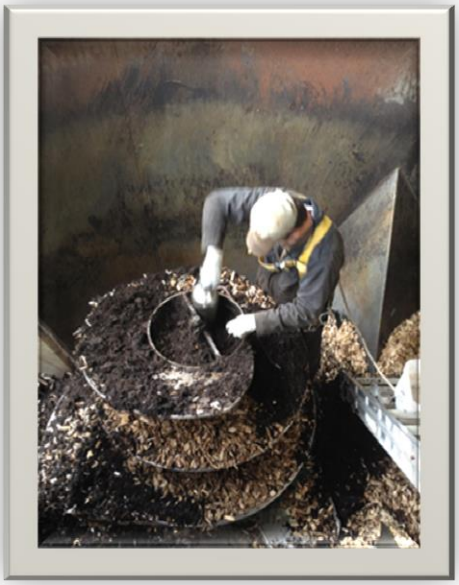
GREEN MOUNTAIN COMPOST BUSINESS ANALYSIS

Final Report | January 5, 2018



Prepared by:

DSM ENVIRONMENTAL SERVICES, INC.
Resource Economists
Environmental Scientists

WeCare Denali

DSM ENVIRONMENTAL SERVICES, INC.
Resource Economists
Environmental Scientists

GREEN MOUNTAIN COMPOST BUSINESS ANALYSIS

Final Report| January 5, 2018

TABLE OF CONTENTS

DSM ENVIRONMENTAL SERVICES, INC.
Resource Economists
Environmental Scientists

Executive Summary

Introduction

The Chittenden Solid Waste District (CSWD), a municipal union created to manage solid waste generated in Chittenden County, VT, assumed operations of Intervale Compost Products in 2008 and constructed the Green Mountain Compost (GMC) facility in Williston. GMC is now the largest composting facility in Vermont and the primary processing facility for both food waste and yard waste in Chittenden County. GMC composted roughly 5000 tons of food waste and 5000 tons of yard waste in FY 2017, of which greater than 90 percent originated within Chittenden County.

The Vermont Legislature unanimously passed Act 148 – The Universal Recycling Law - in 2012. The organics portion of the law bans food scraps from landfill disposal in 2020. Currently, businesses generating 18 tons or more of food scraps a year must divert this material from disposal if there is an organics processing facility within 20 miles of the generator. This generation threshold drops annually with the current law banning all food residuals from disposal on July 1, 2020.

Chittenden County represents 26% of Vermont's residential population (Census, 2016), and an even a greater percentage of commercial food waste generators. An analysis of Act 148 for the State of Vermont estimated that by 2020 Vermont would need to process 28,550 (rounded tons) of food waste state-wide.[1] This would translate into a need to process an estimated 8,200 tons of food waste generated in Chittenden County.

As such, GMC's ability to process large quantities of food waste is seen as critical to the success of Act 148. If GMC did not exist, or were to be closed without a viable alternative facility in Chittenden County, it would send a strong signal to the Vermont Agency of Natural Resources and to the Legislature to reconsider the food scrap ban included in Act 148. In addition, the CSWD would have to find an alternative way to manage yard waste generated in the District.

However, ever year GMC has been operating it has required an annual subsidy from CSWD. In FY 2017 the subsidy was roughly $506,537[2] out of a total expenditure of $1.363 million. Because of the continued need for a subsidy, the CSWD Board has questioned the viability of continuing the operation under its' current business model.

DSM Environmental Services, Inc. (DSM) was contracted by the CSWD to conduct a comprehensive Business Analysis of GMC. The primary goal of the business analysis was to determine whether it is possible for GMC to achieve financial sustainability, as measured by eliminating the subsidy to GMC from the CSWD. DSM was provided technical support by professionals at WeCare-Denali, LLC to complete this analysis.

As stated in DSM's scope of services, elimination of the subsidy could be accomplished through one, or a combination of the following:

[1] DSM Environmental Services, Inc. *Systems Analysis of the Impact of Act 148 on Solid Waste Management in Vermont. Final Report*. Prepared for Vermont Agency of Natural Resources, October 21, 2013.
[2] Including transfers from facility capital improvement reserve fund.

- Increased revenues from tipping fees by either increasing throughput or increasing GMC tipping fees;
- Improved operational efficiency, which could include reducing costs and/or increasing throughput for revenue producing materials without concomitant increases in operating costs; and,
- Increased product sales revenue for bagged and/or bulk products.

DSM analyzed these options and the findings are summarized below.

Market Strengths

GMC is well positioned to continue to be the largest processor of food waste in Vermont, with the capacity to accept reasonable levels of contamination – which many of the other existing composting facilities cannot accept, and with the capacity to process most of the yard waste generated in the CSWD.

In addition, GMC has built exceptional brand recognition in Chittenden County for its Class A bulk and bagged products, which allows these products to be sold at a higher price point, and with lower retail margins than its primary competitors. This allows GMC to achieve the bulk of its revenues (70 percent in FY 2017) from product sales instead of tipping fees, (which typically represent the majority of total revenues at most composting facilities). This has made it possible for GMC to accept yard waste at no cost, and to price their food waste tipping fees at the current reported statewide average, even though GMC accepts higher levels of contamination than other facilities operating in Vermont.

Limits to the Viability of GMC

As presented in the body of this report, because product sales prices are already at the top of the price range for comparable products, increased tipping fees are key to improving GMC sustainability. As discussed below, DSM believes that there is room to increase tipping fees for food waste, and to add a tipping fee for yard waste, but there are constraints on how high those tipping fees can be raised.

Currently there are no viable alternatives to GMC in Chittenden County, or in northern New England, capable of managing an additional 5,000 – 8,000 tons of food waste, with the exception of Exeter Agri-Energy in Exeter, Maine (over 250 miles from GMC). Therefore, in reality there are no current competitors to GMC within a reasonable hauling distance.

However, it is critical that CSWD recognize that there are limits to the price of tipping fees for food waste. If these limits are exceeded, then a series of potential alternatives to GMC for food waste begin to become feasible including:

- Decisions by food waste generators to not participate in food waste diversion unless forced to do so by State or District regulatory enforcement actions;
- On-site processing of food waste at the large food waste generator level, with discharge to waste water treatment plants;
- Installation of food depackaging equipment at one or more transfer stations, with diversion of the slurried food waste to either a manure or sewage sludge digester; and,

- Small generator contracts with competing facilities which require very clean food waste but at competitive collection prices.

The trend in the industry is to focus food waste diversion on co-digestion with manures or waste water treatment plant sludges. While GMC is a potentially viable food waste processing facility, increased tip fees above some threshold will trigger active pursuit of anaerobic co-digestion alternatives, as well as decisions by individual households and businesses to opt out of source separation of food waste.

Any detailed feasibility analysis of the potential to expand GMC processing capacity, or to close GMC, must include a comparison with the potential to slurry food waste with delivery to alternative organic waste digesters.

Operations

GMC produces and markets a high-quality compost. In addition, it appears that GMC has substantially reduced the likelihood of another herbicide contamination issue; and, to date, there have been minimal complaints regarding off-site odors. These are significant achievements for a composting facility accepting food scraps of this size and complexity, especially given the setbacks that the herbicide contamination issue presented to this operation.

However, the current site is less than ideal due to both an inefficient configuration available for processing and composting incoming materials, and the soils on which the equipment must operate. And, it is evident from several metrics that the facility is operating at, or above capacity, given the site and equipment limitations.

Based on a detailed analysis of operations and key operational parameters it is DSM's opinion that GMC operated at, or above capacity in FY 2017. Meeting the projected FY 2018 throughput will require significant improvements to the site including:

- Conversion of all 14 Aerated Static Pile (ASP) bays to Phase 1 processing only, to meet pathogen reduction requirements, with final composting occurring outside in windrows;
- Replacement of the inefficient excavator currently used for pile turning with a dedicated windrow turner; and,
- Significant site improvements to allow for the orderly turning of compost piles and the placement of curing piles and final product screening and storage at the sequential end of the process.

Although beyond the scope of DSM's analysis, DSM estimates that these improvements might cost $2 million assuming the site improvements were made on the existing footprint. This would add approximately $150,000 annually in amortized costs to GMC's budget.[3]

[3] CSWD staff believe that the cost to expand outside of the existing footprint might cost between $2.5 and $3.5 million. Assuming that CSWD decides to pursue expansion, a detailed engineering analysis would be necessary.

If these investments are not made, GMC will be constrained to a throughput of approximately 5,000 tons per year of solid food waste which is insufficient to meet the demand for food waste diversion from the CSWD if Act 148 is fully implemented, and is below the throughput estimated in the FY 2018 budget.

Just as importantly, it is DSM's observation that even without long term improvements there is a need to provide GMC with increased authority and access to funds to repair and replace critical equipment in a timely manner. For example, one of the two Front End Loaders has 18,000 hours on it, which is well above the normal replacement interval. In addition, the Mixer sat idle for roughly two years forcing GMC to resort to inefficient mixing and moisture addition, and double handling of materials, which has contributed to higher cost operations than would have occurred if the Mixer had been repaired as necessary. Both pieces of equipment are critical to efficient operation and cannot be out of commission for any period of time if GMC is to operate efficiently.

Business Analysis

GMC finished FY 2017 with the need for a transfer of $506,537 of solid waste management fees to GMC[4]. To achieve sustainability, it would be necessary for GMC to either cut operating costs (and the budget) or to increase revenues to cover this transfer.

Based on DSM's analysis of GMC's operational costs, tipping fees and price points for products sold, the following conclusions can be drawn.

- GMC cannot achieve sustainability by significantly increasing throughput of revenue generating materials (primarily food waste) without new investments in equipment and site improvements;
- Even with increased throughput and tipping fees it is likely that the CSWD will need to continue to subsidize a portion of GMC costs;
- GMC's staffing levels are consistent with other facilities of this size and complexity, therefore there is limited ability to cut costs to achieve sustainability;
- GMC is selling its bulk and bagged product at or near the high end of price points for comparable products, and therefore is unlikely to achieve sustainability by increasing the price of the products it is selling;
- The cost to sell bagged products beyond the current region may be higher than current costs when product delivery costs and marketing and sales costs are included;
- Even at these relatively high price points it costs GMC more to produce a cubic yard of compost then it is sold at;
- GMC's source of revenues is essentially the opposite of most composting facilities, with roughly 70 percent of revenue coming from the sale of product while most compost facilities receive the majority of their revenue from tipping fees; and,
- Given these findings, the key to reducing the subsidy to GMC rests primarily on changes to tipping fees, and changes to internal transfers between CSWD and GMC, as discussed in more detail below.

[4] This includes $117,588 listed as "Facility Improvement Fees" which DSM understands represents a transfer for capital improvements.

Change in Food Waste and Yard Waste Tipping Fees

It is DSM's professional opinion that it is possible to increase the food waste tip fee from the current $52 per ton to $62 per ton without triggering significant diversion to other food waste processing opportunities. This would add roughly $50,000 in revenue at current food waste throughput, and would substantially increase revenues if GMC were capable of processing up to 7,500 tons per year of food waste.

However, this change in tipping fees would not be sufficient to eliminate the subsidy from CSWD. Food waste would have to be charged a tipping fee of over $90 per ton (depending on the charge for yard waste and the throughput, as discussed below) to fully eliminate the CSWD subsidy.

A second key component toward sustainability would be to charge for yard waste delivered to the facility. Externally, DSM is recommending a charge of $10 per yard for all direct deliveries of yard waste to GMC. This could raise an additional $42,000 per year based on reported direct deliveries in FY 2017. While a limited survey by DSM of landscapers indicated a willingness to pay for yard waste deliveries, it is likely that there would be some fall-off in deliveries once the charge was put in place, resulting in revenues that less than the $42,000 estimated.

DSM also recognizes that charging for yard waste deliveries would entail some method of collecting the fees. Obviously, if this entailed a full-time staff person, it would not be worth pursuing. However, if it could be integrated into existing operations and/or automated (with us of cameras, RFID tags, and/or efficient payment at the existing office), it might be one way to raise some revenue not currently available to GMC.

In addition, DSM does not believe that GMC should be charged internally for the cost of transporting and processing yard waste from CSWD drop-offs to GMC. Currently, CSWD charges GMC for the cost of trucking yard waste from the drop-offs to GMC ($28,000 FY 2017). More importantly, if GMC did not exist, CSWD would have to process the yard waste dropped off at its facilities at another location that would carry some cost. DSM believes that costs to operate a well-run yard waste composting facility would be $20 per ton, and therefore CSWD should be paying GMC this tipping fee for delivery of yard waste to GMC. In FY 2017, almost 3,200 tons of yard waste were delivered to GMC for processing from CSWD operations which could cost $64,000 to tip at another location.

DSM recognizes that any changes to internal accounting simply shift costs from GMC to the CSWD, and therefore do not reduce overall expenditures by the CSWD, but by accounting for these costs, the cost to operate GMC as a stand-alone enterprise is more fairly represented.

Opportunity for Contract Bagging

It is possible that GMC could save money by contracting out bagging, which would also free up space in the current equipment maintenance building.

A rough estimate is that GMC might save as much as $25,000 in bagging costs (depending on the volumes bagged), although GMC would need to investigate this further before entering into a contract.

Summary of Changes and Potential Revenue

Table ES-1, below provides a line item summary of these proposed changes to GMC pricing and operations. Two columns are presented, the first based on FY 2017 actuals and assuming a similar throughput for FY 2018, and the second assuming new capital investments are made allowing GMC to accept 7,500 tons of food waste (and a concomitant increase in carbon sources).[5]

Table ES-1 illustrates that it is possible to increase revenues by roughly $210,000 (rounded) based on FY 2017 inputs, and by $309,000 (rounded) at a throughput of 7,500 tons of food waste – assuming site improvements occur on the existing footprint. In both cases, financial sustainability comes primarily by increasing tipping fee revenues, not by increasing product sales revenues.

Just as importantly, even with these recommended changes, it is likely that the CSWD will have to continue to provide a subsidy, albeit at a lower rate, if the CSWD determines it is in its best interest to continue to operate GMC.

Table ES-1 – Capital Improvements and Potential Changes in Revenues and Throughput

REVENUE ENHANCEMENTS	Units	Proposed Tip Fee Increase	Current Throughput	Increased Throughput
Food Waste Throughput:	tons/year		5,000	7,500
ADDITIONAL COSTS				
Capital Improvements to Increase Throughput				
Windrow Turner (10 years @3.5%)	$200,000		NA	$ (24,048)
Site Improvements (20 years @3.5%) (1)	$1,800,000		NA	$ (126,650)
Additional Operational Costs With Capital Improvements				
Add One Full-Time Staff				$ (75,000)
Additional Maintenance Costs				$ (9,499)
INCREASED REVENUES				
Food Waste Tip Fees				
Increase Fee by $10 (Current Tons)	5,000	$ 10.00	$ 50,000	$ 50,000
New Tons at Higher Fee (@$62/Ton)	2,500	$ 62.00		$ 155,000
Yard Waste Tip Fees				
Current Tons:	1,400			
$10 Charge per Cubic Yard (3 yards per ton)	4,200	$ 10.00	$ 42,000	$ 42,000
$20 Charge per Ton to Process CSWD Yard Waste	3,192	$ 20.00	$ 63,840	$ 63,840
Other Changes				
Eliminate Transport Changes for CSWD Yard Waste to GMC			$ 28,920	$ 28,920
Increase in Product Sales (FY 2018 Projections)				$ 170,000
Contract Bagging Projected Savings			$ 22,000	$ 35,000
Estimated Total:			**$ 206,760**	**$ 309,563**

[5] Throughout this report DSM has relied on actual FY 17 costs and revenues as opposed to the projected FY 18 budget, which is subject to unforeseen circumstances that might arise as the year progresses.

Conclusion

As summarized in Table ES-1, even with site and equipment improvements to enable increased material throughput, along with raising the tip fee for food waste, adding a yard waste tip fee, increasing product sales and contracting out bagging, it would be extremely difficult to raise revenues substantially to eliminate the need to subsidize the operation.

And, as reviewed in the Section, *Limits to Viability*, there are no existing facilities in Vermont with sufficient capacity to accept the food waste currently delivered to GMC. GMC is the largest permitted composting facility in Vermont, and remains the leading food waste composting facility in Vermont, currently handling over one-third of the food waste composted off-site in Vermont.

If GMC were to close, one option would be to set up a transfer station to transfer food waste out-of-state to an operating anaerobic digester. For example, Agri-Energy's digester in Exeter, Maine currently appears to have the capacity to handle GMC's food waste. Extrapolating based on current haul and tip fees Exeter Agri-Energy charges ecomaine (Portland, ME), it appears that hauling and tipping food waste from Williston to Agri-Energy would cost roughly $70 per ton. Transfer station operating costs would need to be added to this, but together may be less than the current cost of operating GMC. This however leaves CSWD without a yard waste composting facility.

I. Introduction

DSM Environmental Services, Inc. (DSM) with technical assistance from WeCare-Denali, LLC (formally WeCare Organics) was contracted by the Chittenden Solid Waste District (CSWD) to assess the operations, financial position and sustainability of the Green Mountain Compost (GMC) facility. This report addresses the key tasks of DSM's Business Analysis, with the primary goal to determine whether it is possible for GMC to achieve financial sustainability, as measured by eliminating the subsidy to GMC from the CSWD.

As stated in DSM's scope of services, this might be accomplished through one, or a combination of the following changes:

- Increased tipping fee revenues from increasing throughput, increasing GMC tip fees for food waste and adding a tip fee for some or all yard waste;
- Improved operational efficiency, which could include reducing operating costs and/or increasing throughput for revenue producing materials without concomitant increases in operating costs (and in turn reducing the cost to produce a yard of compost product); and,
- Increased product sales revenue for bagged and/or bulk products through increasing sales volume and/or prices per unit.

As part of DSM's analysis, the following activities were conducted:

- Met with CSWD and GMC staff to fully understand the current operation and costs;
- Conducted five site visits at GMC to better understand the operation, material flow, labor and equipment used and to examine key operational parameters;
- Reviewed past and proposed budgets and detailed cost data, and then allocated costs by activity to better understand where costs are incurred and how they compare with revenues received;
- Surveyed other similar compost facilities in operation to benchmark against GMC;
- Analyzed GMC's product sales including product price points to compare against other competing compost and soil products;
- Contacted haulers and others in Vermont knowledgeable about food waste collection and processing costs and tipping fees to discuss options, challenges and costs of managing food waste in Vermont; and,
- Surveyed landscapers in Chittenden County to learn about their options for disposal of leaf and yard waste.

II. Operations Assessment

Summary

GMC produces and markets a high-quality compost. In addition, it appears that GMC has substantially reduced the likelihood of another herbicide contamination issue; and, to date, there have been minimal complaints regarding off-site odors. These are significant achievements for a composting facility of this size and complexity, especially given the setbacks that the herbicide contamination issue presented to this operation.

However, the current site is less than ideal due to both an inefficient configuration available for processing and composting incoming materials, and the soils on which the equipment must operate. And, it is evident from several metrics that the facility is operating at, or above capacity given site and equipment limitations.

A complete operational assessment is included as Appendix A to this report. The following section summarizes the key findings by operational step based on the Process Flow diagram and Mass Balance presented in Figure 1, below, and Figure 2 on the next page.

Figure 1. Process Flow Diagram

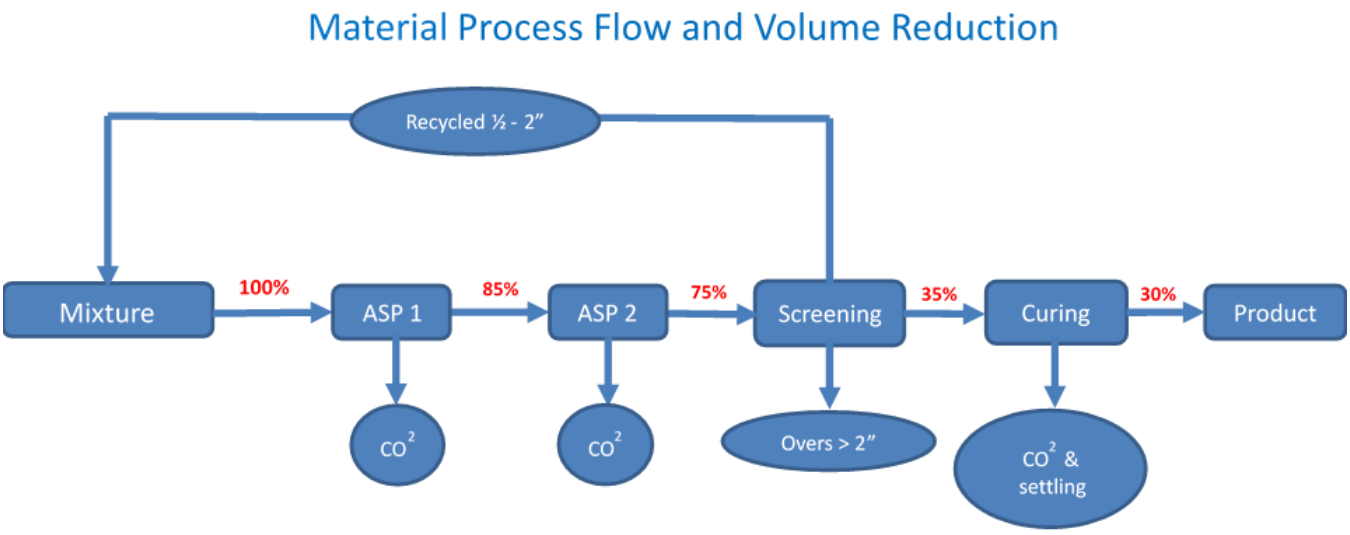
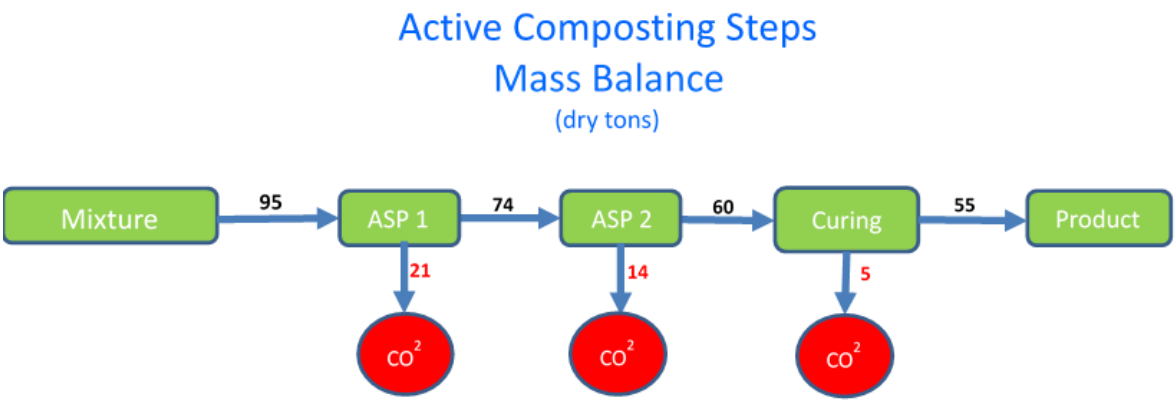


Figure 2. Mass Balance



Site Configuration

The site is laid out from west to east in a step by step process from aeration to screening to curing and blending (Figure 3). Drop-off of incoming material occurs at the same point of ingress and egress as the sales of bulk material and the screening and load-out of pallets of the bagged material.

Both the curing process step and post-production product blending occurs on the remnants of a borrow pit. The soil material is a sand-silt mix that when wet makes it very difficult for trucks to get through.

Ramifications of the current site plan include:

- A poor flow of ingress and egress of delivery of feed stocks due to both public car and pedestrian traffic;
- The constant movement of loaders either moving material to blending, bringing material to bulk sales storage bins, or moving material from temporary storage to either curing, bagging or additional screening;
- Bagged material is placed wherever there is available space (as shown in Figure 3), with the majority placed between the bagging and curing area, although pallets are being put in areas behind the Phase 1 aeration bays and outside the fence adjacent (to the south) of the curing area;
- The excessive distance from the blending location to sales and bagging areas increases materials handling;
- The bagging and maintenance area is constrained due to its shared use;
- There are seasonal limitations to how well material can be moved and processed at this location; and,
- Overall, these constraints could be perceived by the public as a poorly managed facility due to the large rutting, pooling water and general state of organic material being driven over.

Figure 3. Site Layout

Initial Mixing

Food waste is high in nitrogen and often has a high moisture content. To efficiently compost food waste, it is necessary to blend the high nitrogen food waste with materials that have a high percentage of biological available carbon (BAC). This is typically referred to as the Carbon/Nitrogen ratio (C:N). The resulting blend must also have an optimum moisture content.

Typically, a facility of this size composting both food waste and yard waste would use a mechanical mixer to blend and add water to incoming materials. However, until recently GMC has been blending using a front-end loader because the mechanical mixer has not been operational for two years.

Ramifications for mixing with a front-end loader were:

1) Unequal distribution of C:N throughout the composting mass, reducing the decomposition rate;
2) Not all organic material delivered in plastic bags is separated from the bags, which reduces the rate of food waste decomposition and can lead to pockets of anaerobic decomposition;
3) There is double handling of the material when adding water without the use of the mixer;
4) Watering with the pump truck is not as accurate as when metered into the mixer, resulting in a mix that can be too wet or too dry;

5) Pump-truck watering results in some percentage of water being shed by the pile and not incorporated; and,
6) Some material gets compacted in the process which increases the insulating capacity of the piles and enables pockets of the pile to reach excessive temperatures for extended periods, slowing decomposition.

Watering

There are two watering steps. The first is during blending and before the material is placed in the Phase 1 Aerated Static Pile (ASP) bay. Because aeration is under positive pressure, by the end of the two-week Phase 1 process, there is a need for a second watering before the material is placed in the Phase 2 ASP bay.

Water (under normal weather conditions) comes from two sources. The first watering step uses water from an underground 20,000-gallon tank, capturing water coming off the watering pad and percolating down through the composting piles into the drainage pipes. This water can only be added to the first phase of composting since it has possible contamination from pathogens. These pathogens are controlled through the time-temperature regime created in the Phase 1 ASP bay.

The second source of water is from the storm water receiving pond and is only added to the post-Phase 1 piles. This addition of storm water, as opposed to the contaminated underground tank water, allows the facility to avoid continued monitoring of the Phase 2 pile temperatures to meet regulatory requirements to further reduce pathogens.[6]

Water is initially added in the mixer via remote pump in the 20,000 gallon underground tank. Following the initial two-week aeration, water is added using a tanker truck, which sprays water onto the top of a windrow. For the Phase 1 pile, an average of 4,000 gallons is added to a bay's worth of material. This is augmented with an additional seasonal rage of 4000 - 8000 gallons for the second watering as material is transferred from Phase 1 to Phase 2 aerated piles.

Ramifications for this current watering regime are:

1) Material needs to be handled twice during moving the material from Phase 1 to Phase 2 aeration, with the intermediate need of creating a windrow in the composting pad so it can be watered again by the pump-truck;[7]
2) The underground tank water source can be accessed by a stand pipe, but storm water can only be accessed by the pump truck from the north end of the storm water receiving pond. This requires that the pump truck enter an area accessible by the public (those dropping yard waste off), and because facility operators do not have a commercial operator's license (CDL), the operator must first put up a temporary barrier to separate the public from the watering operation;

[6] The facility is required to follow procedures and document pile temperatures over time to show they are meeting a process to further reduce pathogens (PFRP). The facility meets its PFRP requirement in the first phase of the aeration process.
[7] When timing watering, it took up to 105 minutes to water a Phase 1 Pile, and 140 minutes for Phase 2.

3) Both because the GMC operator lacks a CDL and therefore cannot drive on a public road and because of the time it requires, during dry summer months supplemental water must be brought in by a contracted hauler to keep the storm water pond filled;[8]and,
4) During wetter times of year, the amount of water entering the underground storage tank exceeds the 20,000-gallon capacity, resulting in tank water needing analysis, hauling and disposal at a waste water treatment facility (WWTF).[9]

Aerated Piles

Aerated static pile (ASP) composting depends on adequate air delivery and distribution throughout the pile to both maximize decomposition and avoid odors.

Temperature monitoring is used as an indirect proxy for pile aeration. This is because temperature reflects the heat within the pile which is a combination of heat generation from biological activity of the decomposing organisms, and heat retention due to the insulating capacity of the pile.

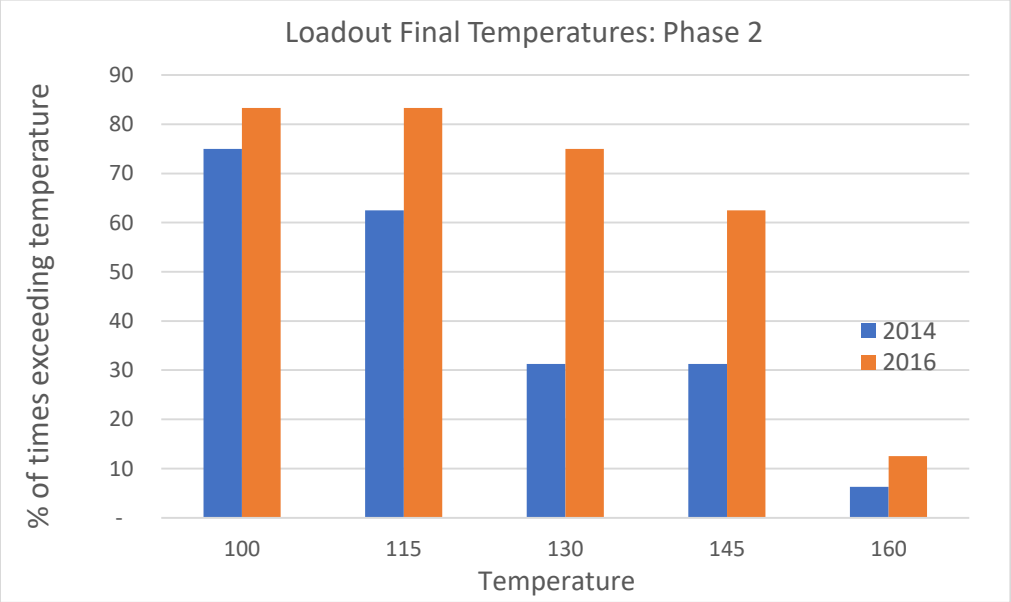
Temperature is also used to meet the regulatory standards for pathogen control. This is a time-temperature standard (PFRP) with temperatures needing to reach at least 55°C (131 ° F) for at least 72 hours. After the desired initial increase to high temperature the most ideal subsequent temperature level should be kept below 140°F to allow for the greatest rate of decomposition.

An analysis of GMC temperature data indicates that temperatures are not only meeting PFRPs, but also reaching elevated temperature above 155°F for extended periods of time. Extended periods of higher temperatures slow down decomposition, and in some cases, can stop it in specific areas within the composting mass. Elevated temperatures can be controlled by reducing the insulating capacity of the pile (using smaller piles), and/or controlling the rate and duration of the pile aeration.

Indication that active composting has ended – which should occur at the end of Phase 2 ASP composting - is when pile temperatures trend towards ambient temperatures. Figure 4 compares loadout temperatures from Phase 2 from a random set of data from the years when the mixer was used to blend and add water (2014) as opposed the loader and tanker truck (2016)[10]. In both cases, most batches were still in the active compost phase at loadout from the Phase 2 ASP bays indicating that material was moving through the ASP bays too quickly, and that the curing time will need to be extended. ***This outcome illustrates the facility is at or above throughput capacity.***

[8] The proposed FY 2018 budget lists $18,600 for hauling supplemental potable water.
[9] According to D. Goossen (6/30/17), the previous weeks required diversion of approximately 7000 gals/week of leachate to the WWTF. In 2016, leachate hauling ran over $10,000 excluding testing and treatment.
[10] In review of preliminary data from 2017, the piles are still ranging in the higher temperatures at time material is moved to screening.

Figure 4. Comparison of Loadout Temperatures from the Phase 2 ASP Bays



Screening

When the facility initially moved to its current location, screening was completed with two used rotary screens (trommels). These were quite inefficient, both because they were often down for repair and because the throughput rate was low - around 40 cy/hour.[11] Recently the facility has been utilizing both a leased Komptech Multistar S-3 Screener as well as a Neuenhauser 3F. The S-3 is no longer on site, and GMC has indicated it has purchased a used Komptech Multistar L-3 Screen.

The (used) Komptech Multistar L-3 Screener has a throughput rate which is more than twice the throughput of the formerly leased S-3. In addition, the L-3 has the feed-hopper size and out-load conveyer height that will make screening more efficient.

Other than ensuring that screening throughput rates are high, the greatest operational challenge is that screening is occurring before curing. Screening reduces the porosity of the curing piles which delays the rate at which material reaches a stable state. While screening occurs at this stage to remove plastic pieces that might blow from curing piles to the gravel operation, this also increases the amount of time the compost must remain in the curing piles.

Curing

The curing area is to the east of the ASP bays and screening operation. The material sent to the curing pile is the 3/8- to 1/2" fraction from the screening process. This product is placed in large pyramidal

[11] According to D. Goossen (6/30/17)

piles (approximately 12' high by 30' at the base). The piles are turned with a 1 CY excavator that can turn piles up to the 12 feet high.

These piles are turned 5-6 times over a 6 to 8 - month period.[12] Then the cured material is either brought back directly to a bulk compost bunker to the north and east of the aeration pads, or moved to a blending location to the south east of the curing area.

Ramifications of the current curing process are:

- The curing area is estimated to hold 15,000 cubic yards of material if stacked in large continuous loaf formations;
- The large piles of finely screened material results in a tight compression of the material in the lower parts of the pile, eliminating adequate aeration for curing, which slows down the stabilization process;
- Due to the challenges outlined in previous composting steps, the material entering the curing area may not be adequately decomposed, which exacerbates the need for proper mixing and aeration during curing; and,
- Turning using a 1 CY bucket is very time-intensive.[13]

Staffing

Table 1A below outlines current staffing assignments associated with operation of GMC and marketing of GMC compost.

TABLE 1A – Current GMC Staffing Levels

Position	Employee Category	Projected Hours per year	Overtime Hours
Compost Manager	S	2,080	-
Compost Sales Coordinator	FT	2,080	-
Senior Equipment Operator	FT	2,080	60
Equipment Operator & Maintenance Lead	FT	2,080	15
Administration & Production Coordinator	FT	2,080	40
Delivery Driver	FT	520	10
Field Supervisor (open as of 7/1/17)			
Equipment Op - 2 days/week	PT	1,248	60
Office Assistant/Production Assistant	FT	1,920	20
Equipment Operator & Production Assistant (some bagging)	FT	2,080	25
Bagging Assistant (PT)	PT	880	
S = Salaried F = Full time hourly PT = Part time hourly		**17,048**	**230**

[12] According to D. Goossen (6/30/17), this may be as long as 12 months.
[13] In timing the turning (6/30/17), it took up to 45 seconds per bucket.

Considering the size of the GMC operation in comparison with other ASP facilities, GMC's three operators are appropriate for the scale of this operation, given site constraints and the production of multiple, post-blended product lines, and marketing of bagged product.

Currently the Field Supervisor position is not filled, with activities of the Field Supervisor covered by a combination of the Manager and operators. It is DSM's observation that there are several places where the Manager should be focusing time to improve throughput rate, manage temperature regimes, and ensuring compost quality; but these are taking on a secondary priority in dealing with day-to-day site operations.

Being one employee down, an operator is being diverted from their primary duties of screening and post–production blending to assist with equipment maintenance. But this is exacerbating the back-log of material sitting on site, reducing available time to keep up with required maintenance, which increases the amount of time equipment is down for repairs.

Based on the stock of mobile equipment, there is a need for a mechanic solely dedicated to equipment maintenance for at least a full day each week –, as well as the need for a dedicated equipment maintenance shed adequate for heavy equipment maintenance.

Mobile Equipment

Table 1B below lists mobile equipment currently on site (September 2017).

TABLE 1B – Current GMC Facility Equipment (September 2017)

Equipment	Purpose	Capacity
2008 SUPREME ENVIRO MIXER 900T	Recipe blending	
2003 MACK PUMP TRUCK (4500 GAL TANK)	Watering	
2004 VOLVO EXCAVATOR EC160BLC	Turning curing piles	1 yd
1997 FORD F350 PICKUP TRUCK	On-site maintenance	
2006 KENWORTH T300 DUMP TRUCK	Materials movement & deliveries	10 yd
2006 Ford F550 with added dump body	Materials movement	5 yd
2007 JD 644J LOADER	ASP Phase 1 & 2	8 yd
2011 JD 524K LOADER	Screening/ Material movement	4 yd
TROMMEL SCREEN 1995	post-production blending	30-40 cy/hr
2012 Komptech L3	Screening	180-200 cy/hr
JCB 527-55 LOADALL TELEHANDLER	Material movement and out-load	
NEUENHAUSER 3F SCREENER, W/WIND SIFTER	Retired	

As discussed above, GMC now has the mixer and water pumping system up and running, which should improve initial mixing and moisture content and free up some front loader time.

In addition, the recently purchased L-3 multi-star screener should significantly increase throughput rates and allow for the processing of backlogged material currently stockpiled.

The two loaders are being utilized 100% of the time. The JD 644 is allocated almost solely to the ASP phase of the composting process, while the JD 524 is utilized for screening, post-production blending and movement of material to and from curing.

Because the facility is operating at capacity, any additional acceptance of material will require the ability to more efficiently turn and move material on site.

In addition, the JD 644 has 18,000+ of operating hours, exceeding the maximum 10,000 hour extended warranty and increasing the likelihood that it will be down more often for repair. This will hamper operations, since it is utilized every day, all day.

The Volvo excavator, with a one cubic yard bucket, inefficiently turns the curing piles. While a front loader would speed up the process, current site constraints would make it difficult to use. Ultimately, it is DSM and WeCare's opinion that GMC should be utilizing a windrow turner for this operation.

Conclusions Concerning the Operational Review

The site's shape and soils contribute to an inefficient composting process. Given these site constraints, it is commendable that GMC has been able to achieve current material throughput, and produce and market such a high-quality compost.

However, several factors indicate that the facility is being operated either at, or above, capacity. These include:

- Excess pile heights in all ASP bays;
- High temperatures within the piles, which slows down the rate of decomposition;
- Temperature data at the end of the ASP process indicating that material is being moved to curing before it is completely composted, resulting in an extended curing phase, stretching the capacity of the approximately two acres dedicated to the curing phase of the operation;
- The screened curing piles are too high, resulting in compacting of the material which increases curing time, and further pushes the site limits;
- Bagged material is stored throughout the site because there isn't enough free space to efficiently organize the storage of bags;
- The equipment maintenance building is too small for the equipment requiring maintenance, and is further constrained by the bagging equipment and operation; and,
- Public traffic and GMC operations are occurring in the same space, which is a safety hazard.

Being at capacity now has significant implications for the financial sustainability of GMC (as discussed below) because one area to increase revenues is to accept more food waste as Act 148 requirements ramp up.[14]

Recommended changes in operation to improve sustainability can be divided into two areas:

- Relatively lower cost changes, which may improve efficiency and reduce costs slightly, but will, in DSM's opinion only increase throughput marginally, if at all; and,
- High cost capital improvements which could improve the site significantly allowing for increased throughput and therefore increased revenue.

Short-Term, Low Cost Operational Changes to Improve Efficiency

The following are relatively lower cost changes to operations that will improve efficiency in the short term.

1) Utilize the recently repaired mechanical mixer to create a more consistent blend, and more importantly porosity, which in turn will allow for more efficient watering before material is put into the Phase 1 ASP bay.
2) Meter water into the initial blend to avoid excess water addition and handling. The addition of metered water volumes becomes that much more feasible when added using the mixer.
3) DSM understands that there are conceptual plans (and cost estimates) to increase underground storage of process water and/or develop a well on site. This capacity may allow GMC to accept additional liquid wastes, which could increase tip fee revenues and reduce costs of contract hauling of potable process water and leachate transfer to the wastewater treatment facility.
4) Reduce the excessive temperature regimes in the Phase 2 ASP bays through more optimal use of the mixer and metered water additions.
5) Move material directly from ASP Phase 2 bays to curing, without screening.
6) Turn curing piles with the loader, rather than with the excavator. By using a loader, with a "loader-rake" bucket, the windrows piles can be aerated more effectively than the current procedure.
7) Configure the turning of the piles so they migrate towards a designated screening area by the end of the curing phase. This strategy avoids excessive material handling of moving material long distances on site.
8) Reconfigure the location of bagging and bagged compost storage to minimize movement of material from post production blending to bagging and from bagging to load-out.
9) Separate the bagging operation from the maintenance garage to free up room in the maintenance garage for equipment maintenance.
10) Configure operations for better flow of ingress and egress to avoid intermingling of citizen drop-off and purchase with commercial waste delivery and facility operations and material handling.

[14] DSM understands that GMC is projecting an increase in food waste deliveries for FY 2018. Part of the increase is expected to be in liquid waste, and part in additional food waste. It is DSM's opinion that it will be difficult to meet the projected deliveries of new food waste without the recommended changes to equipment and operations.

11) Create a single area for bagged compost storage, so that load-out is facilitated and there is less congestion of traffic around active composting operations.
12) Develop a contamination strategy to address contaminants (primarily plastics) that impact the efficient operation of the facility and can impact the final end-product quality.

Longer Term Capital Improvements

It is DSM's opinion that the short-term improvements discussed above will increase efficiency and result in some cost savings. However, they will not lead to sufficient increases in throughput and/or reductions in operational costs to significantly reduce current subsidies.

Reduction of subsidies will require a combination of increased/new charges for yard waste deliveries (see Cost Analysis Section), and increased throughput and charges for food waste. Significantly increasing food waste acceptance will require new capital investments.

First, and foremost, to significantly expand throughput and markedly improve process efficiency, the site needs to be reconfigured and the operable area expanded. The current site configuration presents numerous process inefficiencies (as noted) as well as safety concerns for both customers and GMC employees. Ideally, the site would look more like a rectangle and not like an arc. Expansion into areas south and west of the facility ("South Field" and adjacent "Velco Land") or possibly the Hinesburg Sand & Gravel sand reserves east of the compost screening area would provide the space needed to accommodate more and smaller windrows.

Of equal importance, DSM believes that significantly expanding throughput on the current site will require the purchase and use of a dedicated windrow turner. This would speed the turning of the curing piles and in doing so increase aeration, allowing the piles to reach the point of final curing faster, freeing up space for more piles. This would allow the use of all ASP bays for initial composting, eliminating the need for moving material from the Phase 1 bays to the Phase 2 bays, thereby increasing the overall capacity of the ASP bays.

The first alternative for pursuing this change would be to locate the windrow turning phase in the location of the current curing location. This would require both designing the appropriate windrow lay-out scheme, as well as estimating the maximum volume of material that could be processed during this phase, which would be a combination of site capacity and degradation rate (volume reduction) of the organic material.

If the curing area were reconfigured for this purpose, GMC should consider re-grading the area to maximize windrow construction and turning areas, and possibly make improvements to the pad on which the material will be turned. The output of this step would have material moved to larger, continuous storage piles in the location where post-production processing takes place.

If the screening and bagging operations were then logically located adjacent to the storage piles, a gravel road to this area would need to be constructed so that customers and trucks can pick up material even in wet seasons.

It is likely that regrading and surfacing the existing curing area, the purchase of a windrow turner, improved access roads, a new building for bagging, and site work to maximize the efficiency of curing might cost around $2 million.[15]

A second alternative is utilizing the parcel to the southwest of the aeration bays (Figure 5). There may be 6 to 8 acres that could be utilized for windrow, curing and screening operations at this location, which would free up the current curing area for bagged pallet storage and load-out.

The disadvantage of this alternative is that it would bring the active composting phase in closer proximity to neighbors on Redmond Road and Ledgewood Drive. Prior to active consideration of this alternative, this area would need to be surveyed for wetlands and a determination of the sub-soil made to determine what would be required to establish a pad for the windrow composting operation.

Figure 5. Potential New Location for Windrow Composting

In conclusion, while it is beyond the scope of DSM's business analysis of current conditions, we believe that any significant increase in throughput will require new investments in site work and a windrow turning machine, as well as an adequate equipment maintenance and replacement fund to assure that key pieces of equipment, like the mixer, screen and rolling equipment are operational in a timely manner.

[15] DSM is not an engineering firm and cautions that these are preliminary level feasibility estimates that would need to be confirmed following an engineering analysis. DSM's estimates are on the low end of the range, with CSWD staff estimates of $2.5 to $3.5 million.

III. Business Analysis

Introduction

DSM's business analysis is designed to address the Financial Position and the Sustainability/Opportunity Assessment contained in the CSWD RFP Scope of Services. It consists of five primary areas of analysis:

- A detailed review of GMC's 2017 actual, and 2018 adopted program budgets, allocating costs and revenues by specific activities, such as bagging, to determine added value/profit and loss;
- Analysis of revenues from tipping fees including discussions with haulers and compost operators to determine current market tipping fees to compare against GMC tipping fees;
- Survey of wholesale and retail market prices for bagged and bulk compost products to compare against GMC products;
- Modeling of tipping fees, throughput, and product sales to evaluate the most likely scenario for achieving sustainability; and,
- A review of the potential for, and threats to growth, to achieve future sustainability.

Analysis of Program Budgets

CSWD maintains detailed program budgets for all CSWD programs, including GMC. This allowed DSM to perform activity based cost accounting for the GMC facility for the past year (FY 2017, actual) and the current year (FY 2018, proposed). Activity based cost accounting divides the overall program budget into key activities included in the program budget, allowing for a more precise evaluation of the costs and revenues associated with each of those activities.

The goal was to determine the actual cost to operate and produce compost, and to bag and market composted product. Revenue from the sale of bulk and bagged compost products could then be compared against the cost to produce the compost products to determine net revenues (or cost) for both bulk and bagged product.[16]

Table 2 (on the next page) presents FY 2017 actual and FY 2018 budgeted costs by category.

As shown in Table 2, the budget for FY 2018 is roughly $1.5 million, with a projected deficit of roughly $227,000 (rounded) for the current year, which is 15 percent of the total budget. The deficit is planned to be covered (subsidized) by CSWD solid waste management fees.

By comparison, actual costs and revenues for FY 2017 resulted in a deficit of roughly $506,537which was higher than projected at the beginning of FY 2017. Because the FY 2018 budget is based on projections,

[16] GMC produces a wide range of bulk and bagged products by mixing compost with other materials. The GMC program budgets are not sufficient to allow for development of separate costs for each product, but only for an overall analysis of bulk versus bagged product in aggregate.

and not on actuals, DSM has concentrated our analysis on the final FY 2017 actuals instead of the FY 2018 projected budget.

TABLE 2 - FY 2017 Actual, and FY 2018 Proposed Budget

ACCOUNTS - EXPENSES	FY 2017 ACTUAL (1)	*Percentage of Total (%)*	FY 2018 PROPOSED	*Percentage of Total (%)*
TOTAL 5100 - Salaries & Wages	$375,287	*28%*	$405,775	*27%*
TOTAL 5200 - Personnel Benefits	$140,247	*10%*	$195,194	*13%*
Subtotal, Personnel:	$515,534	*38%*	$600,970	*41%*
TOTAL 5300 - Education & Training	$6,057	*0%*	$7,542	*1%*
TOTAL 5400 - Contracted Prof Svc	$50,194	*4%*	$64,524	*4%*
TOTAL 5500 - Contracted Other Svc	$281,666	*21%*	$239,088	*16%*
TOTAL 5600 - Insurance	$16,724	*1%*	$18,679	*1%*
TOTAL 5700 - Printing & Advertising	$83,567	*6%*	$95,298	*6%*
TOTAL 5800 - Utilities	$35,049	*3%*	$36,964	*3%*
TOTAL 5900 - Computer Equip, Systems	$545	*0%*	$4,040	*0%*
TOTAL 6000 - Office Supplies/Equip	$6,232	*0%*	$6,526	*0%*
TOTAL 6100 - General Supplies (1), (2)	$218,073	*16%*	$256,889	*16%*
TOTAL 6200 - Interdepartmental	$137,149	*10%*	$152,727	*10%*
TOTAL 6300 - Other Charges	$10,609	*1%*	$16,651	*1%*
Total Expenses:	**$1,361,398**		**$1,499,897**	
REVENUES - FROM OPERATIONS				
Tipping Fees	$230,596	*24%*	$358,617	*28%*
Delivery Fee Revenue	$51,235	*5%*	$68,995	*5%*
Sale of Materials	$686,318	*70%*	$847,048	*66%*
Other	$6,370	*1%*	$0	
Total Revenues:	**$974,519**	*100%*	**$1,274,660**	*100%*
Net (3):	**($386,879)**		**($225,237)**	

(1) In FY 2017, decreased Line Item 6112 by $58,500 for topsoil purchased but not used in FY 2017.
(2) In FY 2018, increased Line Item 6112 by $29,250 to reflect 50% of the topsoil expected to be used in FY 2018 (but purchased in FY 2017).
(3) Net excludes any transfers from Capital Reserves.

As illustrated by Table 2, 38 percent of the budget in FY 2017 was made up of labor costs, rising to 41 percent in FY 2018. In addition, 10 percent are from Interdepartmental Charges in both FY 2017 and 2018, of which 90 percent of this (or roughly 9% of the budgets) are charged from other CSWD operations. These charges include administrative and finance department overhead as well as the cost for CSWD to deliver yard waste from the CSWD drop-offs to the GMC facility.

As discussed below, while GMC needs a source of carbon, which yard waste provides, the CSWD would have to haul and dispose of yard waste at an alternate location if the GMC were not available, with that cost then assigned to the drop-offs instead of GMC.

Other large expense categories are Contracted Services (21% in FY 2017, failing to 16% in FY 2018) - primarily made up of equipment leases and maintenance costs - and General Supplies (16%) which include the cost of materials required to make many of the compost, topsoil and bagged products, and the cost of diesel and gasoline.

On the revenue side, material sales made up 70 percent of revenues for FY 2017 and are projected to make up 66 percent of revenues in FY 2018. *It should be noted that this is the opposite of most composting facilities* where tipping fee revenues make up the bulk of needed revenues with material sales accounting for the balance.

Capital Reserve Fund

In addition to the expenses and revenues shown in the FY 2017 and 2018 budgets (Table 2), the CSWD maintains a separate capital reserve fund from which capital is withdrawn to make improvements to all CSWD facilities (including GMC). Monies are transferred into the Fund, and out to cover capital expenses in various years and to various facilities. In FY 2017, $117,588 was transferred into the GMC "Facilities Improvement" Fund, and $120,000 in Facilities Improvements is included in the FY 2018 proposed budget. For the two prior years (FY 2015 and FY 2016), roughly $82,00 and $95,000 were transferred in respectively.

It is important to note that If these transfers were accounted for in the year they were transferred, the deficits shown in Table 2 would increase. Given the scale of GMC operations, and the amount of rolling stock involved processing material that can be difficult on equipment, it is DSM's opinion that a more robust capital reserve fund be set up specifically for GMC, with the cost accounted for in GMC's program budget on an annual basis.

As discussed in this report, it is critical to the long-term efficient operation of GMC that GMC not be required to wait for approval to repair major pieces of equipment (like the Mixer) when they require maintenance.

Activity Based Cost Accounting to Allocate Costs

Line items within the GMC program budget were analyzed to allocate 2017 actual and 2018 budgeted expenses. This included a review of time sheets and hourly labor accounting kept by GMC to better understand how GMC personnel spend their time. The results of this line item review were used to allocate labor, overhead, operating, maintenance, supplies and contracted costs to the major activities undertaken by GMC.

Each line item expense was allocated to the following major activities:

- **Composting Operations** – All labor and expenses associated with operating the GMC facility, receiving feedstock, handling material, producing compost and creating the different products, including bagged, bulk and mulch products. Expenses were allocated to creating compost or producing the bagged products.
- **Product Marketing and Sales** – Any labor or other expenses associated with marketing and selling GMC products, including print and media advertising, participation in trade or retail marketing events and sales calls. These were also allocated to sale of bulk or compost in general vs sale of bagged products.
- **Product Delivery** – The cost to deliver any GMC products sold either by GMC employers using GMC trucks or though contracted trucking services allocated to bulk or bagged product delivery.
- **Other Service**s – These included Administration/Overhead costs from GMC employees time spent on administrative related tasks, CSWD overhead allocated to the GMC facility (based on CSWD's allocation methodology), as well as education and other services. Education expenses are GMC labor and expenses directly attributed to educational activities focused on organics and backyard composting (as opposed to selling compost products). Other Services covers the costs of CSWD services or sponsored projects that may be related to composting but not essential to the operation of the GMC facility, such as transferring yard waste from CSWD drop-offs to the GMC facility or operating the Burlington Electric Department (BED) wood drop-off program.

The goal of performing the cost allocation was to:

- Isolate the actual costs to produce compost and calculate added costs to create bagged products;
- Estimate the added cost to produce and sell bagged products over and above the costs to produce and sell the bulk compost;
- Determine the net cost after tip fees to create the bulk compost;
- Compare revenues from the sale of bulk product with the net cost to produce the bulk product;
- Compare revenues from the sale of bagged product to the added cost to produce and market the bagged product; and,
- Determine what tipping fees and increase in sales might be necessary to take the place of the subsidy provided by CSWD.

Tables 3A and 3B present DSM's analysis of these costs by activity.

DSM ENVIRONMENTAL SERVICES, INC.
Resource Economists
Environmental Scientists

TABLE 3A –FY 2017 Activity Based Cost Allocation

	FY 2017	COMPOST OPERATIONS		PRODUCT MARKETING/SALES		DELIVERIES		OTHER COSTS		
ACCOUNTS - EXPENSES	**ACTUAL (1)**	*Compost*	*Bagged*	*Compost*	*Bagged*	*Compost*	*Bagged*	*Education*	*Admin/OH*	*Other Services*
TOTAL 5100 - Salaries & Wages	$375,287									
TOTAL 5200 - Personnel Benefits	$140,247									
Subtotal, Personnel:	**$515,534**	$235,027	$41,020	$30,942	$45,022	$20,776		$4,598	$138,148	
TOTAL 5300 - Education & Training	$6,057	$3,058							$2,999	
TOTAL 5400 - Contracted Prof Svc	$50,194	$21,294	$3,785	$7,891	$7,914				$3,310	$6,000
TOTAL 5500 - Contracted Other Svc	$281,666	$229,668	$13,683			$26,276	$12,039			
TOTAL 5600 - Insurance	$16,724	$16,724								
TOTAL 5700 - Printing & Advertising	$83,567			$51,127	$32,440					
TOTAL 5800 - Utilities	$35,049	$31,443	$540						$3,066	
TOTAL 5900 - Computer Equip, Systems	$545								$545	
TOTAL 6000 - Office Supplies/Equip	$6,232				$3,194				$3,038	
TOTAL 6100 - General Supplies (1)	$218,073	$148,908	$53,774			$1,433	$358	$15,669		
TOTAL 6200 - Interdepartmental	$137,149	$12,029							$94,864	$30,257
TOTAL 6300 - Other Charges	$10,609								$10,609	
Total:	**$1,361,398**	**$698,151**	**$112,803**	**$89,959**	**$88,570**	**$48,485**	**$12,397**	**$20,268**	**$256,579**	**$36,257**

REVENUES - FROM OPERATIONS		*Percent Of Revenues (%)*
Tipping Fees	$230,596	24%
Delivery Fee Revenue	$51,235	5%
Sale of Materials	$686,318	70%
Other	$6,370	1%
Total:	**$974,519**	100%
Net Operating Revenues (2):	**($386,879)**	

(1) Decreased Line Item 6112 by $58,500 to reflect topsoil purchased but not used in FY 2017.

(2) Excluding transfer from Capital Reserve Fund of $117,558.

SUMMARY - ACTIVITY BASED COST ACCOUNTING					
Activity	***Compost Ops***	***Bagging Costs***	***Other Costs***	**Total**	***%***
Composting Operations	$696,081	$112,803		$808,883	***59%***
Product Marketing and Sales	$89,959	$88,570		$178,529	***13%***
Product Delivery	$48,485	$12,397		$60,882	***4%***
Administration/Overhead			$256,579	$256,579	***19%***
Education			$20,268	$20,268	***1%***
Other Services (1)			$36,257	$36,257	***3%***
Subtotal:	**$834,525**	**$213,769**	**$313,103**	**$1,361,398**	***100%***

TABLE 3B – FY 2018 Activity Based Cost Allocation

	FY 2018	COMPOST OPERATIONS		PRODUCT MARKETING/SALES		DELIVERIES		OTHER COSTS		
ACCOUNTS - EXPENSES	**PROPOSED**	*Compost*	*Bagged*	*Compost*	*Bagged*	*Compost*	*Bagged*	*Education*	*Admin/OH*	*Other Services*
TOTAL 5100 - Salaries & Wages	$405,775									
TOTAL 5200 - Personnel Benefits	$195,194									
Subtotal, Personnel:	**$600,970**	$273,976	$47,818	$36,070	$52,484	$24,219	$0	$5,360	$161,043	
TOTAL 5300 - Education & Training	$7,542	$4,100							$3,442	
TOTAL 5400 - Contracted Prof Svc	$64,524	$22,419	$2,760	$5,635	$9,399				$18,310	$6,000
TOTAL 5500 - Contracted Other Svc	$239,088	$184,684	$8,430			$31,548	$14,427			
TOTAL 5600 - Insurance	$18,679	$18,679								
TOTAL 5700 - Printing & Advertising	$95,298			$57,988	$37,310					
TOTAL 5800 - Utilities	$36,964	$28,747	$445						$7,772	
TOTAL 5900 - Computer Equip, Systems	$4,040								$4,040	
TOTAL 6000 - Office Supplies/Equip	$6,526				$3,456				$3,070	
TOTAL 6100 - General Supplies (1)	$256,889	$198,878	$49,456			$2,044	$511	$6,000		
TOTAL 6200 - Interdepartmental	$152,727	$17,820							$96,927	$37,980
TOTAL 6300 - Other Charges	$16,651	$1,000			$3,900				$11,751	
Total:	**$1,499,897**	**$750,303**	**$108,909**	**$99,693**	**$106,548**	**$57,812**	**$14,938**	**$11,360**	**$306,354**	**$43,980**

REVENUES - FROM OPERATIONS		*Percent Of Revenues (%)*
Tipping Fees	$358,617	28%
Delivery Fee Revenue	$68,995	5%
Sale of Materials	$847,048	66%
Total:	**$1,274,660**	100%
Net Operating Revenues (2):	**($225,237)**	

(1) Includes an additional $29,250 to account for 50% of $58,500 spent on topsoil purchased in FY 2017 but that will be used in FY 2018.
(2) Total greater than proposed budget to recognize additions to General Supplies - 6100, as noted above.

SUMMARY - ACTIVITY BASED COST ACCOUNTING					
Activity	***Compost Ops***	***Bagging Costs***	***Other Costs***	**Total**	***%***
Composting Operations	$750,303	$108,909		$859,211	***57%***
Product Marketing and Sales	$99,693	$106,548		$206,241	***14%***
Product Delivery	$57,812	$14,938		$72,750	***5%***
Administration/Overhead			$306,354	$306,354	***20%***
Education			$11,360	$11,360	***1%***
Other Services (1)			$43,980	$43,980	***3%***
Subtotal:	**$907,808**	**$230,395**	**$361,694**	**$1,499,897**	***100%***

Tables 4A and 4B then total the costs to run the compost operation, but subtract out the costs to produce and market a bagged product as well as any delivery charges, to isolate the costs to produce bulk compost products. They then go one step further to show the cost to run the GMC facility *without* any of the interdepartmental charges assigned to the facility, and without the cost of other non-essential facility expenses assigned to their budget such as: the cost to transport yard waste from the drop-offs to the GMC facility; the subsidy for the BED wood drop-off; and, costs to educate and sell bins for backyard composting.

This results in two sets of calculations: the cost to both produce a cubic yard of finished compost product and to produce an average bagged compost product (or other related GMC bagged product) based on the total budget (first column); and then the cost to produce these same products (average bulk and average bagged) based on the essential GMC facility costs only (shown in the second column entitled GMC Only).

Note that Table 4A uses 13,045 cubic yards as the estimated cubic yards of finished compost product produced which ***includes*** materials that are blended with the compost to produce the products that are sold. According to Dan Goossen[17], the estimated amount of compost sold was roughly 8,800 cubic yards in FY 2017. While it is certainly possible to simply plug in 8,800 cubic yards and run the analysis, this would over-estimate actual compost production costs because GMC's program budget is not fine grained enough to isolate each activity (labor and equipment use) associated with managing and mixing the other materials into the final products produced by GMC during the course of the year.

TABLE 4A – Net Cost to Produce Bulk and Bagged Compost, Per Cubic Yard, FY 2017 (1)

From Table 3A (FY 2017)	**Total Budget**	**GMC Only**
Compost Ops Except Bagging and Delivery	$1,099,143	$924,188
Bulk Cost		
Estimated Volume Produced (yds.)	13,045	13,045
1 - Bulk Cost/Yard:	**$84**	**$71**
From Table 3B - Bagging Costs		
Estimated Volume Bagged (yds.)	1,008	1,008
Operations Cost	$112,803	$112,803
Cost Per Yard to Bag	$112	$112
Product Marketing and Sales	$88,570	$88,570
2 - Total Cost/Yard to Bag:	**$200**	**$200**
Total Cost/Yard in Bags (1 + 2):	**$284**	**$271**

(1) Based on the estimated cubic yards of finished bulk and bagged product produced in FY 2017, which includes all additives.

[17] E-mail correspondence, December 12, 2017 and Excel file "CY's budgeted vs sold FY17 and FY18 v2" sent to DSM.

TABLE 4B – Net Cost to Produce Bulk and Bagged Compost, Per Cubic Yard, FY 2018 (1)

From Table 3B - FY 2018	Total Budget	GMC Only
Compost Ops Except Bagging and Delivery	$1,211,690	$1,011,038
Bulk Cost		
Estimated Volume Produced (yds.)	**16,433**	16,433
1 - Bulk Cost/Yard:	**$74**	**$62**
From Table 3B - Bagging Costs		
Estimated Volume Bagged (yds.)	1,259	1,259
Operations Cost	$108,909	$108,909
Cost Per Yard to Bag	$87	$87
Product Marketing and Sales	$106,548	$106,548
2 - Total Cost/Yard to Bag:	**$171**	**$171**
Total Cost/Yard in Bags (1 + 2):	**$245**	**$233**

(1) Based on the estimated cubic yards of finished bulk and bagged product, which includes all additives.

Table 4A illustrates that in FY 2017 based on ***all of the costs allocated to the GMC facility*** minus delivery and bagged product costs, it cost $84 per cubic yard of compost products produced, including mulch products. In FY 2018 (Table 4B), this is projected to drop to $74 based on the budgeted costs, and increased throughput (roughly 2,300 additional yards of compost and roughly 3,400 additional yards of finished products).[18]

Table 4A and 4B also show the total cost per yard to produce the bagged product which adds the isolated bagging costs (shown in Tables 3A and 3B) and divides by the estimated total yards of products bagged and sold. As shown, the average cost to bag products in FY 2017 was $112 per yard. Adding the marketing and sales costs for bagged products, the total cost per yard excluding the compost equaled $200 per yard, for a total cost of bagged product at $284 per yard. These bagging costs are estimated to be about the same for FY 2018 budget but are projected to be divided by more product which equates to an expected lower cost per yard bagged (estimated based on the budget, to be $171 per yard compared to $200 in FY 2017).

Costs are also presented comparing the average costs for bulk and bagged products based on the total budget (first column) and then isolating GMC facility operation costs (second column). In FY 2017, it cost $71 per yard when only GMC facility costs are included, but $84 per yard when all CSWD charges are include. Similarly, the cost to produce bagged product is $284 per yard for GMC facility costs only, and $271 per yard to produce the bagged products when all CSWD allocated costs are included.

[18] As discussed in the Operational Analysis section of this report, DSM does not believe it is possible to add significant quantities of material to the GMC facility given current site and operational limitations.

FY 2018 costs are projected to drop based on an assumption of increased volume of bulk and bagged product sold with only marginal increases in costs to produce these products. However, as stated above, it is not clear that GMC will be able to push that much more material through the facility without significant changes to the facility.[19]

Additionally, projections for the volume of compost produced for FY 2017 and the volume of finished bulk and bagged products were higher than actual volumes for FY 2017.

Finally, Table 5 uses the average bagging costs per cubic yard in FY 2017 to estimate the average cost to produce of a bag of GMC product in FY 2017.

TABLE 5 – Average Estimated Cost to Produce Each Bag of Finished Product (FY 2017)

Bagged Product Costs	Total Budget	GMC Only
Cost Per Yard For Compost Product (Table 4A)	$84	$71
Average Bags Per Cubic Yard (1)	*40.4*	*40.4*
1 - Cost Per Bag	$2.09	$1.75
Cost Per Yard to Bag (Table 4A)	$112	$112
Average Bags Per Cubic Yard	*40.4*	*40.4*
2 - Cost Per Bag	$2.77	$2.77
Cost Per Yard to Market/Sell (Table 4A)	$88	$88
Average Bags Per Cubic Yard	*40.4*	*40.4*
3 - Cost Per Bag	$2.17	$2.17
Total Cost Per Bag (1+2+3):	**$7.03**	**$6.70**

(1) Note that this is an average of all bagged products produced and sold and includes all additives to GMC compost. Some products cost more or cost less to produce based on the additives used, the bag volume and weight, labor and equipment costs, and other factors.

As shown in Table 5, it is estimated that in FY 2017 it cost between $6.70 and $7.03 on average to produce and sell a bag of GMC product. This can be compared against the weighted average revenue for bagged products sold in FY 2017 of roughly $4.20 (per bag).

Note that when revenues from tipping fees are included in the equation (which were roughly $230,000 in FY 2017), the net cost per yard of compost produced is roughly $67 and the net cost to produce an average bag of compost is roughly $6.60.

This indicates that GMC lost roughly $2.40 per bag (when including all allocated CSWD costs) or roughly $2.05 per bag (excluding CSWD allocated costs).

For Bulk Product, GMC also lost money in FY 2017 as the average revenue per cubic yard solid was roughly $42 per yard, ***$25 less than the net cost to produce finished compost.***[20]

[19] Early reports are that having the Mixer up and operating is resulting in better initial compost quality which may translate into some gains in throughput.

[20] The retail sales price averaged $55.88 in FY 2017, closer to the cost to produce compost but also at the high end of what bulk compost can be sold for as discussed further in the next section.

Potential for Contract Bagging

As shown in Table 5, the operational cost to bag compost was estimated to be $112 per yard in FY 2017. At 40.4 bags of product produced per yard of material, the cost per bag is estimated to be $2.77. This can be compared against the cost to contract out bagging operations.

Based on WeCare's costs of roughly $2.50 per 30-quart bag, which includes trucking bulk material to a contract bagger and trucking pallets of bagged product back to the compost facility, contract bagging might save GMC some money, compared with FY 2017 costs. This calculation is shown in Table 6 and estimates costs of $2.34 per bag assuming GMC contracts out 50,000 bags.

GMC costs are slightly lower since GMC would ship 73 bags per pallet and vs 60 bags per pallet of 30-quart bags.

TABLE 6 – Rough Estimates of Contracting Bagging Operations

Assumptions	**Bagging Costs**
Transport to Bagging Facility	$935
Cubic Yards	35
Tons	21
Return to GMC	
Pallets/load	22
Bags/pallet	73
Total Bags/Load	1606
Tranport (RT)	$1,870
Per Bag:	**$1.16**
Bagging Costs	
Bagging	$0.87
Film	$0.22
Art Work	$0.09
Per Bag:	**$1.18**
Total Per Bag	**$2.34**

As shown in Table 6 with savings of roughly 43 cents per bag at 50,000 bags, GMC might save roughly $21,500 assuming they receive contracted bag prices, including transportation costs, as shown.

Another area for savings in FY 2018 is marketing. If bag sales are doubled, and marketing costs hold constant, the per bag costs to market would be cut in half to roughly $1.20 per bag (from $2.19 per bag). This appears feasible if the increased bagged sales are to existing retailers and within the current sales region. However, if GMC must go outside of the Chittenden region and attempt to penetrate new markets further from Chittenden County it seems likely that GMC would have to increase its marketing budget and offer larger wholesale discounts, as reviewed in the next section.

It should be noted here that VT Natural Ag contracts out at least a portion of its marketing to an outside firm (Chestnut Hill Marketing) specializing in "green products marketing". This allows VT Natural Ag to concentrate on the production of compost products, as opposed to sale of the products.

Market Prices for Bagged Compost

In FY 2017, GMC received roughly $500,000 in sale of bulk product averaging $41.56 in revenue per cubic yard of product sold and selling just over 12,000 cubic yards. GMC sold roughly 95 percent of the compost products (by volume) as bulk with the other five percent (by volume) were sold as bagged product.

Bulk compost sales are typically locally constrained by transport costs, and are roughly similar throughout the region, ranging from $20 per cubic yard wholesale to $35 - $45 per yard retail when picked up at a facility. GMC retail bulk sales average $55.88 per yard. Since GMC sells most of its bulk product at the top of this range, it is DSM's opinion that there is not much room for significantly increasing pricing, and therefore revenues, from increasing bulk sale prices.

Instead, GMC has concentrated on increasing sales of bagged product which can be sold at significantly higher prices per cubic yard of material used, and transported longer distances expanding the market area.

DSM's analysis consisted of the following:

- A comparison of GMC bagged product sale prices (wholesale and retail) with Vermont Natural Ag Product prices – the local competitor to GMC;
- An analysis of bagged product prices in the Upper Valley of Vermont and New Hampshire (White River Junction/Lebanon/Hanover area); and,
- An analysis of the potential to expand sales to Massachusetts, Connecticut and New York.

Comparison of GMC and Vermont Natural Ag (Moo Doo) prices in the Chittenden Region

Tables 7A and 7B compare GMC compost bagged product wholesale and recommended retail prices against publicly available prices for comparable Vermont Natural Ag, Moo Doo products.[21]

As illustrated by Tables 7A and 7B, suggested GMC bagged product prices are significantly more expensive than similar Vermont Natural Ag products – especially when compared on a unit basis since most GMC bagged products are sold in 20-quart bags while Moo Doo is sold primarily in 30-quart bags.

It is clear from DSM's analysis that GMC has done an excellent job of building brand loyalty and demand in Chittenden County, allowing for relatively high retail prices when compared with both their logical competitor and even more so with prices at the big box stores.

[21] It can be argued that there are differences in product quality between the two companies. While this may be the case since the nutrient analysis of the products are not reported on the bags, the average consumer is unlikely to know the difference. More importantly, according to a large grower in the Upper Valley, Vermont Natural Ag products are high quality.

TABLE 7A – GMC Bagged Product Prices (2018)

Product Catergory	Name	2018 Wholesale ($)	2018 Garden Center Pricing ($)	2018 Wholesale @17% ($)	Bag Size (QT)	Recommended Retail ($)	Moo Differential ($)	Margin per bag ($)	Margin per QT ($)
Top Soil	*Premium Topsoil*	$3.14	$2.99	$2.48	20	$4.49	$0.50	$2.01	$0.101
Compost	*Complete Compost*	$4.53	$3.69	$3.06	20	$6.49	$0.01	$3.43	$0.172
Potting Soil	*Premium Potting Soil*	$6.64	$5.14	$4.27	20	$9.49	-$3.24	$5.22	$0.261
Seed Starter	*Premium Seed Starter*	$6.99	$5.40	$4.48	20	$9.99	-$0.49	$5.51	$0.276
Raised Bed	*Raised Bed Mix*	$6.29	$4.87	$4.04	20	$8.99	-$2.74	$4.95	$0.248
Compost (Manure)	*Premium Compost*	$5.59	$4.55	$3.78	20	$7.99	-$2.00	$4.21	$0.211

TABLE 7B – Vermont Natural Ag (Moo Doo) Pricing

Product Catergory	Name	2017 Wholesale ($)	Bag Size (QT)	Observed Retail ($)	GMC $ Differential	Margin per bag ($)	Margin per QT ($)
Top Soil	*Moo Dirt*	2.46	30	$4.99	-$0.50	$2.53	$0.084
Compost	*Moo Compost*	3.59	30	$6.50	-$0.01	$2.91	$0.097
Potting Soil	*Moo Grow*	3.43	30	$6.25	$3.24	$2.82	$0.094
Seed Starter	*Moo Start*	5.36	30	$9.50	$0.49	$4.14	$0.138
Raised Bed	*Moo Grow*	3.43	30	$6.25	$2.74	$2.82	$0.094
Compost (Manure)	*Moo Doo*	3.49	30	$5.99	$2.00	$2.50	$0.083
Planting Mix	*Moo Plant*	3.72	30	$5.99	NA	$2.27	$0.076

What was most notable was the retailer price variance at non-box store local retailers in the Burlington area when compared with the same products in similar stores in the Upper Valley Region (see below). For example, Gardener's Supply in Burlington retails Coast of Maine Lobster Compost at $10.99. The exact same product retails at Lebanon Feed & Supply for $8.49 (New Hampshire retailer). Smaller, but significant, pricing variances were noted across several products. This suggests that the Chittenden County market does not experience the same price sensitivity that is experienced in the Upper Valley.

Chittenden County's tolerance for a higher price point niche, being a local product, and offering organic bagged compostable products all contribute to GMC's success in gaining market share and strong retailer sales relationships. However, the lower size bags and higher than average retail and wholesale price points, when combined with a more price sensitive sales region, may result in a more difficult sales environment outside Chittenden County. Deep wholesale price discounting, free delivery, and reduced retail price points would likely need to be utilized to gain market share in an area where alternative products such as Moo Doo and Coast of Maine all enjoy brand loyalty and are already perceived as both local and organic.

Expanding Bagged Product Sales

According to Dan Goossen, GMC believes that they have come close to saturating the local bagged product market, and that significant increases in bagged product sales would need to come from expanding the sales area. This may be evidenced by the high number of individual customers GMC sells

to with relatively low sales per customer. The median customer bought 292 bags of compost last year and roughly 88% of customers bought less than 800 bags.

One logical area for expansion is the Upper Valley Area of Vermont and New Hampshire. In addition to being located adjacent to DSM's office, and therefore relatively easy to survey, Gardner's Supply is reported to have entered into an agreement with Longacres Nursery Supply in Lebanon to purchase their facility. If this were to occur, then it would be logical for Longacres to begin to sell GMC bagged products in the Upper Valley. Therefore, DSM conducted a detailed survey of bagged compost retail prices and types in the Upper Valley.

In addition, DSM conducted a detailed interview with one of the larger market farms in the Upper Valley that sells Vermont Natural Ag products and uses these products in their greenhouses.

Based on this research in the Upper Valley the following conclusions can be made:

- Large box store retailers (Home Depot & Tractor Supply) are not carrying local products (including Vermont Natural Ag), but they do carry other compost products labeled organic;
- Small and medium-sized retailers in the Upper Valley are carrying both organic and local products;
- GMC products are only carried by a small number of retailers in the Upper Valley, while Vermont Natural Ag products are readily available;
- The primary bag size sold in the Upper Valley is 1 Cubic Foot or 1.5 Cubic Foot – which is larger than most GMC bagged products;
- Only one product came in bags smaller than the typical GMC 20-quart bag (Vermont Natural AG, "Moo Doo" .5 cubic foot);
- At 2018 GMC retail price points GMC would have been the most expensive bag on the shelf at all Upper Valley locations per bag; and,
- At 2018 GMC retail price points GMC would have also been the most expensive on the shelf at all locations per quart.

The primary conclusion that can be drawn from DSM's analysis of Upper Valley retailers is that it would take a combination of discounts and a significant marketing effort for GMC to penetrate the Upper Valley market in any significant way. This is especially the case because unlike Chittenden County, there is not broad recognition of the GMC brand in the Upper Valley, and Vermont Natural Ag products are already available and carry the Vermont name brand.

Expansion into High Income Urban Markets

According to Dan Goossen, GMC has had some success in expanding retail sales into Cape and island communities in Massachusetts. This is potentially a logical area for increased compost sales because of sandy soils and relatively high-income households.

While DSM believes this expansion strategy has merit, it is likely that GMC will have to reduce prices and increase marketing expenses to significantly expand bagged product sales in this market – or similar markets in southern Connecticut and the NYC metro area. This is for three reasons:

First, WeCare estimates that trucking costs to these markets would add about 50 to 70 cents per bag. Given the high price points for GMC in Chittenden County, it is unlikely – at least initially – that GMC could add this trucking charge to the existing wholesale price and still provide retailers with sufficient mark-up to make GMC a desirable product to stock.

Second, GMC will have to compete against other similar products from compost producers in southern New England. One large, and similar, competitor will be McEnroe Farms (western Connecticut) which already has a presence in all New England states – including southern Vermont. McEnroe has two potential competitive advantages over GMC. First, McEnroe Farms produces its' own manure (as does VT Natural Ag), which reduces input and composting costs, and second, it is located in Connecticut, significantly reducing transport costs to Connecticut retailers and the NYC metropolitan market.

Third, the GMC brand will not be known, requiring initial steep discounts and new advertising campaigns to build both brand recognition and sales. As such, DSM does not believe that GMC's existing marketing costs and pricing strategy will be sufficient to expand into major new markets in southern New England. Instead, it will take discounts and increased spending to expand, which will increase costs and reduce sales revenue in the near term.

Tipping Fees

As discussed above, DSM believes that there is limited room for increased pricing of bagged products, or for doubling bagged product sales at current prices. In addition, as discussed in detail in the Operational Analysis, DSM does not believe that there is room for significant changes in throughput, or efficiency gains, given current site constraints, to sufficiently reduce the per ton operational costs to eliminate the subsidy. This leaves increased tipping fees as a potential solution.

Most compost facilities familiar to DSM earn the bulk of their revenues from tipping fees (typically 60% – 70%) with the remaining revenues coming from product sales. *This is the opposite of the current revenue distribution for GMC.* As such, DSM has evaluated the potential to increase tip fees for material delivered to GMC.

Food Waste Tipping Fees

DSM contacted the majority of other in-state compost facilities accepting food waste to discuss throughput, operational challenges, and current tip fees. DSM also discussed with one of the largest waste haulers in the District potential consequences associated with increasing the tipping fee for food waste deliveries.

In general, there are two ways that food waste processing fees are set. The first model, which is prevalent throughout much of central Vermont, as well as for the Exeter (Maine) Agri-Energy Facility which sources food waste from throughout northern New England, is to embed the cost of food waste

processing in the per cart cost of collection. In this case it is difficult to determine the actual processing cost, because food waste collection costs overwhelm the processing cost. This is important because it allows the firm to integrate collection and processing into a single price, and to price food waste collection on a per cart or per stop basis as opposed to on a per ton basis. As with commercial collection of dumpsters, the generator typically does not know the total per ton cost for collection and processing, only the per stop or container cost.

The second pricing model is a stand-alone tipping fee for processing model. Because GMC is not in the waste collection business, GMC does not have the opportunity to integrate collection and processing, and must instead price food waste processing as a stand-alone service

For those compost facilities that do charge directly for food waste processing in Vermont, the prevailing tipping fee for food waste is roughly $50 per ton. That means that GMC's recent price increase to $52 per ton is in line with other facilities.

However, there is an important difference between GMC and all other Vermont facilities accepting food waste, in that GMC accepts food waste with some contamination while all other Vermont facilities essentially require clean food waste with close to zero contaminants.

This distinction is important now, and will become increasingly important if Vermont retains the July 1, 2020 ban on disposal of food waste to landfills. As Vermont begins to enforce the landfill ban on food waste disposal, food waste generators who are not currently required or committed to food waste diversion will be forced to separate food waste. In many cases they will be less committed to keeping food waste separate from contaminants, which will make it difficult to deliver their collected food waste to any facility except GMC. This will inevitably increase GMC composting costs, requiring more manual separation of plastics, increasing screening costs, and increasing residue disposal costs.

For this reason, DSM believes that there continues to be some room to increase tipping fees for food waste to compensate for the higher level of contamination GMC will have to accept. However, there are limits to how high GMC can increase tip fees before other alternatives become feasible. Both WeCare and DSM believe that this limit is probably in the range of $60 to $65 per ton.

What is clear from conversations with haulers in Vermont is that unless the ban on disposal of food waste is strictly enforced, many larger generators of food waste will continue to attempt to opt out of participating in separate food waste collection. Increasing the tipping fee will further exacerbate the problem because the increased tipping fee will be passed through from the hauler to the customer.

At some point, increased tip fees will also put pressure on haulers to consider alternative solutions for food waste processing. These might include:

- Purchase and use of a food depackaging machine at one or more private transfer stations in Chittenden County with transfer of the resulting slurry to a farm or waste water treatment plant digester. Casella has already permitted a facility in Rutland County that will remove contaminants, grind the resulting food wastes, and transport the slurry to a farm in Bridport, Vermont. It is possible that Casella could deliver slurried food waste from Chittenden County to this same, or another farm digester, although there may be issues associated with phosphorous loading that limit the amount of food waste the Bridport farm can accept.

- Integrated food waste haulers/processors such as Grow Compost of Vermont may decide to market a combined service in Chittenden County like the service they currently offer in central Vermont and plan to offer in the Upper Valley.
- Larger food waste generators could move toward in-house treatment systems using package equipment, with the resulting slurries discharged directly to existing WWTP's.
- One or more of the WWTP's in Chittenden County could make modifications allowing them to accept slurried food waste for digestion along with sewage sludge. This is basically the model that Waste Management is pursuing throughout the country.
- The CSWD could consider the alternative of collecting food waste at a transfer location, and then negotiate a contract with Exeter Agri-Energy to accept the bagged food waste where it would be run through a food depackaging machine and co-digested with manure. Exeter Agri-Energy currently charges ecomaine $45 per ton FOB Portland to haul and process food waste from ecomaine communities. Clearly, it is a long haul to Exeter, Maine, which would increase haul costs, but it is likely that if it costs $45 per ton from Portland, that it could be transferred from Chittenden County to Exeter, Maine for between $65 and $70 per ton.

Yard Waste

GMC also receives just under 5,000 tons of yard waste per year. As illustrated in Table 8, roughly 65% of total yard waste deliveries come from CSWD drop-off facilities, for which the GMC budget covers the trucking fee. The other largest source of yard waste deliveries is direct deliveries from households and small landscapers. These direct deliveries are currently not charged a tipping fee.

TABLE 8 – Yard Waste Deliveries by Customer (FY 2017)

Entity	Tons	% of Total
CSWD	3192.11	65%
Burlington	260.84	5%
Casella	38.92	1%
Direct	1419.42	29%
Total	4911.29	100%

A key component of sustainability will be to begin to charge for delivery of yard waste to the facility.

DSM conducted a telephone survey of landscapers who deliver material to GMC, based on a list provided by GMC. Of the list of 15 businesses provided to DSM by GMC, one was deemed to be no longer operating, five completed the survey and nine did not respond to the survey after three telephone calls and an e-mail message. In general, of those who responded, four out of five said that they were willing to pay a nominal fee ranging from $5 to $20 to dispose of yard waste at the facility. This indicates that there is some room for increased revenues from the delivery of yard waste to GMC.

Externally, DSM is recommending a charge of $10 per yard for all direct deliveries of yard waste to GMC. This could raise an additional $42,000 per year based on reported direct deliveries in FY 2017. While a limited survey of landscapers conducted by DSM indicates that they would be willing to pay for yard

waste deliveries, it is likely that there would be some fall-off in deliveries once the charge was put in place, so total new revenues might be less than the $42,000 estimated. In addition, GMC would incur costs associated with collecting the fee. These costs could be relatively minor if GMC were to automate the fee collection process using RFID tags, camera's or pre-paid accounts, but would be significant (and probably not worth it) if GMC found it necessary to create a new position to monitor deliveries and collect payment.

Another way to enhance revenues (or reduce the CSWD subsidy) would be to stop charging GMC for delivery of yard waste from CSWD drop-offs. If GMC were not available the CSWD would have to find an alternative location to dispose of yard waste, or would have to manage the material at the drop-off facilities, and both options would cost CSWD.

Finally, GMC could also post an internal tip fee charge to cover CSWD yard waste drop-off deliveries at GMC. This may be reasonable and posted against any subsidy since the CSWD drop-offs would need to pay to deliver yard waste to another permitted facility if GMC were not available, or would have to compost the material on-site, adding costs to the drop-offs.

DSM recognizes that changes to internal accounting between CSWD and GMC do not result in an overall reduction in CSWD expenditures, even if the more accurately reflect real costs to GMC.

IV. Compost Facility Survey Results

During June and July (2017) Michael Simpson, a DSM Associate and Core Faculty member at Antioch University, New England worked with a graduate student to conduct a survey of composting facilities similar to GMC. The results are summarized below, followed by a comparison of GMC to the surveyed facilities.

The survey was conducted to collect information about operational practices at commercial composting facilities processing food waste and yard waste through use of aerated windrows or aerated static pile (ASP) systems. The questionnaire focused on eight main themes: (1) site size and layout, (2) revenue streams, (3) recipe formulation, (4) active composting process, (5) curing process, (6) screening process (7) finished product attributes, and (8) facility staffing and roles

A total of 22 composting facilities were targeted nation-wide. Preference was given to facilities similar to GMC in methodology and/or feedstocks processed. Of the 22 facilities identified, eight voluntarily agreed to participate in the survey. Table 9 lists the facilities who participated, comparing annual volumes processed, types of materials processed, facility ownership and locations.

TABLE 9 - Facilities Participating in Survey

Facility	Annual Volume Processed *(tons unless noted)*	Materials Processed	Method	Facility Ownership	Location
Anonymous Facility	84,000	YW, Biosolids, FW	ASP	Private	Southeast US
Dirthugger	30,000	YW, FW	TAP	Private	WA
GMC	12,594	YW, FW	ASP	Public	VT
Hirzel Farms	20-22,000 (cy)	YW, M, FW	Aerated Windrow	Private	OH
New England Compost	5,000 (cy)	YW, M, FW	ASP	Private	CT
OCRRA	17,283	YW, M, FW	ASP	Public	NY
SET Empire	28-30,000	YW, FW	ASP	Private	MN
Silver Springs Organics	65,000	YW, M, FW	ASP	Private	WA
WLSSD	5,600	YW, FW	ASP	Public	MN

Summary of Results

The survey results are detailed in Appendix B and summarized below.

- Of the eight surveys, four had a two-step ASP process similar to GMC.
- The majority of revenue comes from tip fees at the surveyed facilities with one facility reporting equal revenues between tip fees and sales, and another reporting that half of cash flow was supported by tax/fee subsidies.
- Tip fees ranged from $10 - 65, with a mean of $39 per ton.
- The charge for finished bulk product ranged from $20 - 65, with a mean of $29 per cubic yard.
- The charge for finished bagged product ranged from $5 - 15, with a mean of $8 per cubic foot, and a common bag size of 1 cubic foot.
- The facility footprints ranged from 3 to 25 acres, with a mean of 11 acres.

- Four respondents used front-end loaders to blend, resulting in a bulk density of 1200-1600, with an average of 1400 lbs./CY.
- Four respondents used shredder/mixers to blend resulting in a bulk density of 850-1500, with an average of 1091 lbs./CY.
- For Phase 1 ASP composting, the range of residence time was 15-30 days and for the three that replied to the question on Phase 2, the residence time ranged from 20-30 days.
- All facilities expressed that maintaining moisture content, especially during summer months, was a challenge.
- Most of the facilities cure between 1 and 2 months and 75 percent screen after curing.
- The number of staff ranged from 3-10, with an average of 6.
- Most facilities have a low tolerance for contamination and will charge steep fees for high-contaminated loads or reject the loads out-right.

Key observations that can be made from the information obtained through the survey are as follows:

- Tipping fees, not product revenues are the key to financial sustainability at the majority of facilities;
- Curing times are much lower for most ASP facilities when compared to GMC, which indicates that material in the ASP bays at GMC is not fully composted before being moved to curing;
- The lack of proper turning equipment, coupled with high pile heights impedes curing – much of this due to GMC being over capacity; and
- Average staffing is very similar to GMC staffing levels.

Major Challenges Noted

Every facility interviewed noted the challenges of dealing with plastic film and working with generators to keep contamination to a minimum. In most cases, food waste is delivered to these facilities via third party haulers. Therefore, the facilities don't have a direct line of communication with the generators, but more often work with haulers on any issues. Most facilities interviewed have a very low tolerance for garbage and will charge steep fees for excessive contamination or will outright reject loads. Some facilities, like Dirt Hugger have hired dedicated quality control staff who manually pick out contamination as loads are dumped. They also provide haulers with periodic contamination reports.

Like GMC, some of these facilities have struggled with compostable utensils and flatware. Silver Springs Organics receives residential food scraps but no longer allows flatware or plastic bags. In their experience, residents had a hard time telling the difference between compostable bags and non-compostable bags, and many of the products did not fully break down (ASTM standard is 60% breakdown in 120 days, but Silver Springs has a 45-day process from start to finish). The anonymous facility echoed issues of dealing with compostable ware and additionally noted problems with broken glass.

Nuisance odors was another concern among several of the facilities surveyed. OCRRA mentioned that part of the reason they screen material after curing is to minimize release of unpleasant odors. Most facilities at the very least use a 6 to 12- inch layer of finished compost on ASP's to act as a biofilters.

V. Sustainability/Opportunity Assessment

Overview

Based on DSM's analysis presented above, the following conclusions about the potential to achieve sustainability of the GMC operation – as defined by elimination of the annual CSWD subsidies – are outlined below.

First, while DSM recognizes that GMC's budget for FY 2018 assumes receipt of 7,053 tons[22] of food waste, it is DSM's opinion, as documented in the Operational Assessment, that GMC is already at or above the capacity of the site unless significant investments in new equipment and site improvements are made. As such, DSM's sustainability assessment is based on FY 2017 actuals, not FY 2018 projections.

It is DSM's opinion that if new investments are made, GMC could process up to 7,500 tons of food waste annually. New investments are predicated on the fact that the process steps would be changed to free up ASP bay capacity by requiring a single ASP step to meet PRFPs. This would be followed by a windrow-turn active composting second step before screening.

Given the site constraints discussed above, a self-propelled, windrow turner should be used to accomplish this proposed process change, which would replace the inefficient excavator currently being used to turn the post-ASP phase piles. Concurrently, requisite site improvements should include: significant site grading/paving and roadway improvements to facilitate efficient windrow turning and handling of materials; additional water and liquid waste storage capacity; and, streamlining the material handling by moving the product bagging and storage area directly adjacent to where cured compost is stored, which would also free up the equipment maintenance shed for equipment maintenance.

While it is beyond the scope of this analysis, a rough estimate is that these improvements might cost between $2 million and $3.5 million. However, it should be noted that this estimate is not based on any engineering assessment, and assumes that sufficient space is available to reorganize the site to accommodate a windrow turner.

It would take a detailed engineering and economic analysis to prove out the capital costs and benefits. However, even without investments in capital to expand the facility, it appears possible to reduce the annual subsidy at current throughput if GMC works to significantly increase tipping fees for material processed, and CSWD re-evaluates inter-departmental charges for yard waste currently assessed against GMC. These changes are discussed below.

One key observation that the CSWD should keep in mind when evaluating the sustainability of GMC is (as discussed above) that GMC does not have the ability to integrate collection and processing charges into a single per cart charge. A model that integrates collection allows for a much greater capacity to price the service to assure that collection and processing are fully covered under a single per cart charge.

[22] DSM recognizes that some portion of the new tons represents liquid wastes and not food wastes.

For this reason, GMC is at a distinct disadvantage since GMC relies on delivery of material collected by private companies who can realize a profit on the collection side of the equation.

Public Needs Assessment

Chittenden County represents about one-quarter of the total residential population of Vermont, and an even greater (unknown) percentage of commercial food waste generation. Based on DSM's Act 148 analysis (October 2013) it is estimated that at a 60% diversion rate for food waste only, roughly 8,200 tons of food waste would need to be processed in 2020 from CSWD commercial and residential generators.

As such, if GMC were to be closed, shutting down one-third of current food waste processing capacity in the State (90% of which is generated in Chittenden County), it would send a strong signal to ANR and to the Legislature to reconsider the food waste ban included in Act 148. Reconsidering the food waste ban would necessarily lead to reconsideration of Vermont's landfill diversion goals as stated in ANR's Vermont Materials Management Plan because food waste and other organic materials comprise approximately 30% of material disposed in Vermont.

As discussed above, there are currently no other facilities available in Vermont that would have the capacity to process anywhere near the 5,000 tons of food waste currently processed at GMC, or handle the contamination that GMC currently handles. If the CSWD continued to enforce the ban on disposal of food waste then either CSWD or the private sector would have to develop an alternative processing or transfer facility to manage this material, and the CSWD would have to find an alternative method of processing the yard waste collected at CSWD drop-offs.

Potential Measures to Achieve Sustainability

Increase Food Waste Tipping Fees

It is DSM's professional opinion that it is possible to increase the food waste tip fee from the current $52 per ton to $62 per ton without triggering significant diversion to other food waste processing opportunities. This would add roughly $50,000 in revenue at current food waste throughput.

Charge for Yard Waste Processing

An important reason that GMC is not sustainable is that GMC realizes roughly 70 percent of total revenue from product sales and only 25 percent from tipping fees (with the balance delivery fee revenue). This is the opposite of most composting facilities. As such, a key component of sustainability will be to begin to charge for delivery of yard waste to the facility.

Externally, DSM is recommending a charge of $10 per yard for all direct deliveries of yard waste to GMC. This could raise $42,000 per year based on reported direct deliveries in FY 2017. While a limited survey of landscapers conducted by DSM indicates that they would be willing to pay for yard waste deliveries, it

is likely that there would be some fall-off in deliveries once the charge was put in place, so total new revenues might be less than the $42,000 estimated.

More importantly, DSM does not believe that GMC should be charged internally for the cost of transporting and processing yard waste from CSWD drop-offs to GMC. CSWD would have to find an alternative permitted site if GMC did not exist, and there would be a cost associated with that alternative. This charge should be borne by the drop-offs, not GMC.

There are two components to this charge. The first is the cost that CSWD charges to GMC for trucking yard waste from the drop-offs to GMC, carried at a cost of $28,000 for FY 2017.

More importantly, if GMC did not exist, CSWD would have to process yard waste dropped off at its facilities at one or more other locations. DSM believes that costs to operate a well-run yard waste composting facility would be $20 per ton, and therefore CSWD should be paying GMC this tipping fee for delivery of yard waste to GMC.

Bagging

It is possible that GMC could save money by contract bagging, which would also free up space in the current equipment maintenance building. A rough estimate is that GMC could save roughly $22,000 in bagging costs, although GMC needs to investigate this further.

Product Sales

As discussed in detail in the report, DSM does not believe that there is any real potential to increase product price points over and above current levels. And, unless there are significant increases in bagged product sales without concomitant increases in marketing costs and/or wholesale price reductions, the fully allocated cost to produce bulk and bagged product will continue to exceed sales prices. As such, while GMC and CSWD have focused much attention on product sales, this is not likely to be an important way to further GMC sustainability goals, over and above the excellent job that GMC is already doing creating and selling a high-quality product.

Conclusion

Table 10, below provides a capital and operating cost model of the potential changes to GMC charges/pricing and operations discussed in this report. Two columns are presented, the first based on FY 2017 actuals and assuming a similar throughput of FY 2017 (Current Throughput), and the second (Increased Throughput) assuming new capital investments are made allowing GMC to accept a total of 7,500 tons of food waste (and a concomitant increase in carbon sources).

This model (summarized in Table 10) illustrates that it might be possible to cut the subsidy in half based on FY 2017 actuals, and that it might be possible to increase revenues significantly if new capital investments are made. However, in both cases, the move toward financial sustainability comes primarily by increasing tipping fee revenues, not by increasing product sales revenues. ***And, in both cases, it would still be necessary for GMC to receive a subsidy from the CSWD***.

In summary, based on our analysis we believe that if CSWD decides to continue operating GMC it will need to continue to subsidize operations. The subsidy can be reduced, but not eliminated, by increasing tipping fees for food waste and instituting a tipping fee for yard waste.

Just as importantly, concentrating on material sales revenues as a way to eliminate the subsidy does not appear to be productive given that it costs more to produce the compost products than current material sales prices for those compost products; and in most cases GMC is already pricing their products at the high end of market prices for comparable products.

Finally, the CSWD will have to decide if it is worth significant investments in capital to increase throughput much beyond the 5,000 tons of food waste composted in FY 2107. While it is possible to increase throughput to 7,500 tons per year, it will take significant investments in equipment and site improvements to do so, and the CSWD will still need to subsidize GMC even after making those investments.

TABLE 10 – Potential Changes in Revenues and Throughput Necessary to Achieve Financial Sustainability

REVENUE ENHANCEMENTS	Units	Proposed Tip Fee Increase	Current Throughput	Increased Throughput
Food Waste Throughput:	tons/year		5,000	7,500
ADDITIONAL COSTS				
Capital Improvements to Increase Throughput				
Windrow Turner (10 years @3.5%)	$200,000		NA	$ (24,048)
Site Improvements (20 years @3.5%) (1)	$1,800,000		NA	$ (126,650)
Additional Operational Costs With Capital Improvements				
Add One Full-Time Staff				$ (75,000)
Additional Maintenance Costs				$ (9,499)
INCREASED REVENUES				
Food Waste Tip Fees				
Increase Fee by $10 (Current Tons)	5,000	$ 10.00	$ 50,000	$ 50,000
New Tons at Higher Fee (@$62/Ton)	2,500	$ 62.00		$ 155,000
Yard Waste Tip Fees				
Current Tons:	1,400			
$10 Charge per Cubic Yard (3 yards per ton)	4,200	$ 10.00	$ 42,000	$ 42,000
$20 Charge per Ton to Process CSWD Yard Waste	3,192	$ 20.00	$ 63,840	$ 63,840
Other Changes				
Eliminate Transport Changes for CSWD Yard Waste to GMC			$ 28,920	$ 28,920
Increase in Product Sales (FY 2018 Projections)				$ 170,000
Contract Bagging Projected Savings			$ 22,000	$ 35,000
Estimated Total:			**$ 206,760**	**$ 309,563**

Growth Opportunity

The biggest growth opportunity for GMC is to invest in the capital necessary to expand operations, and actively market acceptance of new food waste. According to a July 2017 analysis by Vermont DEC, GMC currently composts 35% of the total food waste processed in Vermont. Just as importantly, the Chittenden District was the biggest advocate in Vermont for the enactment of Act 148, which placed Vermont as the first state in the country to ban food waste disposal in landfills from all generators (not just commercial generators over a certain threshold).

Investments in new equipment to enable a significant increase in the volume of food waste accepted at GMC would provide the CSWD with a facility capable of managing much of the food waste generated in Chittenden County. This would allow GMC to reduce its annual subsidy from CSWD through increased revenue from tipping fees and product sales, with continued marketing of the GMC compost brands into a wider region outside of Chittenden County.

Threats to Growth

It is DSM's opinion based on the Operational Assessment that GMC is at or above capacity at the current time. DSM is not convinced that the projected increase in food waste deliveries budgeted in FY 2018 is sustainable without investments in new equipment and site improvements, as well as repair and maintenance of the existing mechanical mixer.

Based on current customers and sales, the market analysis for bagged product, and representations by GMC, expansion of bagged product sales will have to occur primarily outside of Chittenden County. DSM believes this will initially require lowering the wholesale and suggested retail prices to be competitive in more price sensitive areas, or against other well marketed compost products – especially Vermont Natural Ag, Coast of Maine, and McEnroe Farms.

Both Vermont Natural Ag and McEnroe Farms start with an important advantage of having access to large supplies of manure generated on the farm which can be relatively easily composted when compared to the difficulties associated with accepting food waste, removing contaminants and having to purchase manure inputs.

Therefore, one important threat to growth will be the failure of CSWD to provide GMC with the necessary resources and autonomy to make timely investments in equipment repairs and replacements in equipment necessary to more efficiently process the current incoming material (and increasing volumes of food waste).

As documented in the Operational Assessment, it is detrimental to GMC to allow major pieces of equipment such as the mixer to remain idle because of lack of funds or staff to repair it in a timely manner.

A second threat to growth would be to decide not to invest in new equipment and site improvements necessary to expand liquid food waste acceptance. These investments include additional water and liquid waste storage tank capacity to reduce leachate hauling and treatment costs, and the potential to accept more high value liquid waste during drier times of the year.

Equally important is the need to invest in a windrow turner and necessary site improvements to more efficiently process additional food waste. Without these investments, DSM does not believe it is possible to grow GMC, and it will continue to be challenging to sustain the existing operation without continued CSWD subsidies.

Finally, it is equally critical that GMC recognize limits to tipping fees for food waste. If these limits are exceeded, then a whole series of potential alternatives to GMC for food waste begin to become available including:

- On-site processing of food waste with discharge to waste water treatment plants for large food waste generators;
- Installation of food depackaging equipment at one or more transfer stations, with diversion of the slurried food waste to either a manure or sewage sludge digester; and,
- Small generator contracts with competing facilities which require very clean food waste but at competitive collection prices.

The trend in the industry is to focus food waste diversion on co-digestion with manures or waste water treatment plant sludges. While GMC is a potentially viable food waste processing facility, increased tip fees above some threshold will trigger active pursuit of anaerobic co-digestion alternatives.

Any detailed feasibility analysis of the potential to expand GMC processing capacity as proposed above must include a comparison with the potential to slurry food waste with delivery to alternative organic waste digesters.

Niches

GMC is well positioned to remain the largest processor of food waste in Vermont, with the capacity to continue to accept reasonable levels of contamination – which many of the other existing composting facilities cannot accept.

In addition, GMC has built exceptional brand recognition for its bagged products which allows these products to be sold at a higher price point, and with lower retail margins than its primary competitors.

Key Findings

Based on this analysis, DSM concludes with the following key findings about GMC.

- GMC is at or above capacity at current throughput levels. Expanding throughput will require new capital investments estimated to cost between $2 and $3. 5 million.
- GMC products are being sold at the high end of comparable product prices. Therefore, there is little room for increasing materials revenues.
- The cost to produce both bulk and bagged product is higher than the price received for these products, and there is limited ability to either reduce operational costs or increase material sales revenue.

- The primary way to reduce the subsidy is to increase tipping fees for food waste and begin to charge for yard waste.
- Increasing tipping fees will reduce the need for subsidies, but will not eliminate subsidies.
- This analysis indicates that the CSWD will need to continue subsidizing GMC in the future, even if the changes analyzed in this report are made.