



Technical Memorandum

Evaluation of Organics Diversion Potential
Solid Waste Management Plan

Pinellas County, Florida
April 2019



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Contents

Contents.....	i
Introduction	1
Current State of County's Organics Generation and Management.....	3
Opportunities for Wasted Food Management	7
Prevention	7
Collection and Transfer.....	10
Processing.....	13
End Markets	18
Potential Strategies.....	19
Next Steps	21
References.....	22

Tables

Table 1 Estimated amount of wasted food generated by the various sectors in the County	4
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Figures

Figure 1 Yard waste - delivered to processing facility and mulch	1
Figure 2 Locations and generation rate (tons per year) of wasted food generators (excluding restaurants) in Pinellas County and adjacent areas	5
Figure 3 Projected annual wasted food generation between 2018 and 2048	6
Figure 4 US EPA wasted food hierarchy showing the most to least preferred use of wasted food (US EPA, 2018c)	7
Figure 5 Students Compost Cooperative Program at the University of Florida, Gainesville, FL (http://biogas.ifas.ufl.edu/SCC/)	9
Figure 6 Compostable collection truck at one of the San Francisco streets	11
Figure 7 Kitchen collector	12
Figure 8 Curb-side source separated organics collection at Toronto, Canada	13
Figure 9 Animal feed manufacturing facility and manufactured feed using wasted food (Chrobog, 2015).....	14
Figure 10 Anaerobic digestion facility in Orlando, FL using wasted food to generate methane for use as fuel for electricity generation	16
Figure 11 Location of County's Water Reclamation Facilities (WRF) with AD.....	17
Figure 12 Composting of organic matter using large scale industrial composting techniques....	18



Appendix A

- A-1 Locations and wasted food generation rate (tons per year) of correctional facilities in Pinellas County and adjacent areas
- A-2 Locations and wasted food generation rate (tons per year) of educational institutions in Pinellas County and adjacent areas
- A-3 Locations and wasted food generation rate (tons per year) of healthcare facilities in Pinellas County and adjacent areas
- A-4 Locations and wasted food generation rate (tons per year) of hospitality establishments in Pinellas County and adjacent areas
- A-5 Locations and wasted food generation rate (tons per year) of food manufacturers and processors in Pinellas County and adjacent areas
- A-6 Locations and wasted food generation rate (tons per year) of food wholesalers and retailers in Pinellas County and adjacent areas
- A-7 Locations and wasted food generation rate (tons per year) of restaurants and food services establishments in Pinellas County and adjacent areas



Introduction

In 2017, a total of 2,147,112 tons of municipal solid waste (MSW) was generated in Pinellas County (County), for a per capita waste generation rate of approximately 10.7 pounds per day. Between 2016 and 2017, approximately 57 percent of MSW generated in the County was managed at the County’s Disposal Complex.

Organics currently collected separately and processed by the County are limited to yard waste and wood waste including grass, leaves, weeds, tree trimmings, and clean wood (free of nails, paint, or other treatment). This organic waste is generated by single family households, multifamily households, and commercial waste generators. Yard waste is also generated as a result of changes in land use/development.

Residential yard waste in the unincorporated areas is primarily collected with MSW and delivered to the Disposal Complex; however, most of the County’s incorporated area municipalities allow the service provider to deliver yard waste that is collected separately to a different yard waste processing facility as long as the material is recycled. Segregated yard waste typically comes to the Disposal Complex through self-haul by residents and commercial landscapers. Eleven of the 24 incorporated area municipalities provide curbside collection and recycling of yard waste. Support for separation of yard waste and MSW in areas where these materials are comingled would allow for increased diversion of these materials through current and future programs.

Yard waste delivered to the Bridgeway Acres Landfill (BWA) is currently processed at the yard waste processing area on site. The receipt of material and processing operations are performed by the County’s contracted landfill operator. Processed mulch is provided free of charge to customers. Figure 1 depicts yard waste processed at this facility since 2012. Note that “Processed Mulch” is the processed yard waste that leaves the Disposal Complex or is transported to one of the free mulch locations. Some of the processed yard waste is used on-site at the Disposal complex for erosion control or side slope stabilization. It is possible that some of this mulch could be used to help create waste recovery areas in the working face of the landfill.

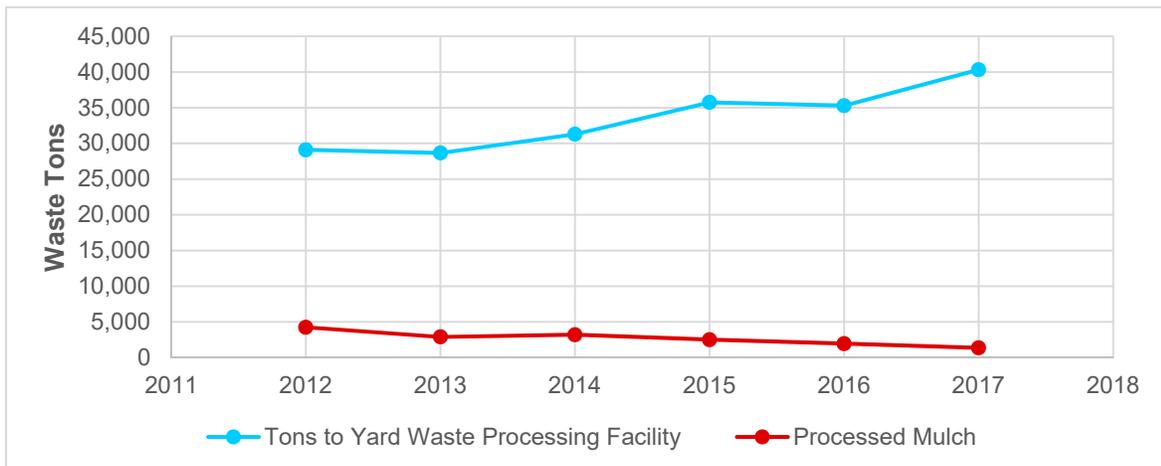


Figure 1 Yard waste - delivered to processing facility and mulch



There are ten operating yard waste facilities in and around Pinellas County and seven of these compost yard waste. In addition, yard waste can also be combusted for power generation at WTE facilities in and around the County. A waste composition study conducted at the Disposal Complex in 2014 estimated that the waste stream delivered was comprised of 24.8 percent of organic waste (wasted food and yard waste) with approximately 16.3 percent of this total being wasted food. The 2017 annual waste quantity report for BWA, which is submitted to the Florida Department of Environmental Protection (FDEP) by the County, shows that organic waste accounted for a total of approximately 21.2 percent in the County's waste stream of which approximately 7.9 percent was wasted food.

Wasted food delivered as part of the MSW at the Disposal Complex is either being incinerated or disposed at the BWA. The recovery and recycling of this relatively high-moisture content waste from the general MSW waste stream would increase the energy content of the waste incinerated and provide for greater efficiencies at the WTE facility. Although landfill gas is not currently being actively collected from BWA, the food waste disposed in landfills decomposes significantly before the landfill gas collection system is expanded to collect gas from the freshly filled areas. The diversion of wasted food from the landfill is, therefore, expected to reduce the greenhouse gas emissions associated with anaerobic digestion of wasted food in landfills. The residuals from processing organics potentially can be used as top soil for application, such as landfill closure cap construction or promoting vegetation growth on landfill side slopes.

This report presents an evaluation of waste food generated in the County from residential, commercial, institutional, and industrial sources, and presents approaches that can be used to reduce, recover, and recycle this material stream.

Current State of County's Organics Generation and Management

Enhanced collection and recycling of organic waste can be a significant part of the County's solid waste management planning to increase diversion/recycling in the future. In 2017, most of the collected yard waste was recycled; however, to date, no significant efforts have been implemented for source segregation and recycling of wasted food. According to the County's 2017 Solid Waste Management Report, less than 6,000 tons of food waste generated in Pinellas County was reported as being recycled by retailers and private composting establishments. Because yard waste is currently either source separated and diverted (i.e., mulch) or is included with MSW and processed through WTE, the area of focus herein for increased organics diversion/recycling is food waste. However, depending on the programs and technologies implemented, food waste diversion efforts can include additional other organic materials (i.e., yard waste and other compostable materials).

MSW collected from residential (single-family and multifamily), and commercial units in the County is managed at the Disposal Complex. Based on the 2014 waste composition study and the amount of waste received at the Disposal Complex, approximately 195,000 tons of wasted food is expected to be generated within the County, and managed at the Disposal Complex in 2019, either through incineration or landfilling, if no changes to the current system of collection are made.

For the purpose of this report, the expected wasted food generated at the County was estimated using the United States Environmental Protection Agency (US EPA) excess food opportunities map¹ that provides an estimated location and amount of wasted food generated by industrial, commercial (except restaurants), and institutional establishments across the US. The County-specific data was downloaded. Wasted food estimation methodologies presented by US EPA (2018a) were used to calculate the annual wasted food generation rates by these types of establishments within the County. To estimate the wasted food generated by the restaurants of the County, the restaurant's specific data were obtained from the Bureau of Economic and Business Research database (BEBR)². The wasted food generation from residential sources was estimated based on the total population of the County and per capita annual wasted food generation rate from US EPA (2018b). The annual single-family and multifamily food waste generation rates were estimated by proportioning the countywide residential wasted food estimate in the same ratio as the number of single and multifamily residential units in the County as reported in the Baseline Report. Using this approach, it was estimated that the County is expected to generate approximately 207,000 tons of wasted food per year; with the data used for developing this estimate corresponding to the 2015-2018 period. This estimate is within 10 percent of the annual wasted food generation of 195,000 tons estimated for 2018 based on 2014 waste composition study, for the amount of total waste managed at the Disposal Complex.

¹ <https://geopub.epa.gov/excessfoodmap/>, accessed on 11/05/2018

² <https://www.bebr.ufl.edu>



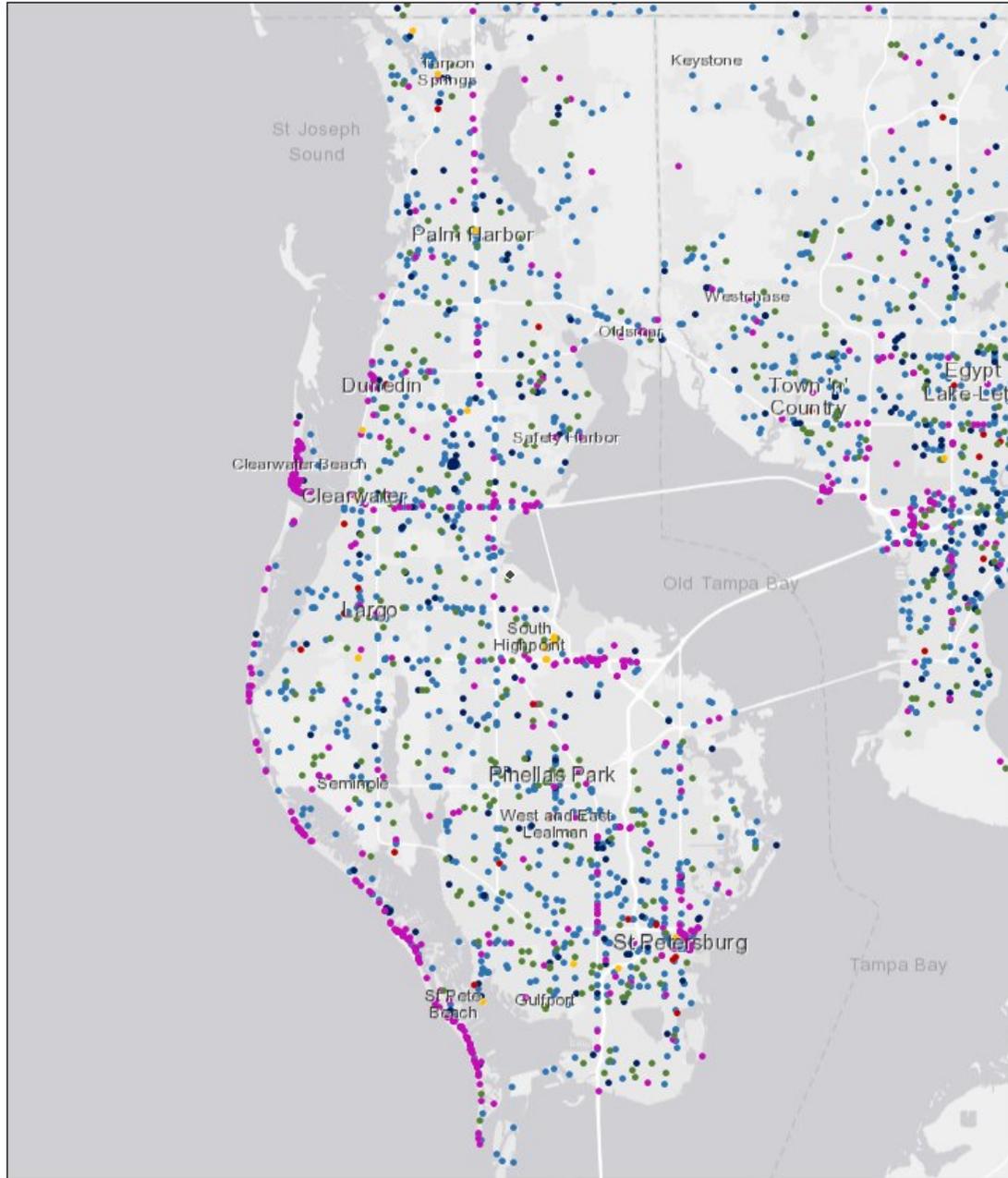
Based on the sources mentioned above, the County has a total of 459,936 units/facilities that generate wasted food. Table 1 shows an approximate number and type of establishments of various sectors and the estimated amount of wasted food generation by each type of these establishments. Restaurants generate approximately 55 percent of wasted food in the County annually. Each restaurant produces an average of approximately 40 to 66 tons of wasted food per year. Each residential unit, on the other hand, is expected to generate only 0.14 tons per year. Due to this significantly lower waste food generation rate, the waste food collection cost (\$/ton) for the residential sector is expected to be much greater than that of the institutional, commercial and industrial sources, due to the sector's decentralized nature and lack of economies of scale.

Table 1 Estimated amount of wasted food generated by the various sectors in the County

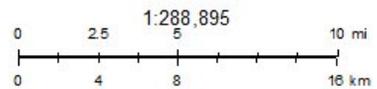
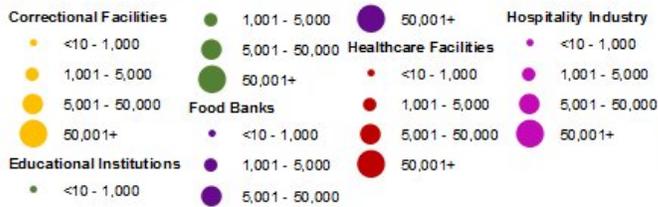
Sector	Number of establishments	Wasted food (tons/year)	Wasted food (tons/year/establishment)
Restaurants	1,750-2,900 ³	114,745	40-66
Correctional facilities	20	660	33.0
Food manufacturers	121	2,648	21.9
Food Retailers/wholesalers	860	16,809	19.5
Hotels/motels	449	7,120	15.9
Educational institutions	274	2,448	8.9
Single-family units	302,765	41,907	0.14
Multifamily units	153,005	21,178	0.14

Figure 2 shows the location of the County's, and adjacent areas, commercial (except restaurants), institutional, and industrial wasted food generators and estimated amount of wasted food generation (tons per year) by these establishments, as shown in the US EPA Excess Food Opportunity Map. It should be noted that these estimates are based on a generalized methodology, and the more precise amount of wasted food generation from each type of establishment can be estimated through a countywide, sector-specific waste composition study.

³ <https://www.restaurant.org/Downloads/PDFs/State-Statistics/Florida.pdf>;



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US EPA Region 9 GIS Center, US EPA Sustainable Materials Management
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 community

US EPA Region 9 GIS Center, US EPA Sustainable Materials Management
 US EPA

Figure 2 Locations and generation rate (tons per year) of wasted food generators (excluding restaurants) in Pinellas County and adjacent areas

Considering that most of the County's Class I waste is managed at the Disposal Complex and wasted food is largely present in the Class I waste, the Baseline Report estimated the amount of wasted food generation by the County between 2018 and 2048, based on the waste composition study conducted at the Disposal Complex in 2014. Figure 3 shows the projected wasted food generation between 2018 and 2048. Assuming that the food waste percentage of the waste received at the Disposal Complex remains constant over the years, the County is expected to generate wasted food in the range of approximately 195,000 to 229,000 tons per year between now and the end of the planning period. The County commissioned a Food Waste Composting Demonstration Project and Market Study (Compost Study) in 2018⁴. Considering 20 percent of all the organics generated within the County can be captured for recycling, the same capture rate as the Compost Study, approximately 39,000 to 46,000 tons of food waste generated in the County could also be captured for recycling.

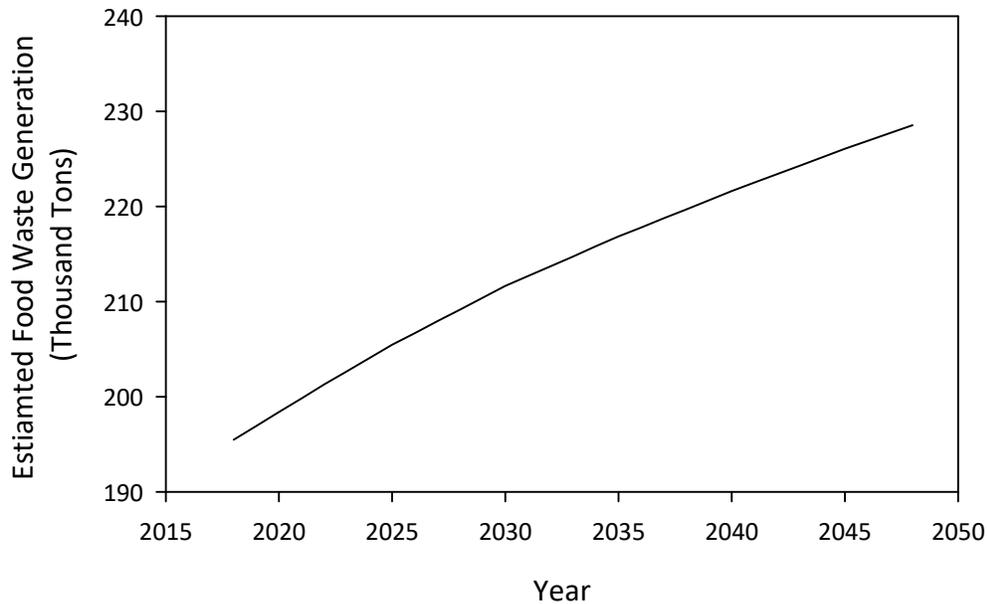


Figure 3 Projected annual wasted food generation between 2018 and 2048

As mentioned earlier, wasted food delivered as part of MSW at the Disposal Complex is either being incinerated or disposed at the BWA.

⁴ Food Waste Composting Demonstration Project Results and Market Assessment, Kessler Consulting, July 10, 2018

Opportunities for Wasted Food Management

Prevention

As discussed in Current State of County's Organics Generation and Management Section, although wasted food processing through composting, combustion, and anaerobic digestion generate lesser equivalent greenhouse gas as compared to landfilling, wasted food prevention, reduction at the source, and its reuse are the most preferred options. The US EPA provides a hierarchy for possible uses of wasted food (2018c) as shown in Figure 4. Wasted food reduction at the source, followed by feeding the edible fraction to hungry people, other scraps to animals, industrial uses and composting, are all possible wasted food options more preferred than landfilling and incinerating. The County could implement a combination of the below-discussed strategies for prevention, reduction, and reuse of wasted food:

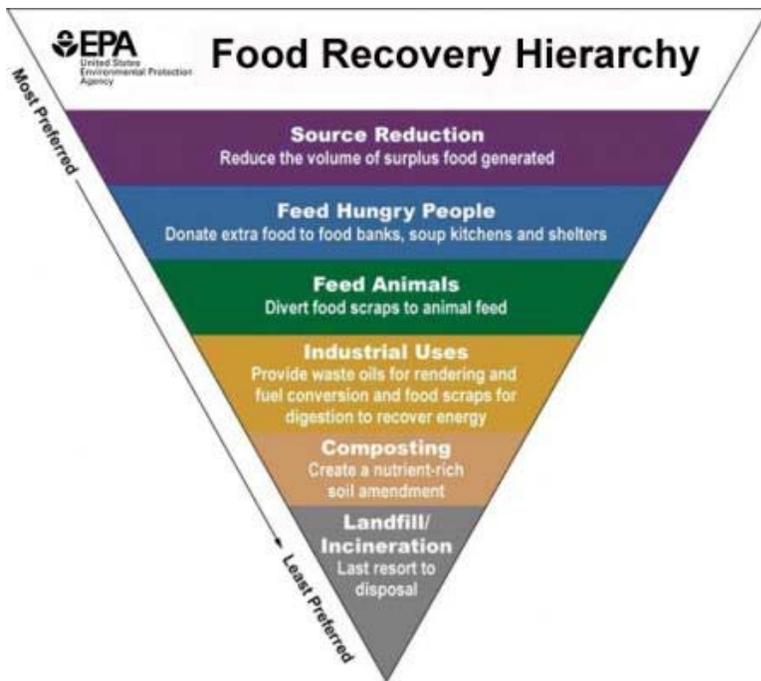


Figure 4 US EPA wasted food hierarchy showing the most to least preferred use of wasted food (US EPA, 2018c)

Based on the methodologies presented in US EPA (2018a), it is estimated that the County's educational institutions and food retailers/wholesalers are expected to generate a total of approximately 400 and 3,000 tons of edible wasted food per year, respectively. The estimates for the other sectors are not available. The County could consider first targeting recycling wasted food generated by the commercial sector and gradually expand the program to the industrial, institutional, and eventually the residential sector. As presented in Table 1, restaurants are the largest wasted food generators in the County based on the total amount of wasted food generation, as well as the amount of wasted food generation per establishment. Therefore, the first commercial sector that the County could consider targeting to implement wasted food recovery and recycling initiatives is restaurants. The County may encourage the

restaurants to separate the edible and non-edible fraction of wasted food and donate the edible fraction of the unconsumed food to local food banks/soup kitchen/food pantry (food bank). Restaurants and other businesses are often reluctant to donate the edible fraction of wasted food due to the liability issues. The County could educate the restaurants and other businesses about the Florida Liability Protection Regulations⁵ that protects donors who donate food which is fit for human consumption to a bona fide nonprofit organization⁶. The County has over 50 food banks, which are listed in the County's 'A to Z Recycling and Disposal Guide'. A search on 'A to Z Recycling and Disposal Guide' web portal shows the location of food banks; the County could provide information about this resource to the restaurant owners for them to identify the nearest food bank locations. The non-edible fraction can be separately collected and could be used in accordance with the hierarchy presented in Figure 4.

Following the restaurants, the County could target the other commercial sector including food retailers and wholesalers, hotels and motels, and food manufacturers. Together, these establishments are estimated to generate approximately 13 percent of all the wasted food produced in the County; however, in terms of number of wasted food generating establishments, they represent only approximately 0.3 percent of all the wasted food producing establishments. These commercial entities generally face similar challenges as restaurants, in terms of separating edible fractions for donation to food banks and management of non-edible fractions of wasted food.

Several cities and counties around the country have established source segregated organics programs applicable to their commercial establishments. For example, the City of Orlando, Florida initiated a commercial wasted food collection and recycling program in 2015. The city provides educational material, training, initial site assessment, signage, and program design for commercial entities including, restaurants, grocery stores, distributors, business cafeterias, hotels, educational institutions, and hospitals⁷.

The County could also try implementing recognition programs based on the amount of wasted food generation, food donations by the establishments, and participation, similar to the Food Recovery Challenge (FRC) initiated by US EPA's Sustainable Materials Management Program. In FRC, a participating organization pledges to prevent and divert wasted food in their operations. Advantages a participant may receive are potential tax benefits after establishing a donation program, visibility in US EPA's website, and receiving recognition through awards and social media. A few commercial establishments in Pinellas County, such as Walmart, Save-A-Lot, and Dar Pro Solutions, already have wasted food recycling programs. The collected wasted food at these establishments is composted, used as animal feed, and used to produce meat and bone meal and tallow. The County could consider implementing a recognition program for such businesses that may also help encourage other businesses to participate in wasted food recycling, and work with private sector service providers that are active in the marketplace for diversion of wasted food.

⁵ Florida Statute §768.136

⁶ Fla. Stat. Ann. § 768.136, 2018

⁷ <http://www.cityoforlando.net/solidwaste/commercial-food-waste/> (accessed on 11/05/2018)

Based on the methodologies presented in US EPA (2018a), it was estimated that the public and private educational institutions located in the County are expected to generate a total of approximately 400 tons of edible wasted food per year. The County could encourage educational institutions to implement a wasted food segregation program and help educational institutions to facilitate delivery of the edible fraction to the food banks. The non-edible fraction can be used in compost generation within the school campus (depending on space availability). Compost generation within the school campus may encourage students to get involved with the County's recycling initiatives which may translate into increased residential recycling as well. Several educational institutions throughout the country have implemented such wasted food composting programs. For example, the University of Florida in Gainesville, FL, collects wasted food from campus dining facilities and other food services and uses it in student operated composting programs. Students also run a Student Compost Cooperative (SCC) (Figure 5), in which wasted food is brought by the students to the composting location and is added to the composters. The generated compost is used in an SCC maintained organic garden. A similar program could be implemented at the County's educational institutions.



Figure 5 Students Compost Cooperative Program at the University of Florida, Gainesville, FL
(<http://biogas.ifas.ufl.edu/SCC/>)

Following the wasted food recycling program from commercial, industrial, and institutional sectors, the County could consider a wasted food collection recycling program from multifamily and single-family residential units. The residential sector represents approximately 30 percent of the total wasted food generation. The County could consider providing education and guidelines that residents and residential communities can implement to reduce wasted food generation, which is consistent with the County's Master Plan value/guiding principle of "Inspire conscious decision making and thoughtful consumption". For example, the County might encourage residents to buy only what they need and will be used, educate proper storage methods of fruits, vegetables, and prepared food that can maintain the freshness for a longer time, being aware of consuming leftovers, keeping track of wasted food generation, etc. The County could provide information related to wasted food composting and encourage the single-family unit residents to perform backyard composting. The City of Orlando, FL provides information and a free composter to its residents to conduct backyard composting. The County may implement a similar strategy by providing resources to the residents for increasing their participation in wasted food recycling.

The County may also implement strategies to increase the participation from the residents for organics recycling similar to those used by other communities such as Hutchinson, MI, Marion County, OR, and City of Arvin, CA. Hutchinson, MI provides compostable bags to the residents at no cost, Marion County, OR provides kitchen collectors (caddy), and City of Arvin, CA provides bilingual stickers and refrigerator magnets to increase the resident's participation. Implementation of universal recycling of organics, as part of a universal MSW collection program, could also help improve the participation rate.

Collection and Transfer

As presented in Opportunities for Wasted Food Management Prevention Section, if the County were to implement wasted food diversion programs, the County could start with restaurants, followed by commercial, institutional, and eventually the residential sector. The County could work with restaurants to segregate the edible fraction of wasted food for donation to food banks, and the food banks could collect and transport the segregated edible fraction of wasted food from the source location to their bank. For example, at Tampa International Airport, the segregated edible fraction of wasted food from the airport restaurants are placed in coolers and picked up by Feeding America, five days a week⁸. The County could explore opportunities to help facilitate restaurants and food banks with the collection of segregated edible wasted food.

The County may also attempt to collect and divert the non-edible fraction of wasted food first from restaurants, followed by other commercial entities such as food retailers and manufacturers. The County might consider using a similar program as used by the City of Orlando, FL that provides 65-gallon carts to restaurants and other commercial establishments and has been collecting pre- and post-consumer food up to three times a week since 2015. In addition to reducing the wasted food intake to the Disposal Complex, the businesses recognize the advantages of a frequent pickup which causes less odor from their dumpsters and compactors. The collected food in Orlando, FL is diverted to composting, or anaerobic digestion, facilities.

Several other cities around the country have source-segregated wasted food or mixed organic waste collection programs. San Francisco, CA uses a three-bin system to segregate the waste into compostables, recyclables, and residual refuse. San Francisco, CA also enacted legislation that requires all wasted food to be properly disposed of in its own (green) bin. Figure 6 shows a compostable collection truck in San Francisco, CA. The compostable bins' waste is shipped to one of the nation's largest composting operations in Vacaville, CA, a privately-owned and operated facility. A small fraction is also transferred to the East Bay Municipal Utility District (EBMUD), Oakland, CA wastewater treatment plant. EBMUD uses post-consumer wasted food to co-digest with sludge in anaerobic digesters. As discussed above, some of the collected wasted food in Orlando, FL is anaerobically digested.

The County could consider establishing a universal source segregation of refuse into recyclables, compostables, and trash and placement of each type of refuse in a dedicated container. For example, San Francisco Environment Code, Chapter 19, Sections 1903 prohibits

⁸ Ricondo and Associates 2014

mixing recyclables, compostables, or trash or depositing refuse of one type in a collection container designated for another type of refuse. The owners or managers of commercial or multifamily properties are required to supply appropriate containers for recycling, and to provide information and annual re-education programs for residents, janitors, and maintenance personnel on how to properly sort recyclables, compostables, and trash. Programs such as waste-stream-specific rate structures, or pay-as-you-throw, which have been used to promote source-segregation of recyclables, can be used to incentivize source-segregation of wasted food and other putrescible organics.



Figure 6 Compostable collection truck at one of the San Francisco streets

Seattle also has an organics recycling program that includes accepting wasted food from commercial and residential facilities. Like San Francisco, Seattle also uses a three-bin system. Businesses are required to contact one of several available haulers to pick-up their organics. Similar to San Francisco, Seattle also has an ordinance requiring recyclables not be thrown out in the garbage bin. Seattle's organic waste is mostly processed by Cedar Grove Recycling, a private operation that also works with individual businesses to develop recycling plans.

Following the commercial sector, the County could attempt to collect the wasted food from the institutional sector including correctional facilities and schools. The County may enact a universal organics source-segregation and collection ordinance similar to the one implemented by San Francisco and Seattle for commercial and institutional sources. As shown in Table 1, the County has a total of 20 correctional facilities, and each of them is estimated to generate an average of approximately 33 tons per year of wasted food. The County could encourage the correctional facility authorities and school board to implement in-house composting programs. Several correctional facilities and schools across the U.S. Have established composting

programs; for example, Waymart State Correctional Institution in Pennsylvania has operated a wasted food composting operation for over a decade⁹. The onsite composting and use of the compost is expected to result in cost savings associated with waste hauling. The long-term success of the onsite organic processing program is strongly contingent on its financial viability.

Based on a nationwide survey conducted in 2012 by Bio-Cycle, more than 150 residential communities have implemented a source separated residential organic waste collection program¹⁰. The majority of these programs are in California (53), Washington (52), and Minnesota (21). Similar to the commercial sector, San Francisco, CA, collects the city's compostables, recyclables, and refuse through an exclusive franchise agreement. The collected organics are sent to a composting facility. The County could consider assessing residents' interest in participating in a source-segregated organics program before developing and implementing such a program.

The communities that perform source separated organics, commonly collect residential wasted food with yard trimmings. In addition, several communities provide kitchen collectors (caddies), Figure 7, to each household and/or allow households to use approved compostable bags for increasing the participation rate and to provide curbside pickup. Figure 8 shows a curbside recyclables collection truck used in Toronto, Canada that has two sections, one dedicated for organics collection and the second section for other recyclables.



Figure 7 Kitchen collector

⁹ Flammer 2014

¹⁰ Yepsen 2012



Figure 8 Curb-side source separated organics collection at Toronto, Canada

Processing

While source reduction and feeding hungry people are the preferred recovery methods for wasted food as shown in Figure 4, these are not always possible. Although sector-specific estimates of edible food amounts are not available, it is expected that a large fraction of the wasted food generated from commercial and institutional sources is non-edible as disposal of this material stream is the most common current practice. This non-edible wasted food can be managed using the following options in order of preference: feed animals, industrial uses (including anaerobic digestion), composting, incineration and finally, landfilling. The goal of a separate organics collection program is to minimize the landfilling and incineration of discarded food, as these are the least preferable options, and to promote higher uses.

Diverting food scraps to animal feed operations is the most preferred use of wasted food due to legal and logistical advantages, but it can be an expensive and challenging option to implement at the community level, and especially for Pinellas County since the majority of animal husbandry opportunities are likely located in adjacent counties. This option requires a clean and uncontaminated feed stream and a high degree of processing to ensure that the material is safe for animal consumption. Sustainable Alternative Feed Enterprises¹¹, a Nevada based company, has patented equipment that can be used to collect and transport the wasted food with minimal

¹¹ <https://www.forktofeed.com/>, accessed on 11/05/2018

contamination, extract the wasted food from other materials, and produce of commercially viable animal feed. While not commonly practiced at the community level in the US, in South Korea, nearly half of all wasted food is managed this way¹². Figure 9 shows an animal feed manufacturing facility, and the resultant manufactured animal feed from the wasted food. Local examples include Organic Matters (Bartow, FL) that collects expired bakery products for animal feed, and the beer brewing industry that relies on cattle, horse and hog farms for management of spent grains from the brewing process.



Figure 9 Animal feed manufacturing facility and manufactured feed using wasted food (Chrobog, 2015)

The project team's preliminary research suggests that there are only eight animal farms in Pinellas County (based on 2015 data) and each of these farms appear to have annual revenue of less \$300,000 and employee less than three employees. The current status of these farms is unknown. Based on the information provided by the County, there is some wasted food generated in the County currently being fed to animals, but the numbers of farms that currently accept/use or will be willing to accept food waste from commercial, institutional, industrial and residential sources after appropriate treatment is unknown. A preliminary analysis suggests that feeding to animals within Pinellas County, and perhaps to animals in adjacent counties if economically feasible, does appear an option to manage a significant amount of wasted food generated within the County.

The next best use for wasted food is one of several industrial uses including anaerobic digestion or fermentation of the waste. These processes use microbial action to degrade the waste in an environment deprived of oxygen to produce a secondary product, like methane, for industrial uses. Methane is the most common product produced by wasted food. Pennington (2018)

¹² Chrobog, 2015

provides a list of 154 anaerobic digesters in the US in 2015 that either were operating solely on wasted food or were co-digesting wasted food with farm waste or biosolids at a wastewater treatment facility. The US EPA (2014) discusses the performance of six wastewater treatment facilities located in California, Wisconsin, and Indiana that use wasted food in anaerobic digesters. Florida also has a total of five anaerobic digesters that accept wasted food. Harvest Power¹³ in Orlando, FL (Figure 10) accepts wasted food with packaging from the commercial, industrial, and institutional sources and co-digests it with biosolids in anaerobic digesters, with the biogas beneficially used as fuel for a 7 MW power generation plant.

Wastewater treatment plants often have anaerobic digesters generating and using methane gas and some of these anaerobic digesters may have excess capacity to accommodate wasted food. As shown in Figure 11, there are five anaerobic digesters already existing in Pinellas County, all of which are at wastewater treatment plants (water reclamation facilities). The County Utilities Department and the Solid Waste Department have been discussing possible opportunities regarding coordination of planning activities for their Biosolids Master Plan with the Solid Waste Master Plan. The South Cross Bayou Advanced Water Reclamation Facility in St. Petersburg, FL has the ability to accept wasted food and use it in an anaerobic digester¹⁴. Based on recent discussions with the County's biosolids master plan consultant, the available existing capacity at the South Cross Bayou facility is limited, and absent expansion, would likely not be able to handle any significant amount of additional material on a routine basis. The County could encourage the wastewater treatment facility to use wasted food as a feed to their anaerobic digesters as expansion options develop, as wasted food has approximately three times more potential for methane generation than biosolids (US EPA). Wasted food is highly biodegradable and has a significantly higher volatile solids destruction rate (86 to 90%) than biosolids, thus the residual generation rate for waste food is expected to be lower than that of biosolids. The generated residuals can be potentially land applied or used for landscaping.

¹³ <http://www.harvestpower.com>, accessed on 11/06/2018

¹⁴ Pennington 2018



Figure 10 Anaerobic digestion facility in Orlando, FL using wasted food to generate methane for use as fuel for electricity generation

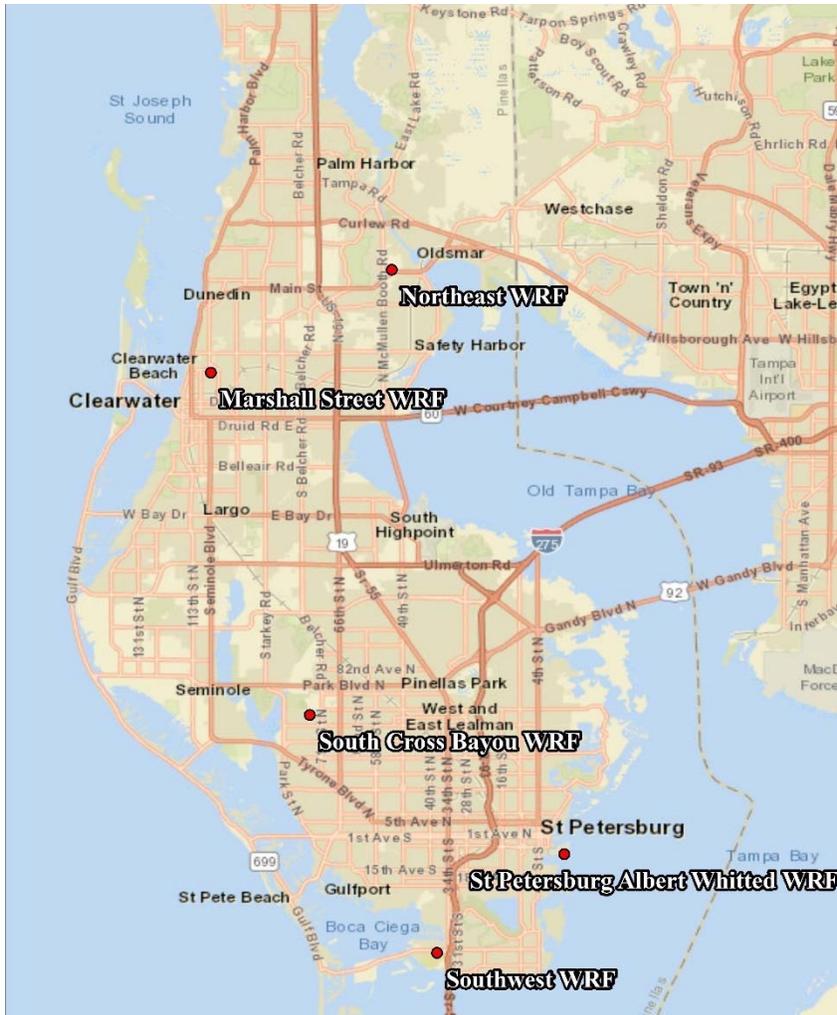


Figure 11 Location of County’s Water Reclamation Facilities (WRF) with AD

Composting is one of the most common methods for diverting wasted food; however, based on the US EPA wasted food management hierarchy, it is the preferred option to use only before landfilling and incineration. Since composting allows mixed organic waste collection, the participation in composting programs is generally high and makes it the most frequently practiced food recovery method in the US. Figure 12 shows a large-scale industrial composting operation. Yepsen (2012) observed that all of the 156 municipalities in 16 states that have source-separated organic collection programs composted the organics. Among all these operations, a total of 132 municipalities accepted mixed organic waste containing food, soiled paper, and green waste. Composting involves stockpiling organics into windrows or piles, which are aerated or frequently turned to promote microbial degradation of the organics. The process generates a soil amendment which is used by agricultural operations as well as local consumers.

Application of Modified Static Aerobic Pile (MSAP) composting can also be used for wasted food recycling. MSAP uses a catalyst in the composting process that maintains pathogen destroying temperatures for a longer duration than the traditional composting operation, thereby

reducing the turning frequency or aeration requirements of the compost pile. The County conducted a pilot-scale composting demonstration project to assess the viability of organics processing/recycling through MSAP composting and evaluated economic and environmental benefits of the process (KCI 2018). Additional strategies such as fermentation can be implemented to increase the rate of degradation and more quickly degrade harmful substances.



Figure 12 Composting of organic matter using large scale industrial composting techniques

The economic, social, and environmental impacts of each of these non-edible food reuse options should be taken into consideration in selecting the best reuse option for the County. More preferred options listed by the US EPA are frequently costlier and more challenging to implement. The ability to find private partners and consumers of food recovery end-products are additionally important considerations in selecting the best food diversion strategy for the County.

End Markets

The organics processing strategy selected will need to produce end-products which are in demand by end-users in order to generate revenue. Successfully identifying and engaging end-users of the organics residuals is an important consideration for the success of any organics management program. KCI (2018) conducted an assessment of the end-users (e.g., farms, sport fields, golf courses, landscapers, nurseries) and the associated compost usage amounts for the compost generated in Pinellas County. Many of the previously discussed strategies result in a residual soil-amendment that can be used for agricultural and in landscaping. These residual soil amendments may be sold to end-users including farms, community garden managers, county and municipal parks, private sports fields, golf courses, landscapers, and nursery owners¹⁵. Other uses may include using the material for landscaping on County building and road projects. It can also be provided to the public at no charge, similar to the County's

¹⁵ KCI 2018

current mulch program. Additionally, the County can work with landscapers, who bring loads of organic waste to the organic processing facility, to promote the use of the end product.

Potential Strategies

In the short term, the County could consider focusing on managing wasted food from restaurants and the commercial sector by encouraging and facilitating donations of the edible fraction of wasted food to food banks. For the commercial sector, the County could:

- Educate commercial establishments to segregate the edible fraction of wasted food and encourage donations to food banks.
- Facilitate contact between food banks and commercial establishments similar to the program implemented by Tampa International Airport.

If there is adequate demand and likely participation, the County could explore further initiatives for managing the non-edible fraction of wasted food in the commercial sector, which could include:

- Establishing a voluntary commercial collection program similar to the City of Orlando, FL, which provides specific organic waste collection bins for pre and post-consumer wasted food and providing (or facilitating) increased frequency of collection.
- Consider mandating source segregation of wasted food, such as the programs cited for San Francisco, CA and Seattle, WA.
- Update the Cutting Waste at Work (CWW) program to include commercial collection options.
- Establish recognition programs for businesses to encourage their participation in the wasted food recycling program.

Following the implementation of a wasted food collection and management program from the commercial sector, institutional sectors including correctional facilities and educational institutions could be targeted. For the institutional sectors, the County could:

- Assist with the establishment of in-house composting programs at these institutions.
- Educate and encourage (voluntary or legislated) the responsible authorities for such programs at these institutions on the benefits of wasted food composting. (The in-house wasted food composting program at these institutions would minimize collection services for wasted food from these institutions.)

The residential sector of the County generates approximately 30 percent of County's wasted food. For the residential sector, the County could:

- In the short term, provide additional education to County residents to further prevent and reduce wasted food generation.
- In the long term, if there is adequate demand and likely participation, implement source segregated residential organics collection programs. (Several cities and communities

across the US have such programs, and they use the collected waste either for compost generation or in an anaerobic digester for methane generation.)

Based on the US EPA wasted food recovery hierarchy, the collected non-edible fraction of wasted food should first be used as animal feed. The County could explore opportunities to use separately collected wasted food for producing animal feed and/or use at animal farms. A preliminary analysis, however, suggests that feeding to animals does appear to be an option currently utilized to manage a significant amount of wasted food generated within the County. Efforts in this market would more likely be feasible in cooperation with commercial operations, or in conjunction with adjacent counties.

There are five anaerobic digesters at the wastewater treatment facilities within the County. The excess capacity available at these plants could be used to digest wasted food.

The County could continue to explore the opportunities to divert the wasted food (and potentially other organics) as expansion opportunities arise to produce methane and/or explore siting an anaerobic digester at the Disposal Complex. As previously discussed, wasted food has approximately three times more methane generation potential than biosolids. The generated methane can be used for electricity generation or synthetic natural gas production, which in turn can be used for vehicle fuel (compressed natural gas) production.

The County could consider using composting, as it is a preferred option over landfilling or incineration, of the non-edible wasted food that is not managed via anaerobic digestion at WRF AD facilities. Composting is relatively easier to implement than the other previously discussed processes, and can be accomplished with mixed organic waste. The compost can be used for soil amendment applications at farms, community gardens, county and municipal parks, private/public sports fields, golf courses, and nurseries¹⁶. The County could consider engaging the residual end-users (e.g., farmers, nursery owners, landscapers) to assess their residual quality and quantity requirements and work with registered/permitted composting facilities in and around Pinellas County as an initial step for developing a wasted food composting program.

¹⁶ KCI 2018

Next Steps

The County may consider implementing the following steps for its organic waste component of MSW, and in particular, wasted food management.

1. Evaluate food bank opportunities in the County to facilitate donations of the edible fraction of waste food. The edible food estimates are only available for educational institutions and food retailers/wholesales. The County may consider collaborating with other wasted food generating sectors in the County for conducting an assessment of the edible fraction of food waste from these sectors. The edible fraction of food waste is expected to be smaller due to current practices of handling and managing the wasted food. With implementation of source-segregated organic collection programs and ensuing awareness, the edible fraction is expected to increase over time.
2. Expand the current CWW program education and encouragement efforts to commercial and institutional sources other than just restaurants, in order to segregate the edible fraction of wasted food and facilitate its donation to local food banks; the Florida Liability Protection Regulations provides legal protection to donors of the food which is fit for human consumption to a bona fide nonprofit organization.
3. Determine the viability of wastewater treatment facilities with anaerobic digesters to accept the non-edible fraction of wasted food for anaerobic digestion with biosolids.
4. Establish a program for recognizing businesses participating in wasted food recycling programs.
5. Potentially through the CWW Program, work with establishments to develop in-house composting programs for institutions and educate the participants, where feasible.
6. In the long term, evaluate the economic feasibility of developing processing capacity for organics (i.e., a composting facility or anaerobic digester) at the Disposal Complex for managing the wasted food that cannot be managed as animal feed. The processing approach could include other organic materials in addition to wasted food. KCI (2018) reported that a full-scale MSAP composting facility can be a viable option for the County, as the County has a potential market for the compost consumption KCI (2018).
7. The County could explore regional collaboration to take advantage of the County's access to feedstock with a diversion program and other partner's access to agricultural markets.

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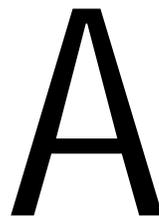
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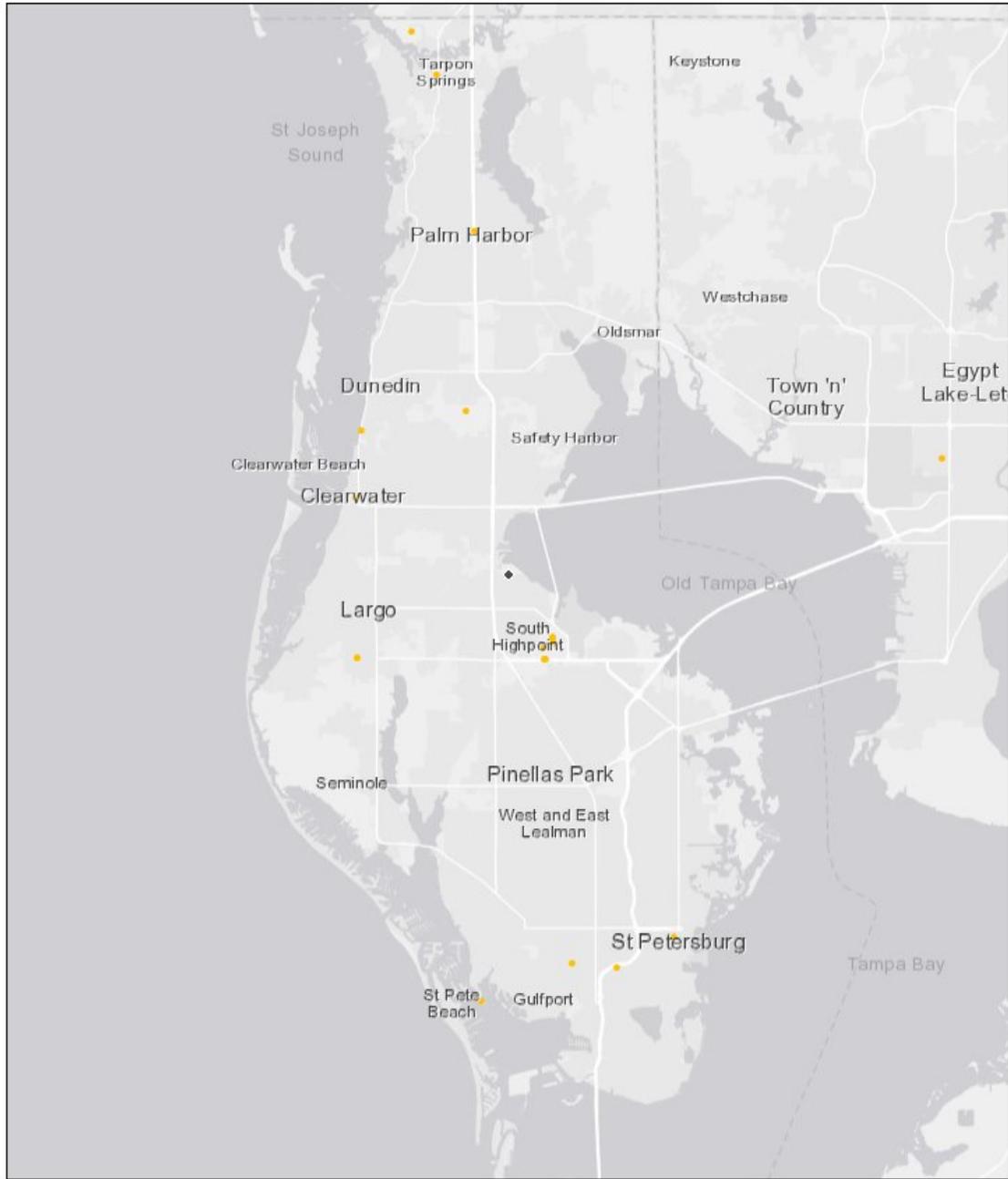
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Appendix A – Sector-wise
Waste Food Sources Maps



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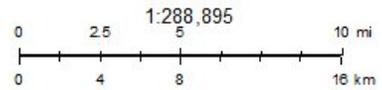
Appendix A-1 Locations and wasted food generation rate (tons per year) of correctional facilities in Pinellas County and adjacent areas



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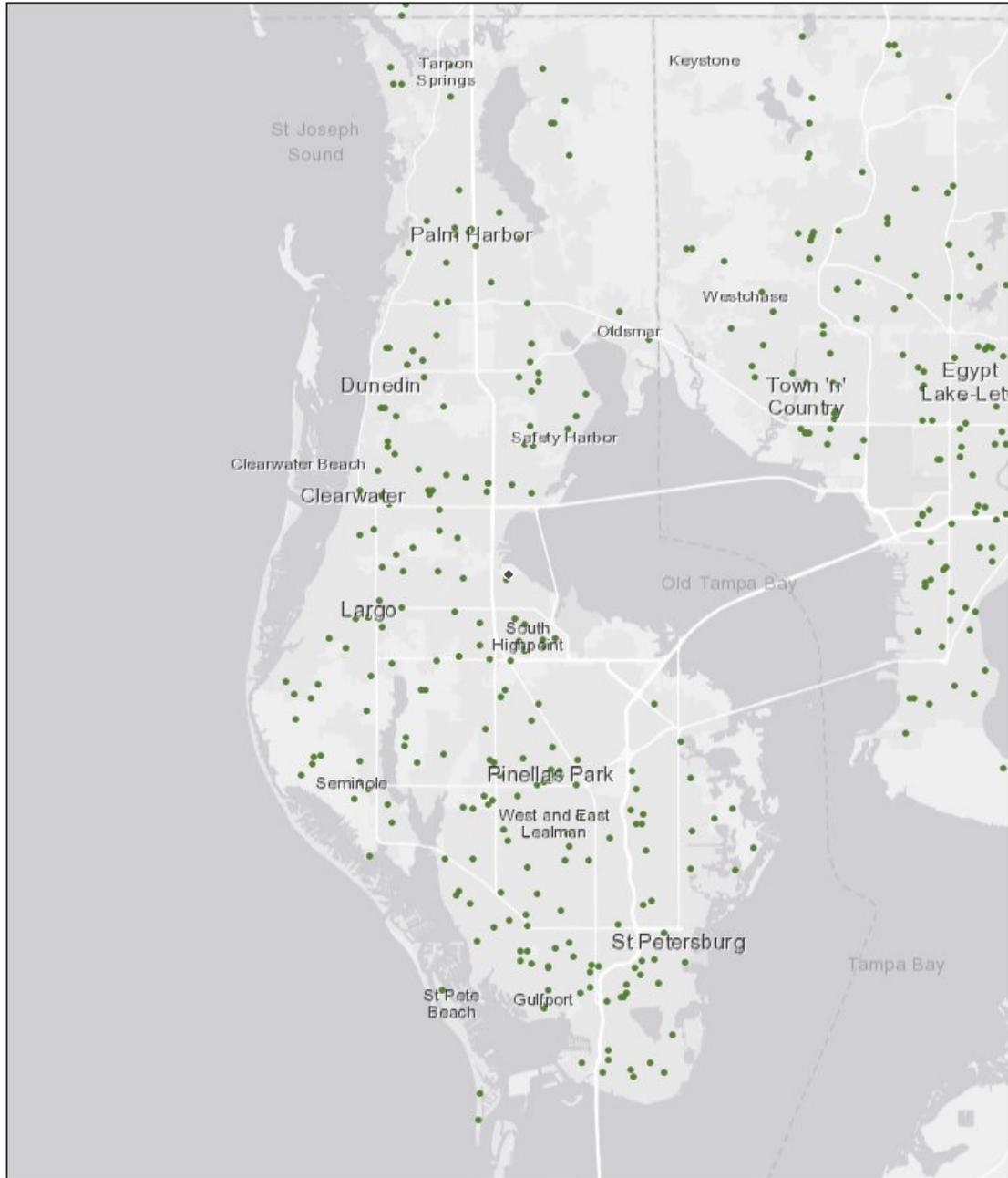
Correctional Facilities

- <10 - 1,000
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- 5,001 - 50,000
- 50,001+



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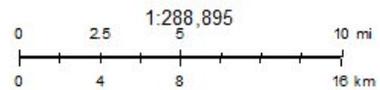
Appendix A-2 Locations and wasted food generation rate (tons per year) of educational institutions in Pinellas County and adjacent areas



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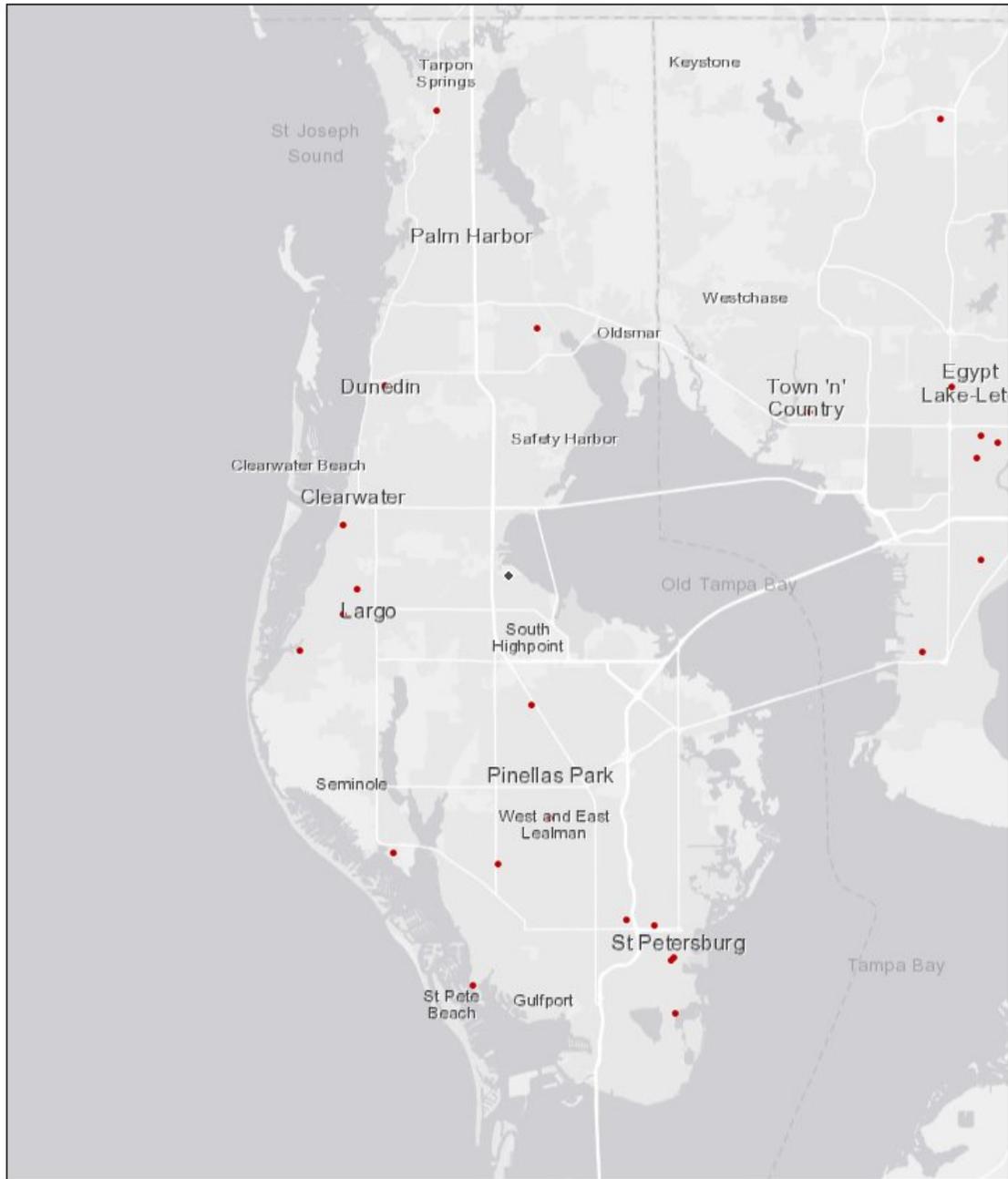
Educational Institutions

- <10 - 1,000
- 1,001 - 5,000
- 5,001 - 50,000
- 50,001+



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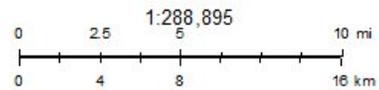
Appendix A-3 Locations and wasted food generation rate (tons per year) of healthcare facilities in Pinellas County and adjacent area



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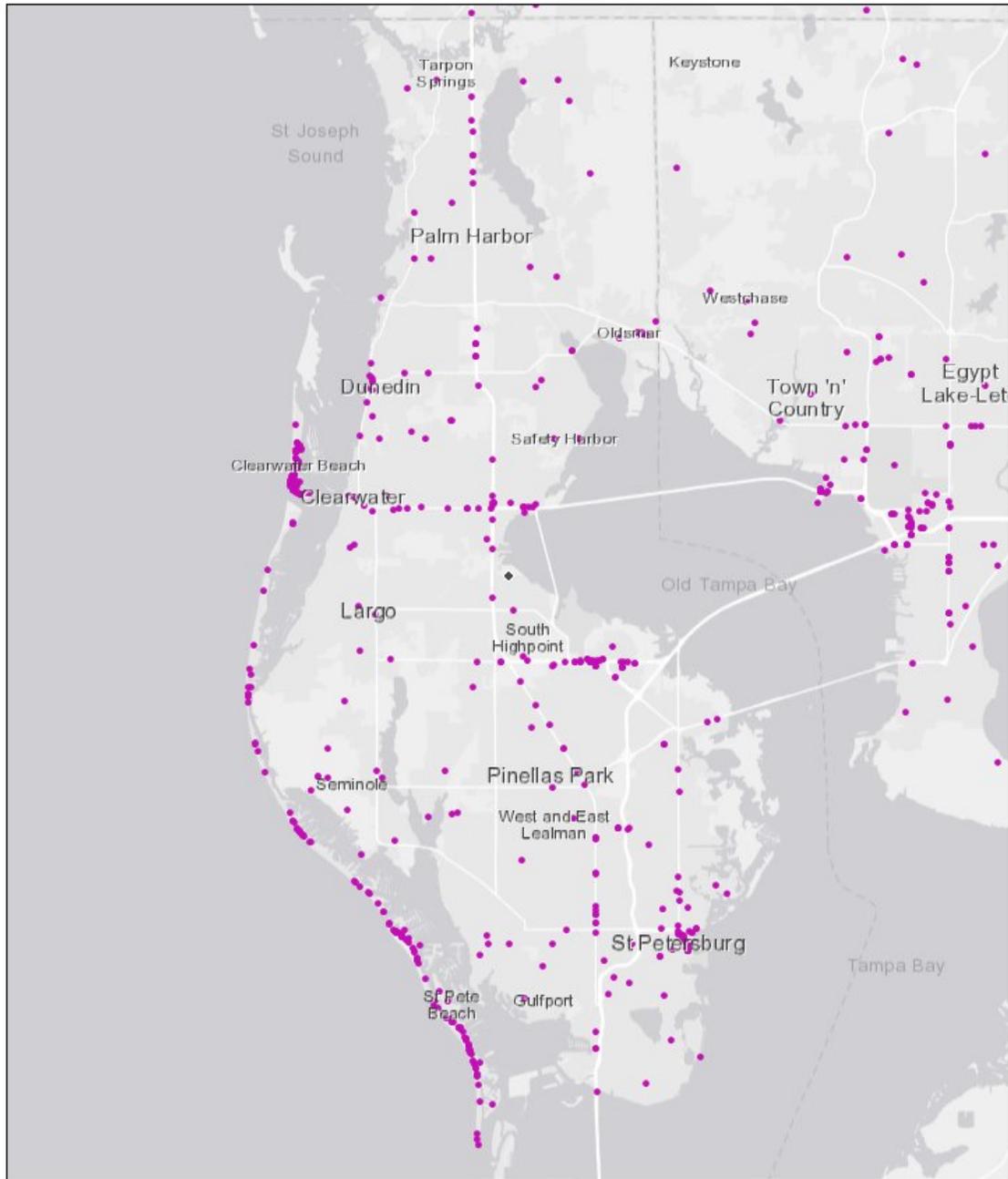
Healthcare Facilities

- <10 - 1,000
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- 5,001 - 50,000
- 50,001+



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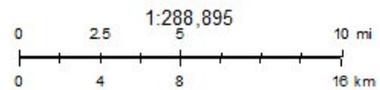
Appendix A-4 Locations and wasted food generation rate (tons per year) of hospitality establishments in Pinellas County and adjacent areas



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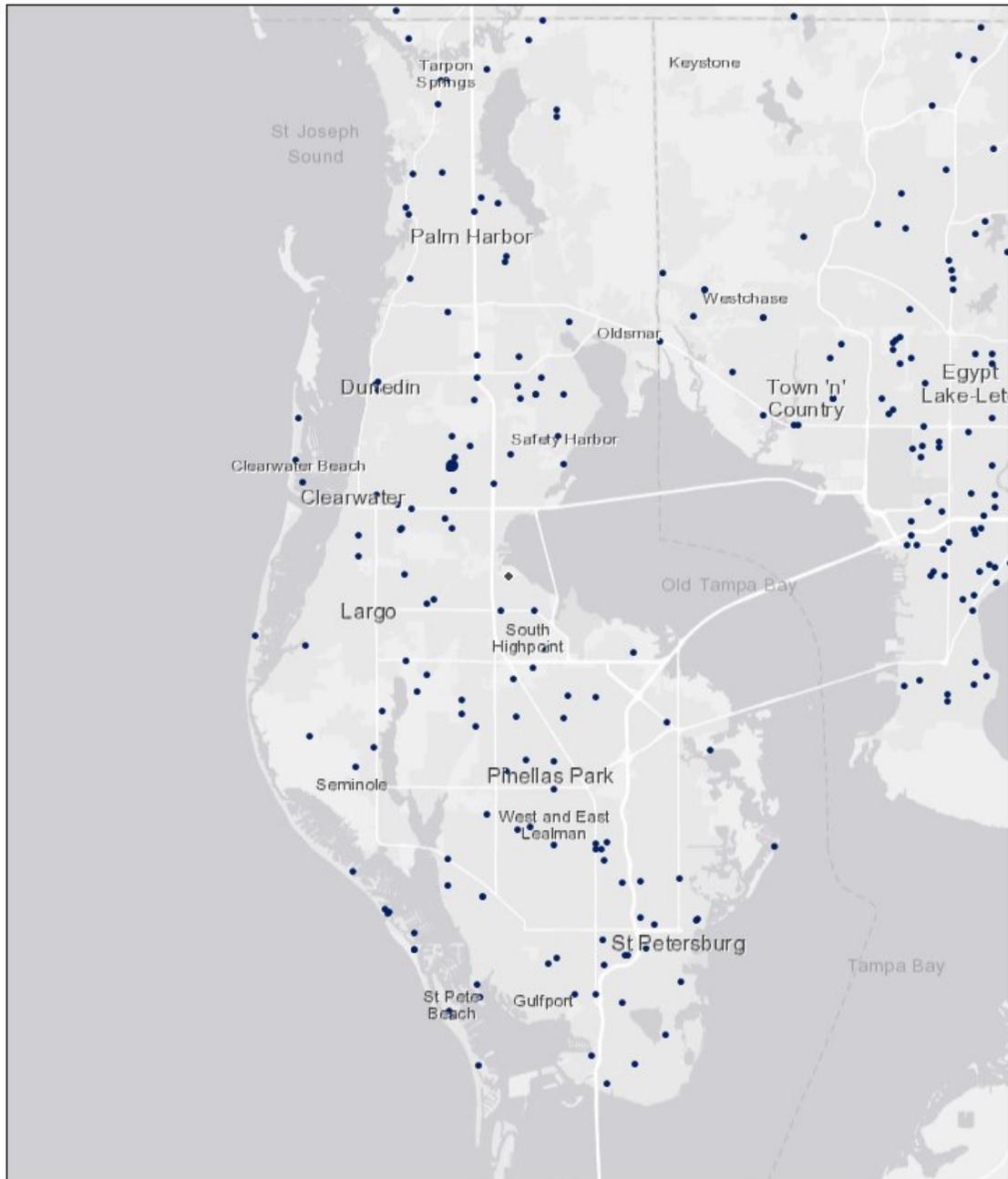
Hospitality Industry

- <10 - 1,000
- 1,001 - 5,000
- 5,001 - 50,000
- 50,001+



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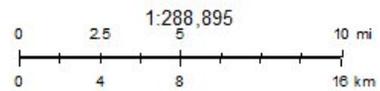
Appendix A-5 Locations and wasted food generation rate (tons per year) of food manufacturers and processors in Pinellas County and adjacent areas



4/9/2019, 10:18:47 AM

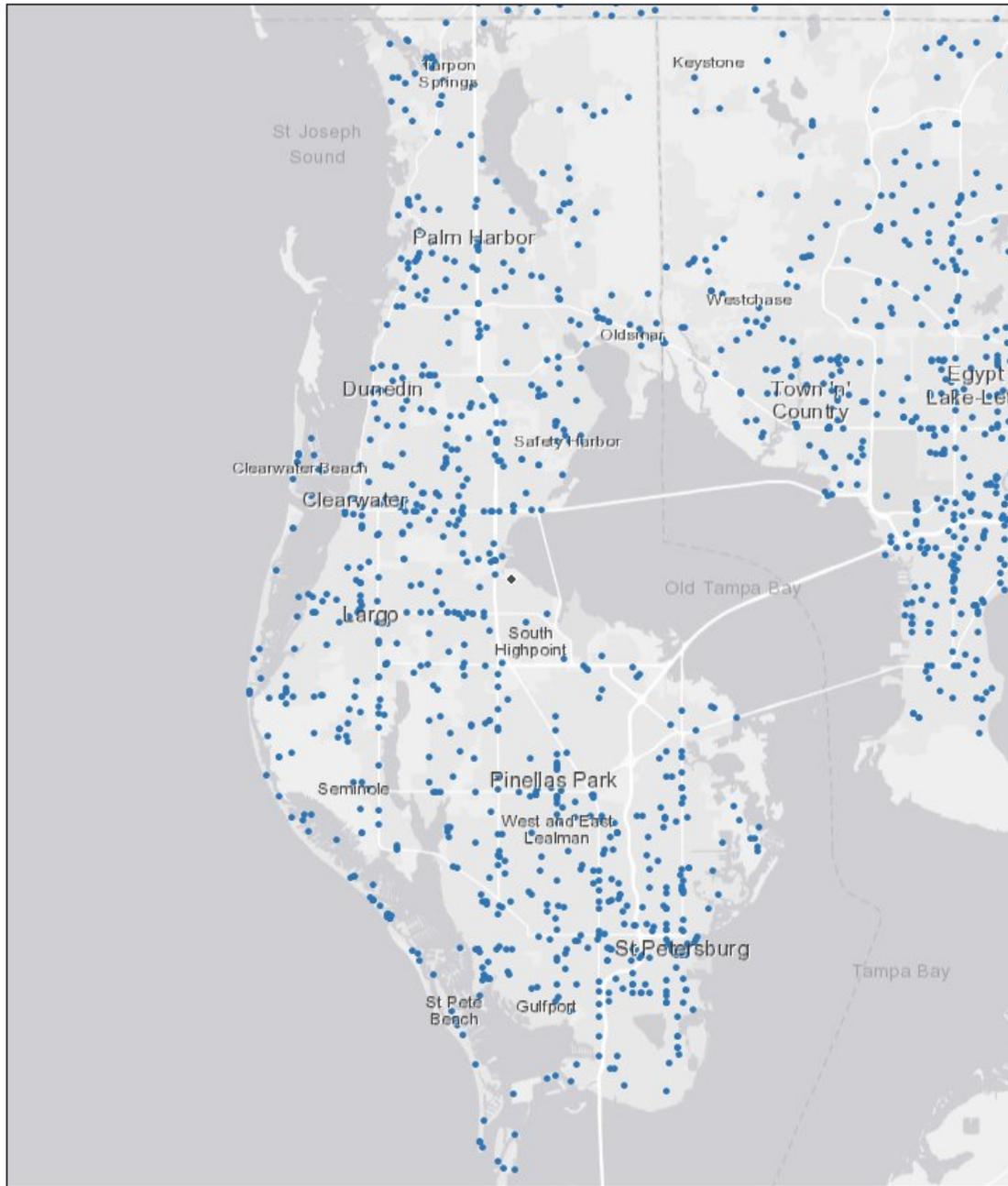
Food Manufacturers and Processors

- <10 - 1,000
- 1,001 - 5,000
- 5,001 - 50,000
- 50,001+



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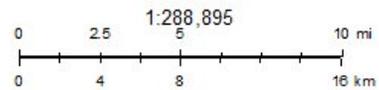
Appendix A-6 Locations and wasted food generation rate (tons per year) of food wholesalers and retailers in Pinellas County and adjacent areas



4/9/2019, 10:18:03 AM

Food Wholesale and Retail

- <10 - 1,000
- 1,001 - 5,000
- 5,001 - 50,000
- 50,001+



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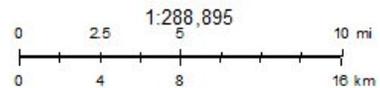
Appendix A-7 Locations and wasted food generation rate (tons per year) of restaurants and food services establishments in Pinellas County and adjacent areas



4/9/2019, 10:17:12 AM

Restaurants and Food Services

- <10 - 1,000
- 1,001 - 5,000
- 5,001 - 50,000
- 50,001+



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