Group Policy Brief

The Town of Miami, located in Arizona's Gila County, is home to only 1,858 people, but faces the threat of shortening landfill space due to its linear waste disposal system ("Miami, AZ Profile," 2017). Community Development Manager, Mr. Alan Urban, conceptualized an alternative outflow for the Waste Water Treatment Plant (WWTP) byproduct through a biosolids program. The idea was not only new to he and Town Manager, Joseph Heatherly, but also potentially controversial among the general public. In consideration to these constraints, the town's problem expanded to include the lack of research behind repurposing human waste, the stigma of this waste as a product, and the marketability of such product; therefore, the Copper Corridor Maroon Group researched these concerns to effectively address Miami's sustainability challenge.

Our group began its research by analyzing various systems that repurposed human waste. The first option was to create an entirely new WWTP because Miami's current facility could not dry the byproduct to a low enough water content and thus, was forced to landfill it. New York City's plan to reduce biosolid landfilling, for instance, relied on its dewatering technology of the treatment facilities ("New York City's Wastewater," 2018). The Miami WWTP did not have this technology which is why our group researched it as an option. It quickly became evident, however, that building from the ground-up brought many challenges. Namely, a new WWTP needed high capital investment, high-waste inflows, and a large amount of space. The likely outcome of this decision – and the most plausible strategy for Miami to meet capital, waste, and space requirements – was to collaborate with multiple jurisdictions. These numbers would be tough to achieve and collaborating with other jurisdictions would take far longer than the Town of Miami could afford. Thus, the option to

build a new WWTP was not considered for further evaluation, but led our group to research an upgrade in the Miami facility: an anaerobic digestion system.

Building a new treatment facility was not a realistic option for the Town of Miami; however, our group discovered in speaking with Mr. Urban that the town's current WWTP may simply need an upgrade to its drying process, rather than need an entirely new facility. Drying the byproduct to an acceptable percentage could be achieved successfully by adding an anaerobic digestion system to the existing WWTP in Miami. This option appeared even more plausible after researching a system in Pennsylvania where excess methane was reused as a source of energy for the plant itself ("City of Lebanon," 2018). This technology could reduce some of the upkeep costs of the WWTP, but the direct anaerobic digestion system still costed around $441 per dry ton and required a capital cost of nearly $37 million dollars (Grace, Carr, & Finley, 1994). While costs can vary per system, the scale of Miami's waste issue was still far too small in comparison to the costs of upgrading the plant. Additionally, Miami's landfill space was quickly shrinking which required a short-term project. It is these constraints which led our group to then analyze various composting processes as a sustainable solution to repurposing WWTP byproduct in Miami.

A composting process was determined to be the most plausible biosolids program for Miami to pursue; therefore, our group analyzed three forms of composting through the criteria of capital, maintenance, and energy costs – the process which ranked the highest would be recommended for Miami. In-vessel composting was the first process analyzed. We found that this system required high capital costs, high maintenance costs, and moderate costs for energy (U.S. EPA, 2000). One thing to also consider is that the vessel blocks sunlight from naturally drying the compost, which increases the need for energy. Arizona's arid climate is ideal to dry

biosolids, so a process utilizing the natural energy of the sun may be a more ideal option for the Town of Miami. Next, aerated static composting was analyzed. It had moderate capital costs, moderate maintenance costs, and low energy costs (U.S. EPA, 2000). The capital costs were mainly in its blower infrastructure which sold for $3.54 per linear foot (Gibson & Coker, 2013). Its maintenance was in the pipes themselves, but the compost was exposed to the sun which decreased the amount of energy necessary to dry the biosolids (U.S. EPA, 2000). Aerated static composting scored better than the in-vessel composting process in terms of the Miami environment, but aerated windrow composting scored the highest. Aerated windrow composting had moderate capital costs, low maintenance costs, and low energy costs. No additional composting equipment was necessary besides the normal machinery, which is likely a reason why its costs are so low. By our analysis, the rankings indicated windrow composting as the best course of action for Miami. Any single one of the composting processes, however, required a homogeneous compost mixture, and this could only be achieved in purchasing the right composting equipment (Lynch & Cherry, 1996). This conclusion – and the choice to continue with aerated windrow composting – transitioned our group into its next phase of research: to budget the appropriate equipment for a successful aerated windrow composting process in Miami.

It was important to analyze various options when contemplating methods and equipment that could maximize both profit and utility. Decision-making factors included the quality of the instrument and its overall cost. Such factors were largely determined by the year, model, and functionality of the equipment. It was essential to weigh each of these factors when budgeting a proper set of equipment for the Town of Miami. The first set of equipment our group analyzed were two models of tub grinders. Tub grinders diminish the volume of green waste material,

reduce expensive landfill air space, and may result in lower trucking costs, savings on fuel, and elimination of dumping or tipping fees. The tub grinder model that was recommended by the Emerald Coast Utilities Authority (ECUA) was the Morbark 1300 model. We analyzed two types of the Morbark 1300: the 2003 Morbark 1300 Electric Tub Grinder with Grapple and the 1999 Morbark 1300 750HP CAT 3412. The 2003 Morbark included two 500-horsepower electric motors and one 150-horsepower electric motor which controlled all hydraulic systems ("2002 Morbark 1300," p.1). There were also electrical requirements to accompany this product. The electrical instrument included a 480 volt, three-phase delta power, 1600 amp with a retail price of $350,000, whereas the 1999 Morbark 1300 retailed at a price of $87,500. While the 1999 model price was much lower, it did not contain new electronics and had a rebuilt engine with about 13,000 hours of use. There was minimal damage to the paint and sheet, but the mill, engine cover, and cab were in exceptional states ("2002 Morbark 1300," p.1). In consideration to these specs, it was concluded that the reliability of the 2003 Morbark outweighed the costs and would create the highest quality product for Miami, but the grinded material still needed to be turned which was the next equipment our group researched.

Our group analyzed two models of compost turners for the Town of Miami. These compost turners would introduce oxygen into the compost pile and help speed up the decomposition process. Compost turners also turn compost three times faster than a bucket loader, which may help maximize the profit and utility of the entire system. In addition, compost turners have high speed flairs that improve material breakdown, which assists in the homogenous mixture that was recommended. The two turners analyzed in this project were the Backhus 22.55 (A55) Compost Turner and the Wildcat FX700 Windrow Turner. The Backhus was powered by a Tier III 325 HP Cummins Diesel engine, created 18' wide by 8' tall windrows, and only had

3,439 hours of use. Additionally, it included an elevating cap, innovative features, and a low hour turner. Plus, the Backhus was ready to work and had flexible movement abilities, but it was retailed at $315,000. The Wildcat FX700 Windrow Turner, in comparison, was retailed at only $15,000, produced 4' high by 14' wide windrows, and could turn compost at 500-700 tons per hour. This piece of equipment simply required a tractor to work properly, and it had been upgraded with new parts and was repainted. While the Backhus demonstrated promising results, the costs and practicality of the Wildcat made it a much better option for the Town of Miami to pursue. The low waste inflows and low costs influenced the decision to recommend the inexpensive turner, but none of this would matter without a proper thermometer which could monitor the compost quality.

The third piece of equipment researched was a stainless-steel temperature probe that could help workers determine its quality. Temperature probes are essential for composting operations to ensure compost is kept within a specific temperature range. If the temperature became too low, the chemical breakdown of organic matter within the compost would not occur at an optimal rate. If the compost pile exceeded a certain temperature, it posed a serious fire risk to the municipality. There are many forms of temperature probes. Some are wireless and can store each second of data, but these costs are far greater than what Miami needs. Thus, to get the most efficient and safe composting operation, it was recommended that the temperature be made from stainless-steel to ensure both durability and temperature accuracy. There were a variety of different lengths associated with the probes ranging from 12"- 48". It was recommended that the municipality invest in a 36" stainless-steel temperature probe because it was affordable (approximately $100) and could ensure a successful composting operation ("Temperature

Probes," 2018). The thermometer could help measure the composting process, but the most efficient process required a screener for the best results.

Screening equipment was necessary for a composting process in Miami, so two different examples of screening machines were researched for this operation. The first option was a 2005 Wildcat 5x16 Trommel Screen by Western ("EarthSaver Equipment," 2018). This screener utilized a hopper where raw compost material was loaded via a tractor. Once the material was loaded into the hopper, it was then fed onto a shaker bed which filtered fine particles from larger pieces. Screeners are essential because they allow like-sized material to be grouped together, which makes composting more efficient. The price for a Trommel Screen varied anywhere between $35k-$80k. Price variability was likely due to factors such as size, model year, and engine hours. The second option for a screening machine was the ZYFY vibrator screening machine ("ZYFY," 2018). This product worked similarly to the previous option, but came in a more compact size. The model ranged in price between $1k-$6k per set. Although this seemed like a more affordable option, the volume of material this screening machine could sift was significantly less than the previous option; however, Miami hardly surpasses one ton of biosolids per year, so it was recommended that the municipality opt for the ZYFY for their composting operation. The screener would certainly help Miami's composting facility, and a tractor was the final piece of equipment needed for each of its stages.

Finally, it was highly encouraged to invest in a tractor because it serves a significant purpose in all stages of the composting system. The tractor could be used to load green waste into the tub grinder, biosolids into the compost turner, and compost into the screening machine. Its many uses in the composting process means that a reliable machine was necessary. The John Deere 6130M was an excellent machine more than capable of fulfilling these requirements. With

a 130-horsepower engine and a hydraulic front loader, this tractor could transport all sorts of materials. Prices for this specific tractor ranged from $40k-$100k depending on factors such as model year, engine hours, attachments, and more ("John Deere," 2018). It should also be noted that yearly operating costs can vary depending on how much the tractor is used and the variability of diesel fuel prices. Regardless, the tractor is an essential, multi-purpose piece of equipment that can boost the success of a biosolids composting process in Miami; however, even the best composting process could not succeed without a sufficient marketing strategy to reduce the overall stigma of biosolids.

After completing a budget for the composting equipment, our group looked at successful biosolid programs across the country, and we tailored these strategies to fit the specific conditions and needs of Miami's facility and market. While the needs of markets may vary by location, fundamental strategies to facilitate public trust and reduce stigma included credibility and focusing on transparent marketing such as easily accessible product. This could be achieved through advertising and other public exposure. There were also strategies such as branding biosolids in a positive theme, and promoting the product in fun, interactive ways. It is these strategies which our group analyzed in order to recommend the best course of action for Miami.

Generating publicity for the product comes in many forms. The King County Water Treatment Division, for instance, could easily be found online and on social media platforms such as Facebook, Instagram, and YouTube or through its page on the city government website, and newspapers too. The biosolids program is so popular that it even has its own website. Another beneficial marketing strategy to get the public interested and educated about the biosolids program would be to promote the biosolid compost through advertising on the local newspapers, articles on the Town of Miami website, letters, and flyers. By providing an article

written in the local newspaper, this will help promote the new eco-friendly fertilizer called biosolids. Reaching out to the local newspaper is beneficial for marketing because it will provide those who prefer to read newspapers and are not technological savvy to still be engaged with the community and the new plan for the usage of biosolid compost. Exposing the public to the program is a great strategy to lower the stigma of the product, and transparency is a way to do this, but the online presence in Miami – according to Mr. Urban – is very limited; therefore, we recommended advertising via newspapers and other physical forms to Miami, but not social media. We continued this research to demonstrate how something as simple as a product's name could reduce stigma too ("King County Wastewater Treatment Division," 2012).

The discussion of biosolids as a compost may be seen negatively by the public, so it becomes imperative to consider this in marketing for the consumers, producers, and the general public. A common theme is that branding focuses primarily on lively, vibrant colors that evoke thoughts of plants and flowers, rather than reminding viewers of the product's gross origination (King County Wastewater Treatment Division, 2012). In Austin, Texas, at the Hornsby Bend Wastewater Treatment Facility, the facility used the name "Dillo Dirt" for their marketing of biosolid compost. From this, it was recorded that "sales have grown from less than $10,000 annually in 1998 to $110,000 in fiscal year 1996-1997 for the product that got its name from the armadillo, an armored mammal native to the area" (Slagle, 1997). It would be highly recommended and beneficial for the City of Miami to have some type of marketing strategy like the "Dillo Dirt", whether it is an interesting brand name, logo, or even a catchy slogan to get the attention of the intended audience. King County, in comparison, decided to survey its stakeholders for a product name. This engaged the public with the product, but there are multiple ways to achieve successful results. The Recycling Committee and Environmental

Advisory Council in the Borough of Mechanicsburg, Pennsylvania, for instance, held a naming contest in 2015 for their compost. The winner received a load of compost delivered by the city's mayor and other gardening prizes were offered for runner-up entries (Stephens et al., 2015). Out of the 26 entries received, the winning product name was "Waste No More", and both the name and product remain to this day. Essentially, it becomes more about what works for Miami. There are countless ways to get the public enthusiastic about biosolids, and our group continued this research by discovering fun ways to engage with the Miami public.

Tacoma may have had a limited budget for marketing, but its product, TAGRO, increased at a considerable rate from 1993 to 1994 due to fun marketing activities such as home and garden shows (Brown, Cox, & Granato, 2008). Tacoma's Central WWTP started a demonstration garden to assist with customer education of the product. Each year, Tacoma's facility enters produce from the garden into State Fair contests, and TAGRO has won over 120 ribbons since 1993. Similarly, Fairbanks, Alaska had great success with a demonstration garden, which was featured on the local news in August 2010, headlining as "Fairbanks wastewater plant's compost garden is wildly successful" (Goldstein & Beecher, 2011). The success of the garden and its feature in the local newspaper created a "high demand from residents and landscaping companies, leading to rapid sales at $5.00/cy" (Goldstein & Beecher, 2011). The newspaper, called the *Daily News Miner*, showed a juxtaposition of the lush garden of flowers and fresh produce alongside the heavy equipment and industrialized scenery of the treatment plant. Brown et al. (2008) suggest that the numerous accolades and the word of mouth from satisfied customers has been the most significant contributor to the high rates of public acceptance of the compost product.

The Copper Corridor Maroon Group researched biosolid recycling systems, created a budget, and discovered the most effective marketing strategies in order to successfully implement a biosolids program in Miami, Arizona. Our group first discovered that the best type of recycling system for Miami was a composting process. This decision was recommended mainly due to the scale of the problem and the affordability of each system. A new WWTP was far too expensive and required multiple jurisdictions' participation, and upgrading the current Miami WWTP with an anaerobic digestion system was simply too costly even with its innovative energy system. Our group recommended that a composting process was the most plausible solution for Miami. After making this decision, we researched multiple types of composting processes that Miami could pursue. First, we looked into in-vessel composting, but it had high capital, maintenance, and energy costs. The aerated static composting, in contrast, had lower costs, but still did not compete with our final recommendation, which was to continue with the aerated windrow composting. After deciding this as the best course of action, our group created a budget. The most expensive aggregate cost was $855,000, whereas the least expensive budget was $104,600. The budget that we recommended totaled $381,100. It is important to note, however, that each of these budgets include all of the heavy machinery listed, and a successful composting process does not necessarily need all of these parts. In fact, it was determined that simply owning a tractor could perform most of these duties. Thus, our group recommended, in consideration to capital constrains, that Miami first invest in a tractor, and then expand its program as necessary. Lastly, our group researched marketing strategies to reduce the stigma of biosolids. We researched case studies in Washington, Pennsylvania, and Texas too, but one theme remained common: it depends on the city you are at. Therefore, we recommended a few different strategies for Miami. First, it should advertise its product through traditional

means, as Mr. Urban advised us that social media would not be effective. Second, we recommended that the branding of the product be determined by the Miami residents, especially considering how tightly-knit the residents are in such a small town. And lastly, it would be beneficial to promote the product in lively, fun ways such as hosting garden demonstrations with the biosolid fertilizers. We believe a combination of these strategies will ensure a successful biosolids product and provide a viable alternative waste flow for a Miami waste system which was quickly running out of space.

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