site be in a central location or in the proximity of the new landfill.

Documentation on this action is provided in Appendix C.

6.1.4. Material Recovery

The activity of recovering valuable resources from the waste stream is typically performed at Materials Recovery Facilities (MRFs). A MRF is a specialized plant that receives, separates and prepares recyclable materials for marketing to end-user manufacturers. There are two types of MRFs, clean and dirty.

A clean MRF accepts recyclables that have been collected in commingled recycle bins. A dirty MRF accepts a mixed solid waste stream and then separates out designated recyclable materials through a combination of manual and mechanical sorting. The complexity of the sorting process depends on the technical specifications established by the end-user manufacturers. The remaining waste is transported to an MSW landfill for final disposal.

A properly functioning MRF (single-stream technology) may comprise the following components:

- the structure itself;
- conveyor belt, from which workers manually pull out select items;
- screening machine;
- trammel-mag;
- air classifier;
- electromagnet device to divert aluminum cans into a storage bin;
- compactor; and
- transport containers for the separated recyclables and waste.

A MRF is a designed facility and its type, capacity, location, internal equipment, ingress and egress patterns are dependent on the commodities expected to be recovered at the facility.

Similar to implementing a comprehensive recycling program, the time to design, construct, and begin operations of a MRF may take up to 3-5 years. For the objective of this Action Plan, 3-5 years may be too long to wait to operate a MRF that can divert waste from the Dump. A MRF should be included in the comprehensive recycling program.

Action

If this option were to be implemented, the development of a MRF would require, at minimum, the following:

- site selection;
- re-zoning of the site;
- EIS ($350,000 – 400,000)/permitting (1.5 years);
- design ($220,000; 3-5 months); and
- construction ($3 to 4 million, 1.5 years including bidding phase).

The cost range for construction is highly dependent on the commodities that the MRF would be designed to separate and if the MRF is a clean or dirty MRF. A dirty MRF would require more complex materials processing.

6.2. Waste Volume Reduction Measures

6.2.1. Deep Dynamic Compaction

Deep dynamic compaction (DDC) is a ground improvement technique used to reduce void space, increase density, and reduce long term settlement in soils. It has also been used in landfills to densify the waste for the purpose of redevelopment and in several cases to extend the life of a landfill by "reclaiming" airspace. This reclaimed airspace can be occupied by additional waste filling.

The technique involves the repeated impact loading of the ground surface by heavy steel or concrete weight (typically 10 to 40 tons) dropped from heights of up to 120 feet.

Impacting is performed in a pre-planned grid pattern, the depth and degree of improvement being dependent on the tonnage of the weight, height of the fall, and the degree and suitability of the soils/waste being compacted.

It is expected that the amount of volume reduction induced is proportional to the input energy used within a practical range. However, previous landfill case studies show significant variability in effective ranges for the relationship, possibly due to variability in initial density of wastes prior to compaction efforts (Fellows, 1995, FHWA, 1997). Density generally increases with the age of the fill, due to surcharge loading by the placement of added overlying waste fills, or "overburden", causing older waste to densify and settle by void space reduction. Younger wastes or at shallower depths without the same stress history and settlement will thus generally exhibit greater volume reduction and densification as a result of DDC.

A reliable estimate of feasibility and cost-effectiveness of DDC at the Dump for the purpose of extending its use will require collection and analysis of site specific subsurface data in greater detail than available from this conceptual desktop review. At least preliminary characterization of the nature, composition, and behavior of actual field conditions and in-place waste characterization will be critical. Also, sideslope stability would have to be analyzed, because the DDC technique may cause excess pore pressures that may create instability at the sideslopes of the mounded waste mass. However, an initial assessment of DDC feasibility can be supported by comparing limited known conditions at the site and compaction performance goals.

An example of DDC design criteria and performance is reported in a case history at a landfill in Arkansas for the purpose of constructing Highway 71 (Hayward Baker Company). The landfill had a waste depth of 20 to 38 feet, including a 2-foot soil cover. DDC was performed in three passes: primary, secondary, and tertiary. The primary pass involved the dropping of a 20-ton weight, ten times, from a height of 88 feet at 15-foot grid spacing. A settlement depth of 6.5 feet over an average crater diameter of 13 feet was achieved in the primary pass. The secondary pass involved the dropping of a 20-ton weight, ten times, from a height of 88 feet at the center point of the 15-foot primary grid. A settlement depth of 6 feet over an average crater diameter of 13 feet was achieved in the secondary pass. The tertiary pass was a repeat of the primary pass. A settlement depth of 4.5 feet over an average crater diameter of 13 feet was achieved in the tertiary pass. The average settlement depth within the created craters was approximately 10 feet, with a net compression of the sanitary landfill of some 5 to 8 feet. This settlement depth is consistent with an order of magnitude rule of thumb based upon DDC experience to estimate approximately 30% volume reduction achievable over a depth of influence of 20 to 30 feet. This equates to approximately 6 to 9 feet of settlement over the area treated by DDC.

Issues of concern in employing DDC at the Dump include:

- undocumented waste stream that may include UXOs;
- unstable sideslopes due to potential unstable initial conditions or excess pore pressure in wet areas created by DDC tamper impacts;

- shallow water (or leachate) table that could dampen the influence and depth of energy delivered by DDC; and
- potential for waste rebound if the significant portions of waste materials are not easily compacted (plastics, large furniture pieces, and other bulky materials).

Safety issues that should be considered in performing DDC include, but are not limited to:

- maintaining a safe distance from the edge or top of slope, because of the potential of sloughing at the sideslopes;
- maintaining a safe clear distance from the DDC activity in order to avoid potential projectiles (waste materials); and
- the potential to encounter and be required to manage leachate.

The cost-effectiveness of DDC at the Dump can be determined by comparing an initial budgetary cost estimate to perform DDC with the potential revenue generated by the reclaimed airspace. The current tipping fee for the Dump, effective November 1, 2005, is $5 revenue per cy of waste received (uncompacted). Using an initial unit price estimate for DDC of approximately $2 to 3 per square foot (sf) to attain an assumed 8 foot settlement (approximately 0.3 cy unit void space) achieved by DDC, results in a potential created revenue volume of $1.50 per sf. This results in a basic operational cost-benefit ratio of about 0.5 to 0.75 (A cost-benefit ratio of 1 is the break-even point, where a ratio above 1 would mean the pursuit would be beneficial for the client, which in the case of the Dump would require a compacted volume of 11 to 17 cf/sf treated to develop $2-3/sf revenue).

If costs of incidental damages prompts interest to better develop feasibility of DDC, prior to a large scale DDC program at the site, further subsurface investigation should be performed followed by a field trial at the site to validate effectiveness. The field trial would require deployment of a tracked crane to the site with drop weight and surface preparation for a stable crane pad. Results of the field trial can better define a production program and attainable DDC cost-effectiveness at the Dump.

6.2.2. Mobile Incineration

Mobil incinerators have been used in Europe with good success and are generally used to incinerate biological waste, wood and paper products. These units are mobile and are well suited to mobilization at active sites like the Ordot Dump. Waste would have to be separated in order to make full use the mobile incinerators. In general, capacities for readily available units range from 70 lbs to 100 lbs per hour.

These incinerators will require permitting with GEPA air and solid waste programs. Given the limited capacity of these units, when compared to a waste stream rate of 316 tons/day (wet season), multiple units will be required to provide volume reduction. **This action not considered feasible.**

7. Post-Closure Action Plan

7.1. Alternative Sites

Three sites were investigated as part of the site section report conducted in 2004. These sites were: Dandan (Preferred site), Sabana Batea and Lonfit.

Detailed information on the Dandan site is provided in Section 7.4. Site information on the remaining site evaluated is provided below.

The Sabana Batea site primarily occupies Lot nos. 177-4-R2-1 and 177-4-2NEW-1 and is located approximately 1km (0.62 miles) southeast of the existing Ordot Dump. The main access to the Sabana Batea site will be through Route 4 by way of Dero Road and the Leo Palace Resort access road. Dero Road must be upgraded to a 2-lane paved roadway with 8-ft wide shoulders. A secondary access road may be created through Pulantat, Yona and would require upgrading and widening of 1.9 miles of existing roadway from Yona Village through Pulantat Road and construction of about 2000 linear feet of new roadway extending from Chalan Teleforo, located east of the Leo Palace Resort to the Sabana Batea landfill site. The proposed landfill would have a footprint that is located south of the Leo Palace Resort access road. The dimensions of the proposed landfill footprint was approximately 1,800 feet wide by 3,000 feet long and would be sited in the eastern corner of the parcel and occupy approximately 125 acres.

The Lonfit site primarily occupies Lot No. 450-4 and a few undeveloped residential lots. The Lonfit site is located approximately 0.5 km (0.31 miles) northwest of the existing Ordot Dump. The main access to the Lonfit site will be through Route 4 by way of Dero Road. The proposed footprint would be sited in the central portion of the parcel where it is generally flat and level. The dimensions of the proposed landfill footprint was approximately 3,800 feet long with a width ranging from 940 to 2,400 feet and would occupy approximately 148 acres in area.
Several wells were drilled in the Lonfit site area by the military in the late 1940s. The wells were located near the divide separating the Lonfit-Sigua drainage. Not all of the wells showed consistent water production, the records suggest that groundwater in this area can be successfully developed.

In addition to the sites listed above, the NASA tracking station located adjacent to the Dandan site has been offered to the Government of Guam for Landfill operations, as stated by DPW (Dominic Muna). The area known as the former NASA tracking station is located directly north of the Dandan location (Lot B-3-REM) and covers a land area of approximately 159 acres. Access to this site is by way of Route 4 through Dandan Road.

There are two operating landfills (other than Ordot Dump) on Guam which are owned and used by two branches of the U.S. Military, the U.S. Navy and the U.S. Air Force.

GRRP has stated that the site will be able to accept waste within *six months* after the landfill permit is approved.

Information received from DPW states that the required average daily waste tonnage to the site must be 300 tons/day and not exceed 350 tons/day

Action

This option will require an operational permit before solid waste can be accepted at the site. To date this permit has not been attained. This requirement is out of DPW's control and depends on GEPA, USEPA, and authorizing government agencies.

7.3. *Ordot Dump Closure / East Valley Cell / Interim New Guam Landfill Cell*

The January 2008 survey indicates that filling has not occurred in the eastern portion of the Dump, up to the east Final Limit of Waste. Filling in this area was previously planned, as part of the Ordot Dump Closure design. This valuable airspace can be used for additional filling at the Ordot Dump. Filling may occur prior to closure construction or it may occur after closure construction is completed. If filling were to occur prior to closure construction, it can be performed in a manner spelled out in the Operations Plan and Final Filling Plan.

If filling were to occur after closure construction is required to begin, due to a court-ordered closure, filling may be able to be performed above and adjacent to the existing waste mass. This "piggy-back" filling will occur in the existing east valley (area between naturally occurring ridge to the east and the existing waste mass). Filling will not extend beyond the Final Limit of Waste, identified in the 2005 Ordot Dump Closure design. Filling in the east valley will also only occur after a geosynthetic base liner system is installed.

The timeline of the concurrent Ordot Dump Closure and active filling of the East Valley Cell at the Ordot Dump would be as follows:

1. Ordot Dump Closure date is established.
2. Approval for East Valley Cell is granted.
3. East Valley Cell Closure date is established in advance to accommodate simultaneous design of the Ordot Dump Closure, East Valley Cell development, and East Valley Cell Closure. The date the East Valley Cell will cease receiving waste would be the same date that the new Guam landfill will begin receiving waste. Early establishment of the Ordot Dump and East Valley Cell closure dates is required so that the final filling topography of the entire site can be calculated and modeled. This final filling topography will then be used as the "existing conditions" for when the Ordot Dump Closure contractor mobilizes to the site. Waste stream reduction (recycling, composting, etc.) and on-site waste volume

reduction (daily cover use modifications, use of ADCs, dynamic compaction, etc.) measures that may be implemented must also be accounted for in the final filling plan, because these measures affect the ultimate topography of the site.

4. Simultaneous design of the Ordot Dump Closure, East Valley Cell development, and East Valley Cell Closure.
5. Design review, modification, acceptance, and permitting.
6. Advertise for construction, the Ordot Dump Closure and East Valley Cell development. Separately advertise the East Valley Cell Closure. If the government chooses, the East Valley Cell Closure can be advertised to bid at a later date. A preferred bidding scenario is to advertise for bid all three designs at once, to minimize the time occupied by the bidding process and to keep consistency between closure and development construction.
7. Lowest responsible contractor is identified, qualifications verified, bid and performance bonds accepted, and construction contract is awarded.
8. Contractor mobilizes to the site. Construction and active filling activities will likely occur in the following order:
    a. Simultaneously:
        i. Construct leachate management system (leachate collector trench and sanitary sewer line to existing sanitary sewer system adjacent to Agueda Johnston Middle School).
        ii. Construct bottom liner of East Valley Cell from east ridge (or some distance up the east ridge) to a location above the toe of the eastern slope of the existing waste mass. The bottom liner will come up the slope of the existing eastern sideslope an adequate distance, so that it can be welded to the Ordot Dump Closure cap geomembrane. The distance the liner system for the East Valley Cell is terminated is dependent on the amount of waste the East Valley Cell would have to accommodate.
        iii. Waste excavation and relocation for the MSE wall construction. Waste to be relocated to the top deck for permanent relocation and temporary staging (portion of waste to be placed behind the MSE wall when completed).
        iv. Active waste placement of incoming waste to be transported by waste haulers to the top deck. For safety reasons and space limitations at the top deck, waste haulers may be required to tip their loads below the top deck and either Operations or Contractor will transport waste to the top deck for final disposal.
        v. Construct temporary erosion and sediment control measures to protect the construction work and the adjacent areas outside of the construction zone.
        vi. Construct tie-in of East Valley Cell leachate management system with Ordot Dump Closure leachate management system.
    b. Construct Ordot Dump Closure stormwater management features.
    c. Construct Ordot Dump Closure landfill gas management features.
    d. Construct Ordot Dump Closure capping system.
    e. Place incoming waste in the East Valley Cell.

1. The Navy operates a landfill on Naval Station. This site has strictly been used by Navy for residential and commercial waste generated by the Navy and their operations

2. The Air Force operated a landfill on Anderson Air Force Base. This site is located over a closed dump and strictly accepts Air Force residential and commercial waste generated by the Air Force and their related operations

DPW has stated that these two Military landfills are **not feasible options** for disposal of Guam's municipal solid waste, as the military intends to close these two landfills and use the new civilian landfill once open.

Action

The sites listed above, less the Dandan site, will all require additional investigations and design work and construction. **This action is not considered feasible.** However, continued investigation of alternative sites located on Government land which could be proposed as temporary sites to be used in the event of emergency should be conducted.

7.2. Private Landfill

A recent development is the intention of Guam Resources Recovery Partners (GRRP) to independently develop a landfill sited on Lot 439-R1 Parcel B, in Santa Rita. The initial construction plan is for the landfill footprint to occupy a total area of 24 acres and would be comprised of two landfill cells. Initial access to the landfill site is by Route 17 and would pass through residences along Felix Babauta Street. The length of the new access road from Felix Babauta St. to the landfill site is approximately 3,500 feet. Upon complete construction of the first landfill cell, the primary access road would be through Route 5 along an access road easement located at the southeast corner of the parcel.
The initial access road through Felix Babauta St. is projected to be completed in July 2008. A hydro geological study of the area remains to be completed, along with the entire permitting process. The first landfill cell is projected to be completed and opened by September 2008 at the earliest.

The following information has been extracted from presentations given by GRRP:

Estimated time for permitting:	500 days
Design and construction:	900 days
Total:	1,400 days
Permit application submitted:	September 30, 2007
Completion date:	July 31, 2011

7.4 Barging

Barging of waste is the process in which waste is collected, transported to a transfer station, compacted and loaded into seafaring containers, transported to a port facility, loaded onto a barge, transported over water to another port facility, unloaded and transported to a receiving landfill (either over road or on rail), and tipped at the receiving landfill for final disposal. Several reasons a community would barge their waste include:

- existing local landfill(s) are at or near capacity and eventual closure;
- lack of land to construct a landfill facility locally;
- inability to select an available site that would not be harmful to the local environment; or
- Development and operating costs for a local landfill are higher than the revenue that can be generated, due to either low incoming waste stream volumes or low tipping fees or a combination of the two.

Although Guam is in a situation in which the only civilian MSW facility is at or near capacity and eventual closure, the process of developing a new civilian MSW facility in Dandan, Inarajan has already begun. If waste barging were to be implemented on Guam, the potential revenue to be generated by operating the new MSW landfill may be diverted to waste barging operations; therefore in direct competition with the new landfill.

Barging of waste cannot be implemented before performing studies, securing applicable permits, and developing infrastructure for waste barging activities. Activities that would need to be performed in order to begin waste barging, at a minimum, include the following:

- locate an MSW landfill willing and able to accept the expected waste volume and waste composition in the local waste stream;
- Perform a tipping fee cost analysis to determine the required fees to be charged to waste generators. Tipping fees should pay for the collection of waste, development and operation of a transfer station(s), transportation of waste from the transfer station to the port facility, purchase/lease of seafaring waste containers, loading of containers onto a barge, transport over water, unloading of containers at the other port facility, transport to a MSW landfill, tipping fee at the MSW landfill, and the reverse transport of the empty containers to Guam;
- determine if required revenue generated by tipping fee would be acceptable to the local community;
- obtain required permits/approvals from regulators and agencies to construct and operate a transfer station and barge waste;
- Develop financial (collections) and physical (facilities, equipment, and training of waste operators) infrastructure required for waste barging.

As with any method of waste management, the operating costs may increase with time. For this reason, the tipping fee analysis should be updated regularly to determine the required change in tipping fees to ensure a positive revenue flow.

9. Obtain certification from regulators that Ordot Dump Closure activities are completed and accepted.
10. Begin Post-Closure Care and Maintenance of Ordot Dump.
11. Stop receiving waste at the East Valley Cell, when the new Guam landfill is ready to receive waste.
12. Construct East Valley Cell closure cap, landfill gas management features, and stormwater management features.
13. Obtain certification from regulators that East Valley Cell closure activities are complete and accepted.
14. Begin Post-Closure Care and Maintenance of East Valley Cell.

An alternative to developing and filling in the East Valley Cell would be to develop a "mini" cell at the new landfill site in Dandan. This "mini" cell shall be sized so that it can be constructed in a short time and must be completed prior to ceasing the acceptance of waste at the Ordot Dump.

7.4. *Increased Footprint at the Ordot Dump*

The 2004 design has the east Final Limit of Waste extending approximately 140 ft east of the Existing Limit of Waste. Based on review of historical aerial photographs, the area of expansion has been used to store waste. DPW has since relocated waste from this area to the Ordot Dump proper. The 2004 design included filling in this area to accommodate the expected incoming waste stream prior to closure construction.

GEPA has expressed concern that this horizontal expansion will require approval from both GEPA and USEPA.

Action

- Obtain approval for expansion to the east from GEPA and USEPA.
- Prepare area for expansion by:
  - constructing the eastern stormwater run-on/run-off control ditch
  - construct temporary retention/detention pond downstream of eastern waste footprint
- Prepare the Filling Plan Standard Operating Procedure (SOP) for the placement of waste.

The SOP will be prepared by DPW with the assistance of Duenas, Bordallo, Camacho & Associates (DBCA). Once complete the SOP will be submitted to GEPA for approval.

This action may be revised based on Section 7.3 Ordot Closure /East Valley Cell/Interim New Guam Landfill Cell

Unless the Government of Guam is prepared to take a different approach in their waste management, waste barging is **not considered feasible.** Barging would be in direct conflict with a new landfill, one in which the Government has dedicated time and money to develop. The Government is also under court-order to open a new MSW landfill.

7.5. Dandan Site

The Dandan site has been evaluated by DPW and selected as the preferred site. This site has also received GEPA and USEPA approval. Sections 8 and 9 provide additional information on this action

8. Recommendations

The following items were considered in determining the "Action" recommendations:

1. Remaining airspace 288,111 cy or December 2009
2. Dandan site opening July 2010, based on authorizing work in January 2008
3. Compliance with the expired GEPA Operations Permit #05-060LFL
4. 2006 ISWMP
5. Feasibility of Action

Recommendations have been separated into three actions:

- On-going Operations
- Pre-Closure
- Post-Closure (include Court-ordered Closure)

<u>On-going Operations</u>

The continuous use of daily cover is recommended and required. DPW shall develop an SOP for the efficient placement of soil cover. Techniques such as soil recovery, minimizing the active face, and prohibiting self-haulers from tipping at the active face shall be implemented.

The actions stated in Sections 5.2 to 5.9 shall be evaluated during final filling SOP. The implementation of these actions will begin once the SOP has been developed. SOP development will be completed and submitted for GEPA review by May 11, 2008

Prohibiting self-haulers from tipping at the active face will be implemented. The action will restrict self-haulers from the active face; thereby reducing its required size. A smaller active face translates directly to a smaller volume of daily cover required. **This will have a positive impact on the airspace consumed by daily cover. The conserved airspace can be used for additional waste disposal.**

Additional resources such as a central transfer station and additional bins at the remaining (3) transfer stations will be required. The proposed interim location for the central station will be the eastern portion of the Dump. Additional bins, personnel and longer operation hours, as needed, will be implemented at the three existing transfer stations. This action will be implemented once the filling plan SOP has been submitted to GEPA. The timeframe from complete implementation of this action is estimated to be 90 days.

Should additional airspace be needed, the actions listed in Section 5 may be implemented. **These actions are not recommended at this time.**

Pre-Closure

Pre-closure activities are largely waste diversion measures. These actions include:

1. Increased Cardboard Recycling
2. Yard Waste Disposal/Composting Site
3. Curbside Recycling/Source Separation
4. MRF
5. Deep Dynamic Compaction

Increased Cardboard Recycling

Increase cardboard recycling is recommended. There are vendors on-island who accept used cardboard and ship it off island for recycling. As stated in Section 6.1, cardboard recycling operations do not generate enough revenue to cover collection and shipping costs and will require either government subsidy of patron tipping fees. Two options are proposed for this action:

1. Coordinate with commercial recycling vendors and advise them that the Dump will no longer accept cardboard. Allow the vendors to modify operations to receive the influx of cardboard waste. Once this is complete, notification will be given to residential and commercial haulers that the Dump no longer accepts cardboard and it must be disposed of at one of the commercial vendors. The hauler will have to bear the cost of cardboard disposal.

2. Place cardboard bins at regional centers such as transfer stations and Mayors' offices. Commercial and residential haulers will be advised that the Dump no longer accepts cardboard and it must be disposed of at one of the regional stations. The Government will have to pickup the cost for disposing of the cardboard.

This action will require a separate feasibility study to determine which option (and additional options) will best be suited for cardboard waste disposal. Once implemented the action will reduce the waste stream into the Dump and will fit into the 2006 ISWMP.

Yard Waste Disposal/Composting Site

This action is required by DPW's operations permit #05-006LFL, therefore **this action must be implemented.** As stated in Section 6.1.3 Yard Waste Diversion, this action will require an EIS. However, if an emergency be declared for solid waste management, GEPA may issue a conditional permit to allow for the immediate implementation of this action. Site selection and construction documentation will be required.

A wood chipper may be procured and mobilized to the Dump. This action will aid in decreasing the bulk volume of wood and could be used as an ADC (Hog Fuel) or as landscaping material.

Curbside Recycling/Source Separation and MRF

These actions are listed in the 2006 ISWMP. DPW and GEPA should move toward implementing this action. However, the time needed for implementation of this action will have little to no impact on operations at the Dump.

It is recommended that the first steps of a MRF facility be undertaken. These steps include:

1. Potential site selection
2. Identify Funding
3. EIS

Deep Dynamic Compaction

This action is not recommended. As stated in Section 6.2.1 the benefits of this action are outweighed by the costs.

Post-Closure

Post closure actions are actions which were considered should the Dump be closed and the new landfill is not operational. These actions include:

1. Dandan Site
2. Alternative Sites
3. Private Landfill
4. Ordot Dump Closure
5. Barging

Dandan Site

The construction of the approved Dandan landfill will require at least two Guam dry seasons. This means that if the Landfill contractor mobilizes to the site by June 2008 the site will not be ready to accept waste until June 2010. This is six months past the

estimated time the Dump's air space is used up (based on the 2004 closure design). In order for the opening of new cells at the Dandan site to occur before the remaining capacity of the Ordot Dump is utilized, work on finalizing the design and other activities must begin immediately, which would require immediately lifting the prohibition against expending funds on the Dandan landfill prior to Government Acquisition of the property. If the prohibition is lifter, the acquisition could occur along a parallel track with the needed design work.

This is the general path that must be taken. Actions listed above (minimizing soil cover, and waste diversion) will be implemented to acquire additional airspace for waste disposal.

A re-design of the Ordot Dump Closure will be required. This redesign will have to account for current conditions, implementation of approved-value engineering recommendations, and addressing outstanding comments. **An assessment report is currently underway to address these items and identify required modifications to the closure design.**

Alternative Sites

GEPA has stated that no alternate landfill or temporary dump site will be approved. As such **this action is not recommended.**

Though listed as not feasible, the two military landfill sites will be the only sites operating should the Ordot Dump be closed and a new landfill is not open. It is recommended that the Military be engaged in further discussions in order to determine whether any options exist for disposal of either limited quantities of or select portions of Guam's municipal solid waste stream.

Private Landfill

As stated earlier, steps are underway to open a private landfill on Guam. The opening date for this landfill is still uncertain. As such, **no recommendation is provided.** DPW should stay informed of this private pursuit, because if/when open, it will provide an alternative disposal site if the Dandan site is not to be constructed.

It shall be stated that this private landfill has been approved by the Government of Guam and if open, the Government of Guam will be required to transport 300 tons/day to the site.

Ordot Dump Closure/ New Ordot Landfill / Interim New Landfill Cell

This action has been accomplished on Guam. The Anderson dump was capped and a new compliant landfill was active on top of the capped dump. This action will require the redesign of the 2004 closure design and the concurrent design of a compliant landfill cell

(East Valley Cell). The Ordot Dump Assessment Report will consider this action. **The action may prove to be a viable option should additional delays in the Dandan site occur. Coordination and approval by GEPA and USEPA is recommended.**

9. Conclusions

The primary intent of this Action Report was to address the actions DPW would have to take if the Dump were closed (presumably because of reaching final capacity) prior to the opening of a new permitted municipal solid waste landfill. The first step in addressing such a situation is to determine when the situation will arise. Based on the recent survey data, if the Dump closure cap design is not altered and nothing is done to reduce the amount of waste being placed in the Dump, the Dump will have to be closed in 2 years. That being said, it is concluded that all possible actions should be taken to 1) adjust ongoing operations to minimize the usage of available space within the Dump; 2) divert waste prior to closure of the Dump to extend its useful life to beyond the remaining 24 months; and 3) accelerate the opening of the new landfill. If the Operation Actions and Pre-Closure Actions recommended are carried out, it is possible to extend the remaining operational life of the Dump beyond the 24 months stated herein. It is important to realize that if such can be accomplished, the technical requirements of design and construction of the new landfill (initial cells) at the Dandan site can likely be accomplished within this period, *provided that such activities be allowed to commence now. This will require the removal of the existing prohibition against expenditure of any funds for the Dandan landfill project that is currently in effect.*

If the preceding actions are not accomplished, it is then likely that the Ordot Dump will be required to close before a new permitted municipal solid waste landfill is in operation. DPW will then have to divert waste to a staging area (temporary dump site). As GEPA has stated that no temporary disposal sites will be permitted or approved, such action will be in violation of existing solid waste regulations. This will certainly call for an emergency declaration by the Governor of Guam. With this emergency declaration DPW may be able to open a staging area(s). Site preparation and construction of such a staging area should be conducted, along with coordination with GEPA, to assure the site will have the minimal impact once waste is redirected from the Ordot Dump.

Therefore, in determining the "action" that will be taken, the timing of Ordot Dump closure will dictate what direction is taken:

- Should the Ordot Dump be closed immediately (within the year), DPW will have to set up a temporary dump site. This condition may be similar to conditions encountered during post typhoon events. Delayed collections, trash pile up and potential environmental impacts to temporary site could be realized

- Should the Ordot Dump be closed at the end of two years (December 2009), DPW will have to work with the executive office to expedite the new landfill construction. Perhaps obtaining a permit from GEPA for placing waste at the Dandan site before construction completion. As stated earlier, if notice to proceed

is given this month (January) to continue design work for the new Dandan site, the optimistic target date for opening is July 2010. Two options are available to DPW for this scenario:

- Condemn the Dandan site and receive title (or in the alternative, remove the existing prohibition to continuing project funding while condemnation process is ongoing). This will allow for revenue appropriation for the continued design work needed for the Dandan site

- Send the pre-final design package out to bid and require the successful respondent to Design/Build and Finance the construction and operation of the Dandan Landfill.

➢ Should the Ordot Dump be closed and the end of two and half years (July 2010), DPW may be able to secure a proper permit for the operations of a new Dandan landfill. This is certainly the preferred option, but is dependant on proceeding with design work.