Environmentally Sustainable Redesign of Seabreeze Amusement Park Waste Management

By

Briana Freeman
Department of Environmental Science

Allegheny College

Meadville, Pennsylvania

April, 2018

Submitted in fulfillment of the senior thesis requirements of the

Department of Environmental Science at Allegheny College

and approved by the senior thesis committee.

4/20/2018 4/20/18

Dr. Rich Bowden **Date** ***Dr. Casey Bradshaw-Wilson*** **Date**

B. Freeman

Table of Contents

Introduction	Page 1
Discussion	Page 1-11
Current Waste Management of Seabreeze Amusement Park	Page 1-2
New York State Permits and Regulations	Page 2-3
In-vessel Composters	Page 3-4
Waste Bins Around the Park	Page 5-6
Offsite Option	Page 6
Current Versus Compostable Paper Products	Page 6-8
Return on Investment	Page 8-11
Conclusion	Page 11-12
Appendix 1	Page 13-16
Appendix 2	Page 17
Appendix 3	Page 18
Works Cited	Page 19-22

I would like to thank Rich Bowden for guiding me through the comping experience, my dad for supporting me through all the stressful times and my roommates for always making me laugh when I needed it the most. I would also like to thank Seabreeze Amusement Park for allowing me to use company information within the project.

Abstract

Every day in the United States each person produces approximately 4.4 pounds of waste (US EPA Municipal Solid Waste, 2016). The majority of this waste ends up in landfills, releasing high quantities of methane and carbon dioxide. Corporate sustainability focuses on increasing a company's environmental responsibility while still concentrating on the economic, social and moral aspects of business. Seabreeze Amusement Park is a family-owned business located in Rochester, NY. The park currently sends approximately 2,600 tons of waste to landfills during each operating season (May through September), costing them around $18,800. To become more environmentally responsible, composting is a plausible alternative for Seabreeze to manage their waste. An in-vessel composting system, is the best option for the park due to their location next to several neighborhoods and Lake Ontario. This option would cost the park approximately $150,000. There are beneficial returns of investment including $6,758.33 saved per season from not having to purchase fertilizers and selling the compost produced. The park can also experience social benefits received from consumers and green advertisement and environmental benefits by preventing 341.33 tons of carbon dioxide from entering the atmosphere each season. Economically a total return on invest would take approximately 26.7 years. The information discovered was presented to the Seabreeze Amusement Park managers and owners as a proposal for the implementation of an onsite composting facility.

Introduction

In the United States, approximately 4.4 pounds of trash is produced per person per day (US EPA Municipal Solid Waste, 2016). In 2013, Americans generated around 245 million tons of trash and only 87 million tons of this material was recycled or composted (US EPA Municipal Solid Waste, 2016). Sending this amount of waste to landfills is detrimental to our environment and creates mass amount of methane and carbon dioxide release. The amount of methane released from landfills ranks third in anthropogenic sources after fossil fuel production and ruminant animals (US EPA, 2018). Businesses can increase their corporate sustainability and create strategies to improve the natural environment, while taking into consideration economic, social and moral standards (Appendix 1).

Composting is an environmentally responsible way to manage waste due to the decrease in methane and carbon dioxide release compared to landfills. Composting is nature's process of decomposing organic materials into rich soil (County of San Mateo, 2017). There are several styles of composting that a company can use on their property depending on location, space available, and economic stability. These styles include: vermicomposting, aerated (windrow) composting, aerated static pile composting and in-vessel composting. Each style requires close monitoring and maintenance to ensure quality compost is produced (Appendix 1).

The entertainment and tourism industries are a massive source of revenue and waste production all around the world. Tourism is a major threat to environmental sustainability, but with the ongoing development of sustainable solutions, especially focused around composting, Seabreeze Amusement Park can do their part in becoming more environmentally responsible. A full analysis was developed on the amount of waste produced and sent to landfills by Seabreeze and what changes they can make to better manage their waste. These changes include: an in-vessel composting facility, shifting to compostable paper and plastic products, and placing new waste vessels around the park that separate compost, recycling and landfill waste.

Current Waste Management of Seabreeze Amusement Park

Seabreeze Amusement Park has an established contract with the waste management company, Suburban Disposal. The waste bills from Suburban Disposal were reviewed for information on the rate and costs of waste pick-up. During the season of operation, Suburban Disposal, picks up one 10-foot-long waste dumpster and five 8-foot-long waste dumpsters three times a week. They also pick-up one 10-foot-long recycling dumpster and two 8-foot-long recycling dumpsters, three times a week. Additionally, the company picks up a 30 yard roll off twice a month, charging the park $55 a ton. If extra pickups are needed, Suburban Disposal charges $25 per recycling dumpster and $50 per waste dumpster. Overall, in the operating season of 2016, Seabreeze paid $18,845.24 for waste and recycling pick-up. Out of the

$18,845.24, recycling costs only $1,370.22, resulting in the cost of landfill waste to be $17,462.02. Over ten years, Seabreeze Amusement Park pays approximate $175,000 for waste to be taken to a landfill.

Based on the number and sizes of waste dumpsters utilized by the park and how often they are picked up, the park produces a total of around 2,651.8 tons (1,894 cubic yards) of waste during the operating season. Organics are approximately 25%-33% of the waste (Calvez, 2018). By breaking down the total amount of waste Seabreeze Amusement Park produces in season and comparing it with the average amount of organics in a total waste stream, Seabreeze produces approximately 4-5 tons of organic waste per day.

The food to paper ratio of organic waste was calculated by collecting a bucket of organic waste from an operating compos facility at Allegheny College, that focuses only on composting food and paper products. The organic waste was sorted into separate piles of paper and food products and weighed out accordingly. Out of 11 pounds of organic waste, 8 pounds was food waste and 3 pounds was paper waste. Resulting in a 2.67:1, food to paper ratio. The ratio is significant in the monitoring of moisture content and how much extra feedstock would be necessary to keep the composting vessel operating at optimum levels.

New York State Permits and Regulations

Seabreeze Amusement Park, if they follow New York regulations, will be able to register the facility, instead of applying for permits. One of the major regulations that Seabreeze must be aware of is the location of the facility. In New York State, a composting facility must be "at least 200 feet from the nearest surface water body, potable water well, and residence or place of business, excluding the generating business and any residence or place of business built after the facility began operation. This separation distance requirements may be increased to 500 feet in densely populated or otherwise sensitive areas, as determined by the department" (NY Department of Environmental Conservation, 2017). The optimal location for a composting facility on Seabreeze Amusement Park property is in the far corner of the water park parking lot, as seen in image 1 and image 2. This area can be fenced off from the public and is accessible from an access road within the park. The location is just about 700 feet away from Lake Ontario in the northern direction and over 700 feet from the Irondequoit Bay in the eastern direction. The facility would also be between 650 and 700 feet from other businesses located along Culver Road and over 800 feet from any residential areas.

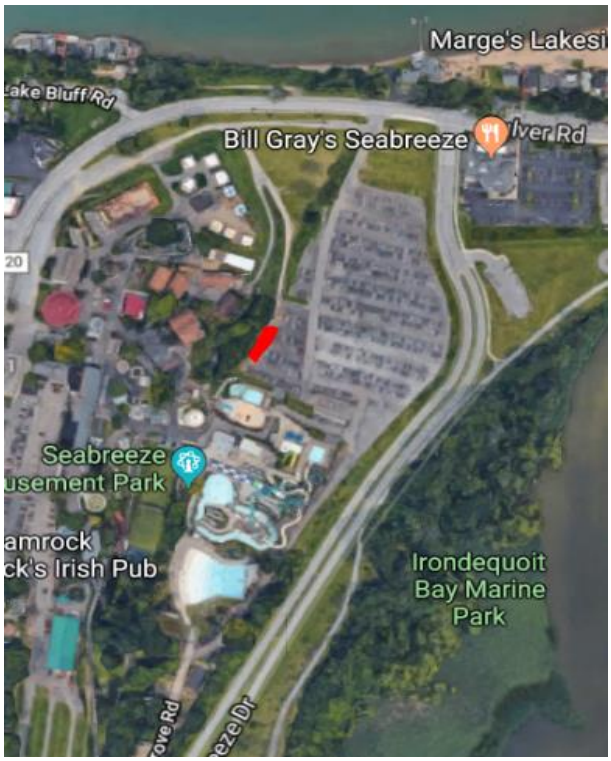


Figure 1. Aerial photo of Seabreeze Amusement Park and surrounding environment. Red square indicating potential location for composting facility (Google Maps, 2018).

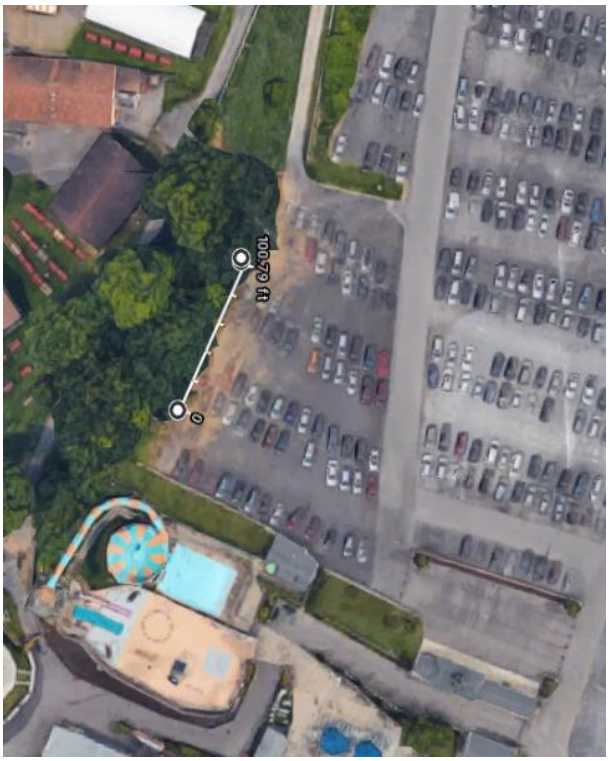


Figure 2. Aerial view of potential location for composting facility at Seabreeze Amusement Park (Google Maps, 2018).

Based on New York State regulations a composting facility can register if it accepts more than 3,000 cubic yards, but no more than 10,000 cubic yards of waste per year or the composting facility accepts no more than 1,000 cubic yards of source separated waste per year (Department of Environmental Conservation, 2017). Seabreeze falls within the second option. The park produces approximately 1,894 cubic yards of waste per operating season, and as mentioned above only 25%-33% of that waste is organic material and can be composted. Seabreeze will send approximately 475-625 cubic yards of source separated waste to the compost facility during the operating season. This number would allow for the park to work with other surrounding business in collecting food waste to compost during the winter season, without going over the 1,000 cubic yards benchmark.

Other regulations include: "material accepted does not remain on-site for more than 36 months; the process uses acceptable amendments or bulking agents and follows an acceptable method of composting that minimizes odor generation and results in mature products" (NY Department of Environmental Conservation, 2017). The compost facility must also be constructed to minimize any ponding on the composting area. The listed regulations will be easy to follow if the compost facility is maintained and run in a proper and efficient manner, which will be taught to Seabreeze employees by the company where the composting vessel is purchased.

In-vessel Composters

An in-vessel composting option is the most appropriate for the location and space available of Seabreeze Amusement Park. This style of composting can process a large quantity of waste without taking up copious amounts of space. In-vessel systems can compost virtually any organic material while producing minimal odor or leachate. This is a viable and recommended option for a company that functions in varying weather conditions because an in-vessel system can operate in all climates. This would allow Seabreeze to continue to produce compost during a rainy summer or a snowy winter.

Vendor	**Model**	**Composter Style**	**Dimensions**	**Material Per Day**	**Price**
FOR Solutions	Model 8000	Aerobic rotary drum composting system	57'Lx9'Wx15'H	5,600 pounds (2.8 tons) per day	$524,900
Ecodrum Composter	Model 560 Series	Ecodrum rotary system	57'11"Lx6'8"Wx8'10"H	750 pounds per day	$75,000
Green Mountains Technologies	Earth Flow 6016	Site-built track system	60'Lx16'Wx5'H	4-5 tons per day	Base: $89,980, Approx.Total: $150,00

Figure 3. Three in-vessel composters available for purchase. See Appendix 2 for company contact information.

In-vessel composting systems are available in a wide range of sizes and prices depending on what a company is looking for. Three different in-vessel composter suppliers were contacted for size and price quotes. At the high end of the pricing scale is FOR Solutions, who produce an aerobic in-vessel rotary drum composting system. These stainless steels systems can produce mature and pathogen free compost after five days of processing and are simple and safe to operate. Their systems are also energy efficient and produce no leachate or undesirable odors (Smith-Sebasto, 2018). The Model 8000 can process up to 40,000 pounds (20 tons) of organic waste per week or 5,600 pounds (2.8 tons) per day if loading seven days a week. This system allows for a fast turnover process, producing mature compost at a faster rate than any of the other systems researched. However, the price is at least four times higher than the other options available.

At the low end of the pricing scale is Ecodrum Composter. The ecodrum system is clean and simple to operate, reduces odor and pathogens and can maintain composting activity in cold weather (Bunko, 2018). The largest composter that the company currently has available is the Model 560 series. This system is priced at $65,000, plus $5000 for the PLC controller and $5000 for shipping, totaling

$75,000. However, this system is not large enough to manage all the waste produced daily by Seabreeze Amusement Park, meaning multiple systems would be required. While the initial price is appealing, purchasing multiple systems would put this company in the higher range of price quotes.

The final and recommended company is Green Mountains Technologies. The Earth Flow 6016 system uses a continuous flow design where food waste and green materials are added daily to the loading end of the earth flow system. An automated auger mixes the new waste into the hot compost, which rapidly breaks down as it moves toward the discharge end of the vessel (Calvez, 2018). This system can handle the 4-5 tons of organic waste produced per day and the typical process time of waste through the vessel is 14 to 21 days. The internal bay dimensions of the Earth Flow 6016 are 60'L x16'W x5'H and would require an enclosure. The stainless-steel track system can be mounted on poured concrete or block walls up to 5' deep and 100' feet long. This enclosure can be as simple or as sophisticated as the park desires. The open floor plan allows for trucks and trailers to access the loading zone and storage for the curing compost. The base price of the Earth Flow 6016 is $89,980 and can cost up to approximately $150,000 with additional system features and the sophistication of the enclosure (Appendix 3). Green Mountain Technologies has the most ideal system for the park, being able to handle the amount of waste produced per day on the lower range of the price scale.

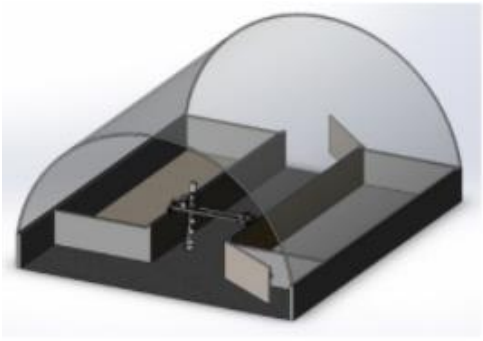


Figure 4. Blueprint of the Earth Flow 6016 Site-Built System (Calvez, 2018).

Waste Bins Around the Park

For optimal functioning of the compost facility, cooperation is required by employees and guests with sorting their waste between compostable, recyclable and landfill waste. To do this food stand employees need proper training on what can be composted such as all food scraps versus what needs to be sent to a landfill. A specific bin should be placed in each food stand to collect all food scraps that will be

Vendor	**Model**	**Style**	**Size**	**Price**
Glasdon	Nexus City 64-gallon	Customizable individual bins	64-gallon bag or 32-gallon liner	$926 for one; $2,778 for three
Nex-Terra	Oxford Triple Front Loader	Customizable three sections in one structure	38-gallons per section	$2,070

Figure 5. Two waste bin options available for purchase to be utilized at Seabreeze Amusement park. See Appendix 2 for contact information.

sent to the composter. A simple 64-gallon bin with a lid, for odor control, and wheels, for easy mobility, would suffice for each food stand. These bins can be purchased at any hardware store for approximately $50-$75.

Outside the food stands, the waste bins should be well labeled and easily accessible in multiple locations for guests to use. The waste bins should be in groups of three: one for compostable waste, one for recycling and one for landfill waste. To ensure the greatest compliance by guests, each bin should have a specific color and restrictive opening. For example, compost should be green with a square opening, recycling should be blue with a circle opening and landfill waste should be black with a rectangle opening. Pictures or symbols on the front of each bin indicating what can go into each container, can also help increase guest compliance.



Figure 6. Glasdon Nexus City 64-gallon compost can (Glasdon Inc., 2018).

Two different companies were contacted for designs and price estimates. Glasdon, located in Richmond, Virginia, supplies a 64-gallon waste bin that can be customized with different colors, symbols and openings. The bins are individual, but can be placed next to each and can hold either a 64-gallon bag or 32-gallon wheeled rigid liner. The compost bin has an aperture flap that is designed to keep vermin out and odors in. The bins are designed with a 5-point interlocking slam-shut door for security. The second, and recommended company is Nex-Terra. This company designs an Oxford Triple Front Loader waste bin, where all three sections are in one structure. Each bin is 38-gallons and when purchased includes: custom openings, opening labels, hinge doors and rigid liners. The bins are flat topped to allow for a space for trays to be collected. This waste vessel can be customized with company logos for an additional cost. Seabreeze Amusement Park, going through Nex-Terra, is eligible for a 10% IAAPA discount and depending on how many waste bins are ordered, is also eligible for a volume discount.



Figure 7. Nex-Terra Oxford Triple Front Loader waste bin (Nex-Terra, 2018).

Having the proper waste vessel is significant to making environmentally responsible changes within the park. Guest compliance is necessary for the success of a compost facility and for having the cleanest possible compost, with minimal contaminants. Having a high percentage of compliance comes from proper education and solutions that are simple and cause minimal burden for guests. It has been

found that most Americans are open to the idea of composting, but require guidance and simple solutions (Smith, 2014). This can be accomplished with educational signs of what can and cannot go in each bin and having conveniently placed and well labeled waste vessels.

Offsite Option

As a second option, instead of an on-site composting facility, Seabreeze can look to collecting compost and sending it off-site to an already developed facility. This option can be a permanent choice or act as a temporary transition phase, while the park progressively purchases the waste vessels, builds the compost facility and trains employees on how to safely operate the composter. One of the landfills utilized by Suburban Disposal, High Acres Landfill, operates a composting facility that businesses can connect with and send their compost. Suburban Disposal, is unwilling to pick up and transport compost separate to other waste, forcing companies to design a contract with Waste Management, the owners of the landfill, to discuss cost and pickup options.

The upfront cost of this option may be more appealing; however, it will be a continual cost similar to how waste is managed currently, compared to the one large initial cost of an on-site composting vessel. Going this option would also result in Seabreeze, not being able to use the compost they produced or sell the compost for profit. While this is a great option as a transitional phase for the park, there are downfalls with making it the permanent solution.

Current Versus Compostable Paper Products

Seabreeze Amusement Park currently purchases their paper and plastic products for their food stands from six different vendors. These vendors include: Regional Distribution, WB Mason, Allen Associates, Palmer Food Services, Sysco and Pepsi. The cost of the total amount of paper products purchased for the season of 2016 was approximately $52,129. That is a total of 2,615,888 paper and plastic products purchased, all of which end up heading to a landfill.

Alternatives to these products are available, which can end up being composted instead of sent to a landfill. A paper product that is considered compostable must demonstrate that it is capable of undergoing biological decomposition in a compost site, such that the plastic is not visually distinguishable and breaks down to carbon dioxide, water, inorganic compounds and biomass, at a rate consistent with known compostable materials (Song et al., 2009). To achieve the specific rate and materials of decomposition, there is a more expensive rate of production for compostable products compared to traditional plastics. This results in the cost of bioplastic polymers (compostable plastics) to generally cost more than that of traditional plastic counterparts. This difference in cost is a major restriction for more widespread use. However, significant growth rates have been achieved in product capacity over the last decade (Song et al., 2009). Bioplastic polymers are expected to become priced as commodity materials as

performance and costs improve, benefits are assigned to the use of renewable resources, the prices of oil increase and the increase in awareness of environmental impacts and legislation (Song et al., 2009).

	Product	**Current Products**	**Compostable Products**
Company:	1/4-Fold Napkins	Regional Distribution	Paper Products Company Inc.
Quantity per case:		6000	6000
Cost per case:		$50.64	$49.73
Company:	Teaspoon (unwrapped)	Regional Distribution	Paper Products Company Inc.
Quantity per case:		1000	1000
Cost per case:		$5.88	$39.76
Company:	6" Paper Plate	Regional Distribution	Paper Products Company Inc.
Quantity per case:		1000	1000
Cost per case:		$9.68	$41.87
Company:	Straws	Allen Associates	Paper Products Company Inc.
Quantity per case:		12000 (unwrapped)	9600 (wrapped)
Cost per case:		$31.14	$168.05
Company:	10 oz. Clear Cups	Regional Distribution	Paper Products Company Inc.
Quantity per case:		2500	1000
Cost per case:		$55.99	$57.82
Company:	Flat Lids	Allen Associates	Paper Products Company Inc.
Quantity per case:		1000	2500
Cost per case:		27.94 (13.97 per 500)	65.91 (13.18 per 500)

Figure 8. Six popular items products purchased by Seabreeze Amusement Park and compostable alternatives.

There are several different companies to purchase green paper and plastic products from. The leading companies in the global compostable foodservice packaging market include: Eco Products Inc., Biosphere Industries LLC, International Paper Company, Cereplast Inc., BioBag Canada Inc., and Penley Corporation (GlobalQYResearch, 2018). While these are the top manufacturers and players in the market, the company that was found to have the most comparable prices to what is currently purchased is Paper Products Company Inc., located in Pittsburgh, Pennsylvania. Many of the products that Seabreeze purchases can be bought through Paper Products Company Inc. for a similar or lower price including ¼-fold napkins, 10 oz. clear cups and flat lids, as seen in Table 1. However, several of the products are significantly more expensive including teaspoons, 6” paper plates, and wrapped straws (Table 1).

Unfortunately, the choice to purchase compostable products must be an all or nothing decision. If only a portion of the paper and plastic products are compostable, the park runs a higher risk of guests throwing all their paper or plastic waste into the composting bin, which contaminants the end compost product and decreases its value.

Return on Investment

The implementation of a compost facility on Seabreeze property is a large economic investment. With purchasing the in-vessel composter, a chipper shredder to pre-shredder the materials, ten waste containers for guests to use and composting containers for each of the food stands, the park is looking to invest approximately $180,680. While this is a large upfront expense, there are beneficial environmental, economic and social returns on investment.

Total Cost Breakdown	
Green Mountain Technologies Composter	$150,000
Wallenstein (4") 35-HP Kohler Tow-Behind Chipper Shredder	$11,550
Nex-Terra Oxford Triple Front Loader Waste Bin (x10)	$18,630
Waste Bins for food Stands (x10)	$500
Total	$180,680

Figure 9. Total cost breakdown and potential investment.

When waste gets sent to landfills it becomes a major source of methane and carbon dioxide release. One ton of food waste equals approximately .59 tons of carbon dioxide (US EPA Waste Reduction Model, 2016). Seabreeze Amusement Park, produces approximately 4.5 tons of organic waste per day equaling 2.66 tons of carbon dioxide per day. Totaling 18.59 tons of carbon dioxide a week and 334.53 tons of carbon dioxide per operating season. This is equivalent to the carbon dioxide released from 64.5 passenger vehicles per year (US EPA, 2018). All this carbon dioxide could be prevented from entering the atmosphere, through composting organic waste. A well-managed compost pile produces close to zero carbon dioxide (Brown, 2013). Seabreeze has the opportunity to make a difference with decreasing the amount of pollutants being released into the atmosphere.

Transportation of the waste produced by Seabreeze has both an economic and environmental impact. The waste collection trucks that pick-up waste from Seabreeze get approximately 2.8 miles per gallon of diesel. The waste gets transported to either Millseat Landfill, located 31 miles from the park or High Acres Landfill located 18 miles from the park. 50 cubic yards of waste is picked up and transported to one of the two landfills three times a week. Following the calculation of load size times miles divided by miles per gallon times the number of times waste is picked up per week, results in the number of gallons of diesel used per week. The waste that is sent to landfills from Seabreeze Amusement Park requires 32.8 gallons of diesel per week, totaling 344.3 kg of carbon dioxide. That is a total of 590.4 gallons of diesel over the 18 weeks of operation, equaling 6,197.4 kg (6.8 tons) of carbon dioxide. This

does not include any diesel used or carbon dioxide released for any extra pick-ups. Combined with the carbon dioxide reduction from composting waste Seabreeze has the opportunity to prevent 341.33 tons of carbon dioxide from entering the atmosphere each season.

By switching to compost and decreasing the amount of waste being transported, the park can save money and decrease the amount of carbon dioxide being released from transport. Approximately 1,894 cubic yards of waste is produced in an 18-week operating season. Around 25% of that waste is organics, resulting in the park producing 26.3 cubic yards of organic compostable waste per week. With this amount of waste being removed from the waste stream that gets transported to the landfill, the park could do away with the 10FL dumpster that is picked up three times per week. Removing this dumpster would save the park $523.25 per month, including tax would total $1,695.33 per season. This number does not include any of the extra pick-ups costing $50 each that could be saved through the reduction of waste being sent to the landfill.

Total Savings Breakdown	
Selling compost produced by the park	$5,063
Reduction of waste bill	$1,695
Total	$6,758

Figure 10. Breakdown of total savings for the park with the implementation of an onsite composting facility.

When producing their own compost, the amusement park will save money by not having to purchase fertilizers and potting soil for their grounds and plant beds. The park will be putting into the composter approximately 4.5 tons of organic waste per day, and around 50% of the amount put in comes out as compost resulting in about 2.25 tons of compost produced per day (Calvez, 2018). An option for all the excess compost not used on Seabreeze grounds, is to sell it to surrounding businesses and local farms. Compost can be sold for approximately $25 a cubic yard (about 80 lbs.) or $5 a cubic foot (40 lbs. bag) (McConkey, 2018). This price can vary slightly with the quality of compost produced. A high-quality compost can sell for upwards of $40 a cubic yard. To be considered a high-quality compost, the producer should know what ingredients went into the compost and be able to confirm that no harmful materials were added to the pile. Also, the producer should be able to confirm that compost reached an adequate temperature for killing harmful pathogens and went through a proper curing process (Compost Junkie, 2012). To sell fertilizer, including compost, in the State of New York a license is required. The license can be purchased for $150 and needs to be renewed every two years (New York State, 2017). Selling compost is an extra income for the park and a return on the investment of the composting vessel. The park operates for approximately 18 weeks, 7 days a week, totaling 126 days. If producing 2.25 tons of compost per day for 126 days, the park will produce 283.5 tons (202.5 cubic yards) of compost per season. If selling compost for $25 a cubic yard, there is a possibility to earn around $5,063 a season through selling

the compost produced or save the equivalent amount from not having to purchase soil or fertilizer from outside sources.

There is the opportunity for a positive social return on investment with the advertisement of the parks environmentally responsible initiative. Researchers have identified many virtues of green marketing such as compliance with environmental pressures, obtaining competitive advantage, improving corporate images, seeking new markets or opportunities, and enhancing product value (Kong and Zhang, 2013). Consumers tend to believe that companies using green appeals are socially responsible, reputable, prestigious and stable. The environmental association can also make consumers experience sensational benefits which comes from feelings of well-being or happiness produced through contact with nature (Kong and Zhang, 2013). The significant main effect of green appeal in advertisement suggests that compared to advertisement without it, the message is largely more effective in the enhancement of attitude toward the ad and toward the brand. Therefore, when exposed to environmentally friendly information versus information without environmental associations, consumers yield more positive, affective and cognitive responses (Kong and Zhang, 2013).

Total Initial Investment	**Total Saving Per Year**	**Years for Economic Return on Investment**	**Total Potential Carbon Dioxide Reduction per Year**	**Potential Carbon Dioxide Reduction over 26.7 Years**	**Reduction Equivalence of Passenger Vehicles over 26.7 years**
$180,680	$6,758.33	26.7	341.33 tons	9,113.51 tons	1,939.04 passenger vehicles

Figure 11. Shows breakdown of investment versus yearly saving of money and carbon dioxide.

Choosing to invest in the composting facility and related changes would cost the park an upfront price of approximately $180,680. The savings from reducing the amount of waste picked up per week and from not purchasing fertilizer for the park or selling the compost produced would save the park around $6,758,33 per season. With only looking at the money saved per season it would take approximately 26.7 years to make a complete return on investment economically. However, each season that the park chooses to compost, they would prevent a total of 341.33 tons of carbon dioxide from entering the atmosphere. Over the 26.7 years, this would prevent a total of 9,113.51 tons of carbon dioxide from entering the atmosphere. This is equivalent to removing 1,939.04 passenger vehicles from the road.

Conclusion

Seabreeze Amusement Park has the opportunity to become an environmental leader in the amusement park industry by developing an onsite composting facility. Utilizing the information provided

can guide the park towards a sustainable decision that reflects environmental, economic and social factors. Environmentally, the development of a compost facility will decrease the amount of methane and carbon dioxide release the park produces through transportation and the decomposition of landfill waste. Economically, the park will save money by decreasing their waste pick-up expenses and by not having to purchase fertilizers and potting soils for their grounds. Socially, Seabreeze can create a positive appearance and enhance consumer attitudes toward the park through green advertising. The decision to go compostable with an on-site compost facility is highly recommended and will result in both short and long-term benefits. As well as it can influence other parks to follow in Seabreeze's steps and create an environmental movement among the amusement park industry.

Appendix 1.

Background Information on Corporate Sustainability and Waste Management

Each day in the United States every person produces approximately 4.4 pounds of trash (US EPA Municipal Solid Waste, 2016). This waste is detrimental to our environment by damaging ecosystems, producing mass amounts of methane and carbon dioxide release with decomposition and placing pollutants into the air that are harmful to human health. To prevent the ongoing negative side effects of waste, people and businesses need to reevaluate their actions and become environmentally responsible by altering their unsustainable practices. Businesses have the opportunity to make positive environmental change on a large scale. Companies can use corporate sustainability to create a green strategy aimed towards improving the natural environment, while taking into consideration every dimension of how a business operates including economic, social and moral.

The concept of corporate sustainability has seen ongoing development, specifically among three types of relevant capital: economic, natural and social (Dyllick and Hockerts, 2002; Baumgartner and Ebner, 2010). Every company presents a unique case and requires a comprehensive review of strategies, operations and goals to advance sustainable practices (Dosal, 2013). There is a wide variety of corporate sustainability strategies that a company can use to help improve their environmental standings and increase the company's market value (Lo and Sheu, 2007). A one-solution-fits-all concept for corporate sustainability is not plausible, instead sustainability is a custom process that needs to match the development, awareness and ambition levels of a business (Van Marrewijk and Werre, 2003;Lozano, 2012). The designing of a custom management plan must be focused around supporting the institutional structures of the company.

Corporations and businesses produce large quantities of waste that is sent to municipal solid waste landfills. A municipal solid waste landfill is a discrete area of land or excavation that receives household waste. This waste can include: nonhazardous waste, commercial waste, nonhazardous sludge and industrial waste (Municipal Solid Waste Landfills | US EPA, 2017). In 2009, there were approximately 1,908 municipal solid waste landfills within the United States, all managed by the state in which they are located. As waste continues to be produced the number of landfills will continue to increase (Municipal Solid Waste Landfills | US EPA, 2017). In 2013, Americans generated around 245 million tons of trash and only about 87 million tons of this material was recycled or composted (US EPA Municipal Solid Waste, 2016). Founded by the EPA, food waste is the single biggest occupant in American landfills (Chandler, 2016). When calculated out, about 21% of landfill volume is food waste (Feeding America). The waste that ends up in landfills is a significant source of methane and carbon dioxide (Du et al., 2017). The amount of methane released from landfills ranks third in anthropogenic sources after fossil fuel production and ruminant animals (What's Your Impact, 2017). The waste piling

up in landfills, produce fifty-five million tons of methane per year (Bousquet et al., 2006). The largest environmental impacts from disposing of solid waste in landfills are gas and leachate generated from microbial decomposition, climate conditions, refuse characteristics and landfill operations (ElFadel et al., 1997). The negative results of these impacts include: potential health hazards, fires and explosions, vegetation damage, unpleasant odors, groundwater pollution, air pollution and global climate change (ElFadel et al., 1997).

Composting is an environmentally responsible way to manage waste. The process of composting is the decomposing of organic materials into rich soil (County of San Mateo, 2017). Scientists have been working towards increasing the efficiency of this process, which requires an understanding of the materials involved and the interactions of the physical parameters (Mohee and Mudhoo, 2005). The physical parameters include five specific areas that need to be controlled and monitored throughout the composting process. The five areas include: feedstock and nutrient balance, particle size, moisture content, temperature and oxygen flow. Each of these parameters are required to be at a specific level or ratio to optimize the functioning of the compost pile. For feedstock and nutrients, the approximate amount of green versus brown material is 40% green to 60% brown. Green material includes: grass clippings, food scraps, manure and any material that contains large amounts of nitrogen. Brown material includes: dry leaves, woodchips, branches or any material that is high in carbon (US EPA, 2016; McGovern, 2017). Particle size is optimal at a small size because it increases the rate of surface area for microbial activity (Trautmann, 1996). Microorganisms need enough moisture to be able to survive which is optimal around 50-60% (Trautmann, 1996; Kumar et al., 2010). Oxygen flow is required by microorganisms because composting is an aerobic process (Richard, 2000). Microbial activity can raise the temperature of the pile's core to at least 140 degrees Fahrenheit (US EPA, 2016). The hotter the pile the faster the decomposition process will go. For rapid composting the temperature should be over 120 degrees Fahrenheit, but not go over 160 degrees Fahrenheit (UCSB Associated Students, 2017) Each of these parameters needs to be closely monitored and should be focused towards their optimal levels to ensure peak functioning of the compost facility.

There are several types of composting that can be used depending on location, space available and the amount of money one is willing to spend. One popular type of composting that can be done on multiple scales is vermicomposting. This method is a viable, cost-effective and rapid technique for the efficient management of organic solid waste (Garg et al., 2006). This type of composting uses red worms in bins that feed on food scraps, yard trimmings and other organic material to create compost (US EPA, 2016). Aerated (turned) windrow composting is another option, which is most beneficial for large volumes of organic material (US EPA, 2016). This method yields large amounts of compost, which may make this the ideal method for those looking to market the end product. A third method to consider is

aerated static pile composting. This method is best for large quantity generators of yard trimmings and compostable municipal solid waste. However, this method does not work well for composting animal byproducts or grease from food processing industries (US EPA, 2016; Sesay et al., 1997). A final method is in-vessel composting, which can accommodate a large amount of waste in a limited amount of space. Different vessels can include: containers, silos, tunnels, rotating drums or enclosed halls (Zero Waste Scotland, 2017). Within these vessels virtually any organic material can be composted, and the vessels provide protection from environmental conditions (US EPA, 2016). It is important for a company when choosing a method of composting to understand their budget, the amount of waste they plan on composting, labor available and the surrounding land. Each of these factors are significant in deciding which type of facility to build.

One of the leading developments in compost technology is how plastics are being transformed to be composted (Stevens, 2002). Development of green plastics has been progressing, but one of the major difficulties for companies and consumers to understand is the differences between degradable, biodegradable and compostable. Compostable plastic is a material that undergoes degradation by biological processes during composting to yield carbon dioxide, water, inorganic compounds, and biomass at a rate consistent with other known compostable materials and leaves no visually distinguishable or toxic residues (Stevens, 2002; Greene, 2007).

Having multiple types of composting materials can be beneficial for the carbon to nitrogen ratio of the pile. The carbon to nitrogen ratio is one of the most important factors affecting the composting process as well as the property of the end product (Christensen, 2009). A carbon to nitrogen ratio ranging from twenty-five to thirty is usually considered the optimal ratio (Kumar et al., 2010). Co-composting of two or more types of organic materials is expected to overcome the disadvantages of composting a single material and balancing the carbon to nitrogen ratio (Kumar et al., 2010). A range of organic materials can include: yard trimmings, leaves, food waste and green plastics.

The entertainment and tourism industry is a major source of revenue all throughout the world and an area of major waste production. This results in tourism to be a great threat to sustainability. Mass waste production can result in the depletion of natural resources and be an associated threat to global climate change (Becken and Simmons, 2003). There have been efforts by major amusement parks to decrease the amount of waste they send to landfills through recycling programs and composting efforts. For example, Universal Orlando Resort is minimizing its impact on the environment through conservation, recycling, education and designing attractions. The parks have more than 2,300 recycling bins and in 2011 increased their recycling efforts from previous years. In 2011 Universal recycled 255 tons of plastic and glass bottles, 23 tons of aluminum cans, 1,188 tons of cardboard, 745 tons of yard waste and 3,300 wood pallets (Comcast, 2012). Walt Disney World is helping to manage their environmental impact through

composting at the Reedy Creek Composting Facility. Beginning in October 1988, the program composts biosolids, hotel food scraps, construction and demolition wood chips and yard trimmings. During this time Disney was estimated to compost 150 tons per day of food waste (Spencer, 1993).

With growth of knowledge, can come better developments of solutions to the ongoing environmental problems that occur in society, specifically in the amusement park industry. The development of strategy requires extensive research and the understanding that each issue calls for an individualized approach. However, before creating an individualized plan, one needs to be aware of general information on different strategies, design options and requirements for optimal functioning. For a company to decrease the amount of waste that is sent to landfills through the use of a composting facility, all aspects of landfills, composting facilities, business operations and regulations need to be thoroughly understood.

Seabreeze Amusement Park has the potential to reduce their waste production and become a more environmentally responsible park, through the development of an onsite composting facility. Seabreeze Amusement Park located in Rochester, New York, on the shore line of Lake Ontario is a small, family-owned business that requires environmentally sustainable changes. The park originally opened on August 5, 1879 and has been growing ever since, with the installation of different rides and water park attractions. The park now sits on approximately thirty acres of land and can accommodate up to 7,500 people per day (Seabreeze Amusement Park). Owned by the Long family, for five generations, the park has reached a total of seventy different attractions for guests to enjoy (Seabreeze Amusement Park). The park is only open for operation between the end of May through the beginning of September, open from the hours of 11 AM to 10 PM. The amusement park attracts people from all over the world and employs around 800 people each season (Jeff Bailey, 2017; Mike Mantione, 2017). Seabreeze has made advancements in providing new rides, renovating buildings and adding in several new food stands, however major growth can still be made with the parks environmental responsibility.

Appendix 2.

Company Contact Information

In-vessel Composters

Ecodrum Composter
Byron Irwin- (701)446-6139

FOR Solutions
Nicholas Smith-Sebasto- (973)945-9150, <nsmithsebasto@forsolutionsllc.com>

Green Mountain Technology
Vance Calvez- (206)319-7102, <van@compostingtechnology.com>

Landfills

High Acres Landfill
Customer Service- (800)333-6590

New York State Composter Permits and Regulations

NYS Bureau of Waste Reduction and Recycling
Chris Galander- (518)402-8706

Waste Collection Bins

Glasdon Inc.
Sales Office- 1-(855)874-5273

Nex-Terra
Glenn Roskilly- (888)868-6297x1230, <groskilly@max-r.com>

Appendix 3.

Information on Green Mountain Technologies Earth Flow 6016 Site-Built System

GREEN MOUNTAIN TECHNOLOGIES
COMMERCIAL COMPOSTING SOLUTIONS

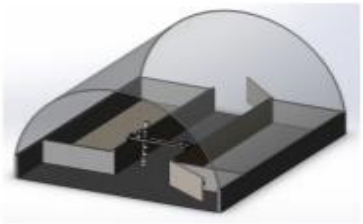
Earth Flow™ 6016 Site-Built Price & Specifications

Effective May 2017

EF-6016-SB Base Price[+]: $89,980

Key Features

- Stand-Alone Earth Flow Mixing System
- Can Be Integrated into Any Site-Built or Locally-Built Vessel ++
- Exclusive Traveling Auger System and Continuous Flow Technology
- Stainless Steel Auger, Rails, Carriage and Travel Car
- Flexible, Configurable Design



Vessel Specification

Total Vessel Compost Capacity (cubic yards)	160 yd^3
Internal Dimensions for Composting Vessel	60'L x 16'W x 4.5'D
Daily Input Capacity @ 21 days retention	4.3 tons/day*
Daily Input Capacity @ 14 days retention	6.1 tons/day*
Daily Input Capacity @ 10 days retention	7.8 tons/day*
Daily Input Capacity @ 7 days retention	10.2 tons/day*
Daily Input Capacity @ 5 days retention	13.6 tons/day*

Mixing System

Mixing Auger	14" 304 stainless steel, 3/8" thick flighting
Gear Motor	5hp, 3 ph (208/230/460V – 60 Hz)
Auger Gearbox	Helical bevel, synthetic lube
Carriage & Rail Gear Motors	Fractional hp Helical Bevel
Control Panel	Programmable PLC in NEMA 4x panel
Power Requirements	30A 3 phase 208V or 40A 1 phase 220V

Options Available

Replacement Bolt-On Auger Flighting (one set)	$ 1,295 (4 pieces per set)
Spare Parts Hardware Package (parts list available)	$ 995
Automated Temperature Monitoring	$ 9,975
Tote Loader with Hydraulic Package	$ 11,980
Moisture Addition System	$ 895
Piping for Pile Based Biofilter	$ 990
Single Phase Power Connection	$ 895
Custom Placement of Electrical Control Panel**	$ 750

Warranties

Extended Parts Only Warranty***	$ 2,980/yr

+ **Important Note:** vessel, enclosure and infrastructure costs not included.
++ A site-built system is typically installed on a concrete pad with concrete or wood walls and a hoophouse enclosure. However, the Site-Built Earth Flow can installed into a variety of vessels. In any case, no vessel or other site-built costs are included on this price sheet.

* Assumes an aggregate bulk density of 850 lbs/yard for all feedstocks. Also assumes a continuous flow of inputs and some reduction of volume in vessel.
** Standard placement of electrical panel is on the right side of the unit when facing the load end.
*** This extended warranty is for replacement of defective parts only. It does not include labor to remove or install components. It does not include repair/replacement of wear items (such as auger flighting, slide blocks, chains) that require periodic replacement. Our Standard Warranty is a 1-year parts only warranty.

Custom Sizes Available. Prices subject to change without notice. Shipping FOB Origin, assembled.

compostingtechnology.com
sales@compostingtechnology.com
802.368.7291

5350 McDonald Avenue NE
Bainbridge Island, WA 98110
WA License # GREENMT852CS

Works Cited

Baumgartner, R. J., & Ebner, D. (2010). Corporate sustainability strategies: Sustainability profiles and maturity levels. *Sustainable Development, 18*(2), 76-89.

Becken, S., Simmons, D. G., & Frampton, C. (2003). Energy use associated with different travel choices. *Tourism Management, 24*(3), 267-277. doi://dx.doi.org/10.1016/S0261-5177(02)00066-3

Bousquet, P., Ciais, P., Miller, J. B., Dlugokencky, E. J., Hauglustaine, D. A., Prigent, C., & Langenfelds, R. L. (2006). Contribution of anthropogenic and natural sources to atmospheric methane variability. *Nature*, *443*(7110), 439-443.

Brown, S. (2013). Connection: Climate Calculations. *Biocycle,54*(6), 52. Retrieved March 2, 2018.

Bunko, H. (2018, February 6). Ecodrum Composter Price Quote [E-mail interview].

Calvez, V. (2018, January 22). Green Mountain Technologies [E-mail interview].

Chandler, A. (2016, July 15). Why Americans Lead the World in Food Waste - The Atlantic. Retrieved November 12, 2017, from • www.theatlantic.com/business/archive/2016/07/american-food-waste/491513/

Christensen, E. (2009). Best Management Practices (BMPS) for Incorporating Food Residuals into Existing Yard Waste Composting Operations (United States, US Environmental Protection Agency, US Composting Council). Bethesda, MD: US Composting Council.

Comcast. (2012, October 11). Universal Orlando Goes Green. Retrieved March 2, 2017, from http://corporate.comcast.com/news-information/news-feed/universal-orlando-goes-green

Compost Junkie. (2012). We Help You Find and Buy Compost. Retrieved February 26, 2018, from http://www.compostjunkie.com/buy-compost.html

County of San Mateo. (2017). Composting. Retrieved November 9, 2017, from http://www.recycleworks.org/compost/

Dosal, C. (2013, August 14). 5 Key Steps to a Sustainable Corporate Strategy. Retrieved November 12, 2017, from http://www.pgsadvisors.com/2013/08/5-key-steps-to-a-sustainable-corporate-strategy/

Du, M., Peng, C., Wang, X., Chen, H., Wang, M., & Zhu, Q. (2017). Quantification of methane emissions from municipal solid waste landfills in China during the past decade. *Renewable and Sustainable Energy Reviews*, *78*, 272-279.

Dyllick, T., & Hockerts, K. (2002). Beyond the business case for corporate sustainability. *Business Strategy and the Environment, 11*(2), 130-141.

ElFadel, M., Findikakis, A., & Leckie, J. (1997). Environmental impacts of solid waste landfilling [Abstract]. *Web of Science,50*(1), 1-25. Retrieved November 12, 2017.

Feeding Americ. (n.d.). Our Approach. Retrieved November 12, 2017, from from http://www.feedingamerica.org/our-work/our-approach/

Garg, P., Gupta, A., & Satya, S. (2006). Vermicomposting of different types of waste using Eisenia foetida: A comparative study. *Elsevier*,*97*(2), 391-395. Retrieved November 8, 2017.

Glasdon Inc. (2018). Nexus® City 64G Food Waste Recycling Bin. Retrieved February 20, 2018, from https://us.glasdon.com/recycling-bins-recycling-containers/outdoor-recycling-containers/nexus-city-64g-food-waste-compost-recycling-bin

GlobalQYResearch. (2018). *Global Compostable Foodservice Packaging Sales Market Report 2018*(p. 109, Rep.).

Google Maps . (2018). Seabreeze Amusement Park [Map].

Greene, J. (2007). Biodegradation of compostable plastics in green yard-waste compost environment. *Journal of Polymers and the Environment*, *15*(4), 269-273.

Jeff Bailey [E-mail interview]. (2017, April 20).

Kong, Y., & Zhang, A. (2013). Consumer response to green advertising: the influence of product involvement. *Asian journal of communication*, *23*(4), 428-447.

Kumar, M., Ou, Y. L., & Lin, J. G. (2010). Co-composting of green waste and food waste at low C/N ratio. *Waste Management*, *30*(4), 602-609.

Lo, S., & Sheu, H. (2007). Is corporate sustainability a value-increasing strategy for business? *Corporate Governance: An International Review, 15*(2), 345-358

Lozano, R. (2012). Towards better embedding sustainability into companies' systems: An analysis of voluntary corporate initiatives. *Journal of Cleaner Production, 25*, 14-26.

McConkey, G. (2018, February 1). Producing and Selling Compost [Telephone interview].

McGovern, A. (2017). Home Composting & Green Landscaping. Retrieved November 13, 2017, from https://www.mass.gov/lists/home-composting-green-landscaping

Mike Mantione [Personal interview]. (2017, August 15).

Mohee, R., & Mudhoo, A. (2005). Analysis of the physical properties of an in-vessel composting matrix. *Powder Technology*, *155*(1), 92-99.

Municipal Solid Waste Landfills | US EPA. (n.d.). Retrieved November 12, 2017, from https://www.epa.gov/landfills/municipal-solid-waste-landfills

New York State. (2017). *Circular 910; Rules and Regulations for Sale and Analysis of Commercial Fertilizer* (10th ed., pp. 1-13) (United States, Department of Agriculture and Markets). Albany, NY.

Nex-Terra. (2018). Max-R. Retrieved February 20, 2018, from https://www.max-r.com/product/oxford-triple-front-load-recycling-bin

NY Department of Environmental Conservation. (2017). Regulations for Organic Recycling Facilities. Retrieved February 24, 2018, from https://www.dec.ny.gov/chemical/97488.html

Platt, B. (2016, May 20). New York - Composting Rules. Retrieved February 11, 2018, from https://ilsr.org/rule/on-farm-composting/new-york/

Richard, T. (2000, October). Oxygen. Retrieved November 11, 2017, from http://compost.css.cornell.edu/Factsheets/FS4.html

Seabreeze Amusement Park. (n.d.). Retrieved March 01, 2017, from http://seabreeze.com/

Sesay, A. A., Lasaridi, K., Stentiford, E., & Budd, T. (1997). Controlled composting of paper pulp sludge using the aerated static pile method. *Compost science & utilization*, *5*(1), 82-96.

Smith, E. (2014, January 13). Study: What Could Get Us to Compost More? Retrieved February 22, 2018, from https://associationsnow.com/2014/01/study-what-could-get-us-to-compost-more/

Smith-Sebasto, N. (2018, January 23). For Solutions Price Quote [E-mail interview].

Song, J. H., Murphy, R. J., Narayan, R., & Davies, G. B. H. (2009). Biodegradable and compostable alternatives to conventional plastics. *Philosophical transactions of the royal society B: Biological sciences*, *364*(1526), 2127-2139.

Spencer, R. L. (1993). Composting Expands Disney Recycling Program. *Biocycle*. Retrieved November 20, 2017, from • http://infohouse.p2ric.org/ref/30/29316.pdf

Stevens, E. (2002). How Green are Green Plastics? *Biocyle,*42-45. Retrieved November 12, 2017.

Trautmann, N. (1996). Compost Physics. Retrieved November 11, 2017, from http://compost.css.cornell.edu/physics.html

UCSB Associated Students. (2017). Aerobic Composting: Adding Material and Maintaining the Pile. Retrieved November 11, 2017, from https://worms.as.ucsb.edu/aerobic-composting-adding-material-and-maintaining-the-pile/

US EPA. (2016, August 29). Types of Composting and Understanding the Process. Retrieved November 8, 2017, from www.epa.gov/sustainable-management-food/types-composting-and-understanding-process

US EPA. (2018, March 14). Methane Emissions from Landfills. Retrieved March 26, 2018, from https://www.epa.gov/lmop/basic-information-about-landfill-gas

US EPA. (2018). Greenhouse Gas Emissions from a Typical Passenger Vehicle. Retrieved March 6, 2018, from https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle

US EPA Municipal Solid Waste. (2016, March 29). Municipal Solid Waste. Retrieved September 27, 2017, from https://archive.epa.gov/epawaste/nonhaz/municipal/web/html/

USA EPA Waste Reduction Model. (2016). Per Ton Estimates of GHG Emissions for Baseline and Alternative Management Scenarios .

Van Marrewijk, M., & Werre, M. (2003). Multiple levels of corporate sustainability. *Journal of Business Ethics*, *44*(2), 107-119.

Zero Waste Scotland. (2017). What is in-vessel composting? Retrieved November 9, 2017, from http://www.zerowastescotland.org.uk/content/what-vessel-composting-0