

TRASH TALKS

Defining the Next Generation of Sustainable Sanitation Services for the Union Square Partnership and the Public Realm

SUMA CAPSTONE SPRING 2018

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EXECUTIVE SUMMARY

The launch of a zero waste to landfill goal (0x30) in New York City's *One New York: The Plan for a Strong and Just City* crystalized the momentum surrounding the need for cities to modernize their existing waste management practices and infrastructure. The city's 75 business improvement districts play a vital role in helping its neighborhoods achieve this goal.

USP, the business improvement district (BID) and local development corporation serving the greater Union Square – 14th Street neighborhood, brought the Columbia University Master of Science in Sustainability Management Integrative Capstone Workshop Team on-board to support their efforts to accelerate progress towards zero waste in Union Square Park, pedestrian plazas, and the wider public realm throughout the district.

Accomplishing this change requires a thorough assessment of the USP's existing waste management services and waste trajectory, understanding best-in-class sustainable waste management practices, and an evaluation of interest within the Union Square business community for sustainable waste management solutions.

USP is taking proactive measures to improve sustainability within the BID. This *Trash Talks: Defining the Next Generation of Sustainable Sanitation Services for Union Square Partnership and the Public Realm* report provides USP with a baseline to see how they are currently performing under existing practices and will help USP identify the necessary steps to reach the zero waste to landfill goals outlined by New York City. Recognizing that the road to zero waste does not occur overnight, this report presents a wide range of short-term and long-term strategies for USP to consider. These strategies include means and methods to improve the existing services, a tailored pathway to achieve a zero waste to landfill goal, and the creation of a forum that can serve to connect the businesses and lead to scaling for impact across the BID.

INTRODUCTION

Union Square is an important and historic neighborhood located in lower Manhattan, New York City. Union Square Park is bounded by 14th Street on the south, Union Square West on the west side, 17th Street to the north, and Union Square East bringing up the east. The park is under the aegis of the New York City Department of Parks and Recreation.¹

Union Square is also near key neighborhoods, including the Flatiron District to the north, Chelsea to the west, Greenwich Village to the southwest, East Village to the southeast, and Gramercy Park to the east. Moreover, several universities, including New York University and The New School, are in the park's vicinity. Thus, the park is within walking distance of various business, academic and touristic facilities.

Union Square is a hub of activity. The neighborhood houses the 14th Street – Union Square New York City Subway station, the second busiest transit location of New York City (second only to Times Square), and serves the 4, 5, 6, L, N, Q, R, and W trains. As a result, over 100,000 people pass through the district each day.

The lively Union Square neighborhood is anchored by a busy pedestrian plaza and bustling park, which in addition to being a major tourist location, attracts various professionals, street artists, students and protesters, as well as visitors out to enjoy a day outdoors. The surrounding streets are lined with high-rise apartments and large chain stores, as well as casual eateries and cafes. The stalls of the long-running Union Square Greenmarket draw crowds for local produce and artisanal food.²

As a BID serving the greater Union Square – 14th Street neighborhood, USP has been on the frontline of the city's evolving waste management landscape since its establishment in 1984. USP, comprised of both the BID (the District Management Association) and the Local Development Corporation (LDC), executes various programs and services. The LDC was established in 1987. USP's mission is to enhance the neighborhood's quality-of-life by creating a cleaner, safer, and more enjoyable environment for its residents, businesses, and visitors. With such a high level of activity, USP sees significant value in dedicating resources and critical investments in providing clean and safe programs. In our effort to support the USP in managing their waste, the Capstone team spent time both in the district and outside evaluating the overall district usage, its appearance, and how its waste management services are delivered.

BACKGROUND

1. New York City Business Improvement Districts

BIDs deliver services and improvements above and beyond those provided by New York City.³ A total of 75 BIDs currently serve New York City.⁴

In general, each BID is run by a not-for-profit organization with a Board of Directors.⁵ Elected by members in the district, the Board must include property owners, merchants, residents, and representatives of local elected office.⁶ The Board is in charge of making key decisions about programs and services, budget, goals, policies, and staffing.⁷

BID programs and services are funded by a special assessment billed to property owners within a district. Assessments are unique to each BID and decided upon by the BID's stakeholders.⁸ The City of New York assists with the collection of the special assessment, which in turn is distributed directly to the BID. The BID receives 100% of the money collected.⁹ On average, assessments make up 75% of BID budgets.¹⁰ Most BIDs also fundraise, apply for grants, and generate revenue from programs to support the services they provide.¹¹

2. Overview of Union Square Partnership

USP's mission is to enhance the neighborhood's quality-of-life by creating a cleaner, safer, and more enjoyable environment for its residents, businesses, and visitors.¹² USP primarily receives its support from a real estate special assessment levied by the City of New York on properties located in the USP BID.¹³ The USP BID's boundaries are approximately 14th Street from Sixth Avenue to First Avenue, and properties surrounding Union Square Park.¹⁴

USP's services to the Union Square – 14th Street neighborhood include sanitation (e.g., power washing, graffiti removal, and trash bagging), public safety, economic development, market research, and marketing services.¹⁵ USP also invests in the beautification of Union Square Park (e.g., street furniture, tree care, sidewalk planters, street lighting, and public art) and maintains the public plazas along Broadway from 17th to 18th Streets and at University Place & 14th Street.¹⁶

3. USP Contract with StreetPlus

In 2017, total revenues across the BID and LDC were \$3,138,369. USP spent \$1,036,601 on sanitation, representing 33% of USP's support and revenues.¹⁷ Although sanitation is USP's largest expenditure, most New York City BIDs generally spend around 25% of their budgets on sanitation.¹⁸

On May 7, 2014, USP entered into a contract for supplemental sanitation and graffiti removal services with StreetPlus (formerly Atlantic Maintenance Corporation). StreetPlus works with 63 improvement districts in seven states with regional offices in New York, Los Angeles, Chicago, and San Francisco.¹⁹

ANALYSIS & OPPORTUNITIES

1. Task 1: USP's Existing Sanitation Practices

The first task for the Capstone team entailed an in-depth evaluation of USP's existing sanitation program to highlight benefits to the community and potential areas for improvement. Discussed below are the team's findings based on a combination of stakeholder interviews, field research, and data analysis.

1.1. Overview of Stakeholders

While there are many stakeholders that interact with USP, a few are particularly relevant when understanding the waste landscape. Discussed below are the stakeholders integral to the handling and collection of the BID's waste. These stakeholders, along with other entities that the BID regularly engages with can be found in Appendix A.

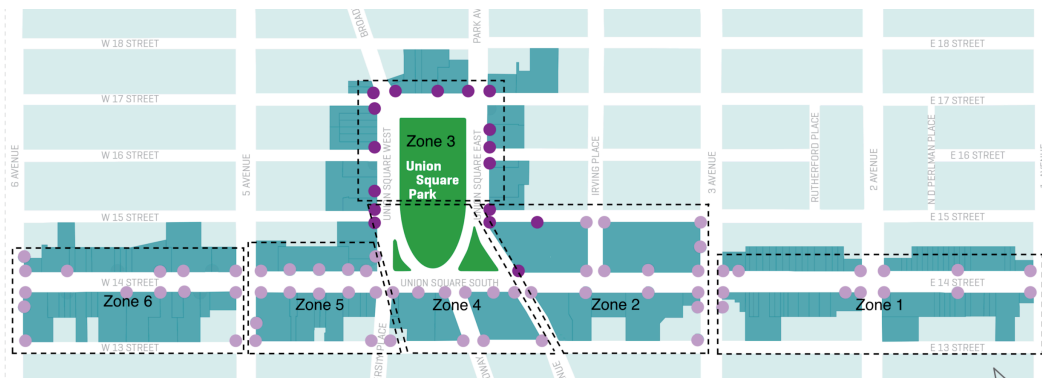
- **StreetPlus** is the company that USP contracts to manage waste within the district. The Clean Team is the group of 22 workers who are on the ground in the district emptying trash bins, picking up litter, cleaning up graffiti, and generally keeping the place beautiful. StreetPlus is also responsible for supplementing waste collection services offered by the City.
- **New York City Department of Sanitation (DSNY)** is the unit of the government in New York City responsible for garbage collection, recycling collection, street cleaning, and snow removal.

1.2. Trash Flows in USP's Service Area

1.2.1. Routes Taken by Clean Team

On a typical day and during each shift, each of the six zones of the USP service area is occupied by a Clean Team member. During their shifts, the Clean Team members walk through their assigned zones so that they check each trash receptacle and clean the streets. Clean Team members will walk through their zones several times during a typical shift.²⁰ A recent configuration of the zones and trash receptacles is shown in Figure 1 below.

Figure 1: USP Clean Team Sanitation Zones



Clean Team shifts start at 6 AM in the summer and at 7 AM in the winter. The initial round of trash collection is focused on emptying bins and organizing and tidying waste from the night before (waste from contractors, people experiencing homelessness, miscellaneous residential, street vendors, etc.). During this round, very little street sweeping, and pickup of stray trash or sticker/graffiti removal is completed. The first round takes about three hours and is completed between 9 and 10 AM. During the second round, the Clean Team continues to empty cans as they fill up, pick up litter, sweep the streets, and paint/scrape off stickers, as necessary.

1.2.2. Frequency of Bagging

During their shifts, the Clean Team members patrol their assigned zone with a large trash receptacle on wheels. As they survey each trash receptacle in their zone, they decide whether to transfer the existing waste from the receptacle to the wheeled bin, or bag the trash and transfer it to the designated trash collection spot within the zone.²¹ The frequency of bagging changes greatly between the zones and through the year.²² During the Capstone team's observation periods in March and April 2018, it was observed that bins in the district need to be emptied anywhere from once per day (farther away from the park/on 13th Street), to three to four times per day (in the park, on the most trafficked parts of 14th street). From experience, the Clean Team members have a good idea about the expected volume passing through their zones, and when cans will be full, or need to be emptied.

From the research completed by the Capstone team through interviews and observations, Bigbelly cans are emptied along a similar timeline as the regular waste bins, and do not substantially reduce the frequency of bagging. The Clean Team ends up checking the bins frequently, as the red sensor light, intended to indicate when the bin is full, is especially sensitive and sometimes malfunctions.

1.2.3. Volume of Waste

The Clean Team maintains the 126 trash receptacles and collects over 175,000 bags of trash annually in the Union Square BID.²³ According to USP, many members of the Clean Team have worked with USP for several years. According to StreetPlus CEO, David Goldberg, the Clean Team spends over three-quarters of their time sweeping and cleaning trash from the ground.

Additionally, as part of ‘keeping the BID beautiful,’ the Clean Team not only handles specific waste from the USP garbage bins, but also takes care of stray trash like televisions, mattresses, and extraneous materials that end up on the street or are left behind by waste haulers. Trash is picked up by both DSNY and StreetPlus but is not systematically measured by either organization to derive an overall volume of waste.

1.2.4. Storage and Siting of Bagged Trash

Each zone within the BID has its own designated spot for storing full garbage bags until they are either collected or moved to the main garbage bag storage location along Union Square East. In some zones, the Clean Team is able to leave the full trash bag at the side of the trashcan until pick-up, a practice common in other BIDs.²⁴ In other zones, it must be brought to a designated storage spot within the zone, as there are many businesses that do not want any bagged trash near their stores or on the sidewalk near their storefronts. Per USP, trash from zones 2, 3 and 4 is placed directly at the main storage location on the east side of Union Square Park. There are often other piles of commercial or residential trash (in standard black bags) similar to the USP piles (in grey USP bags). Businesses sometimes add their garbage bags to piles of USP’s collected trash. In addition, in USP’s experience, piled garbage bags can cause damage to the trees along the street.

1.2.5. Frequency and Timing Collection of Waste Hauler

The Clean Team monitors the condition of the BID’s trash cans to ensure they are not overflowing. Trash cans are regularly emptied, and the surrounding area is thoroughly cleaned, and power washed on a regular basis. The Clean Team removes filled trash bags from receptacles and Bigbellys and covers trash cans with clean liners regularly. Bagged litter is transferred to designated corner locations. According to David Goldberg, CEO, StreetPlus, over 80% of the Clean Team’s time is spent on manual litter removal and bagged refuse removal. The Clean Team spends about 28 hours per week on bagged refuse removal while an estimated 600 hours per week are spent on manual litter pick up. Finally, the sanitation contract provides that garbage bags are to be picked by StreetPlus waste haulers three times a day.

StreetPlus supplements trash hauling carried out mainly by DSNY. Approximately 60% of the trash collected within the Union Square BID is picked up by DSNY trucks with built in

compactors.²⁵ StreetPlus provides supplemental trash pick-up two to three times a day in open top trailer trucks for the remaining 40% of trash.²⁶

1.3. Siting of Existing Trash Receptacles and Overview of Local Regulations and Programs Pertaining to Waste Management in Public Spaces

Currently, there are 126 waste receptacles placed within Union Square and spanning east to west between 1st and 6th Avenue, and north and south between 13th and 17th Street. On the major crossroads of avenues, there are green dynasty trash cans in place at every corner, and sometimes an extra can or two. For example, at the intersection of 3rd Avenue and 14th Street, there are seven dynasty cans, and five at the intersection of 2nd Avenue and 14th Street.²⁷ Refer to Appendix B for the approximate locations of the BID's waste bins based on an audit by the Capstone team. In mid-April, Union Square Park received a delivery of a new batch of trash cans.²⁸ Figure 2 below provides a photo of the new waste bins.

Figure 2: New Dynasty USP Waste Bins



Photo Credit: USP²⁹

USP has installed ten Bigbelly trash compactors in Union Square Park to reduce pest issues, see Figure 3.³⁰ The Bigbellys are solar powered compactor bins marketed as cutting-edge technology, and are intended to help reduce the number of trash pickups in highly used areas. According to USP, the Bigbelly cost \$450-\$550 each.

Figure 3: USP Waste Bins – Dynasty Can (left) and Bigbelly (right)



Although the Bigbelly bins are equipped to send notifications when they are full, USP notes that the notifications are only sent to the supervisor of the Clean Team and known communication challenges with some members of the Clean Team hinders the ability to use this feature. In practice, the Clean Team empties the Bigbelly bins when they pass them on their route, as opposed to when the bins are full.

Figure 4: Inside a Bigbelly Waste Bin



DSNY places and maintains 25,000 garbage receptacles at commercial street corners along standard collection routes.³¹ Street baskets are concentrated in commercial areas where they may be emptied as frequently as five times a day.³² They may also be placed in predominantly residential zones and collected on residential refuse routes along with household trash two or three times a week.³³ DSNY also accepts requests for litter baskets in new locations within commercial and mixed-use zones.³⁴ Nonprofit organizations may also request collection from the city service for a specific address.³⁵

In 2007, Union Square Park was selected by DSNY as the Manhattan pilot location for public space recycling.³⁶ DSNY published its findings in *New York City Public Space Recycling Pilot Program Report on Results*.³⁷ DSNY concluded, among other things, that recycling bins in Union Square Park should be maintained.³⁸ However, USP currently does not engage in any public recycling. Moreover, DSNY no longer houses any recycling receptacles in the Union Square Park area.

According to Thomas Milora, Executive Assistant to the DSNY Commissioner, New York City is looking to get as much recycling as possible and has placed a number of recycling baskets throughout the city. He believes DSNY would be able handle USP BID recyclables, provided they are separated.³⁹ DSNY is also mandated to expand its Public Space Recycling Program.⁴⁰ As part of this expansion, DSNY is required to “place public space recycling receptacles in all business improvement districts that provide public litter basket maintenance.”⁴¹ Thus, the USP should engage in discussions with DSNY to expand public space recycling within the BID.

1.4. Waste Characterization of Trash Collected from USP’s Service Area

In 2013, DSNY conducted a waste characterization of New York City curbside waste. DSNY published the results of its waste characterization study in the *2013 NYC Curbside Waste Characterization Study*.⁴² The study provided valuable insight into NYC waste as a whole, but the Capstone team found it appropriate to conduct a pilot waste characterization study to develop a breakdown of the waste generated in the USP BID to provide USP with specific, tailored, recommendations, as well as helping the BID align with the city’s 0x30 goal.

A waste characterization study is used to understand what materials are being thrown out in the waste-stream along with ascertaining quantities of waste streams. To conduct the pilot waste characterization analysis, the Capstone team worked closely with USP on selecting trash receptacles where trends could be observed based on their location. The study was conducted over three days: Friday, April 6, Sunday, April 8, and Monday, April 9, 2018. Friday and Sunday were selected for the bag pulls to observe the variance between weekday versus weekend waste composition and waste components with and without the local greenmarket traffic. For each day the Capstone team, with the help of the Clean Team, pulled trash bags from 19 locations, referred

to in Figure 5 below. Each bag was located, pulled, and tagged with labels identifying them with an accurate date and location number. Due to unforeseen circumstances upon arrival, waste from four bin locations had already been pulled and removed from the area, leaving the Capstone team with no waste to analyze for those particular locations. Additionally, multiple bags were collected from some locations, increasing the number of the waste bags collected and sorted to 47 bags.

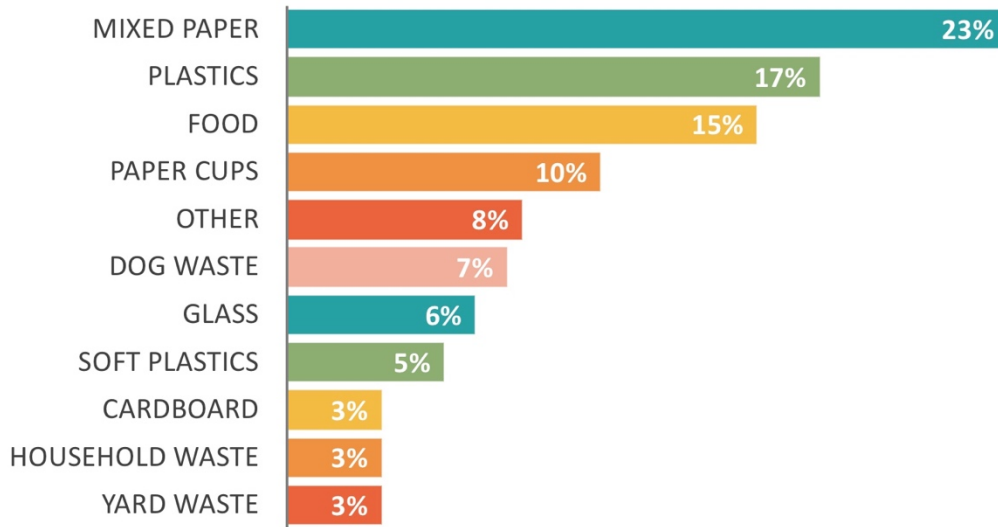
Figure 5: Pilot Waste Characterization Collection Locations



To conduct the study, the Capstone team trucked the waste to the Covanta Union site in Rahway, NJ. The Capstone team selected to use this facility as it provided them with a controlled environment where they could sort through the waste efficiently and safely without disrupting park operations. Based on hypothesis, the DSNY waste analysis,⁴³ and EPA methods,⁴⁴ the Capstone team developed a list of categories best suited to characterize waste prior to the pilot waste study. Upon opening the bags, the Capstone team realized that the level of detail in the original categories could not be met due to contamination or waste not being part of the originally identified categories. For each bag, the Capstone team took an initial weight and logged it into a data spreadsheet. After logging the initial weight, Capstone team members opened the bags and sorted the waste into piles which represented separate categories. After all the waste was sorted, the piles were weighed individually. The same process of weighing and sorting was conducted for all 47 bags. After all bags were analyzed, the materials were pushed into the refuse pit where it was combusted to produce electricity.

After concluding the characterization study, the Capstone team was tasked with analyzing the data to see the composition of the waste and determine if any trends were present. The Capstone team found that 50 percent of the waste being thrown away could alternatively be managed for recycling, refer to Figure 6 below.

Figure 6: Overall Distribution of USP Waste by Category



Further analysis was conducted on the data to provide additional insights, such as Union Square Park waste compared to 14th Street waste, and weekday compared to weekend. This additional analysis is provided in Appendix C. The waste characterization pilot study was successful in providing an initial snapshot of the materials being discarded in the BID. However, a complete annual analysis should be conducted to gain an in-depth understanding of the materials and seasonal variations in waste throughout Union Square.

1.5. Processing and Destination of Waste Collected in USP’s Service Area

The Capstone team conducted interviews with the Clean Team, StreetPlus, and DSNY, to understand the lifecycle of USP’s waste. From the interviews, the Capstone team determined that the Clean Team collects the trash and brings it to a designated collection point or leaves it for pick up in the BID by either DSNY or private hauler contracted by StreetPlus. Regardless of who picks up the trash, the BID’s waste ends up at one of DSNY’s contracted transfer station facilities. The specific transfer station location depends on the district where the waste is collected.

The extent of DSNY’s collection districts are based on the limits of each of the city’s 59 community districts⁴⁵. The USP BID straddles four DSNY collection districts - MN02, MN03, MN05 and MN06⁴⁶. According to DSNY, the trucks serving each of these districts dispose of the waste directly at the corresponding facility either immediately after collection or later on in the day⁴⁷. Waste from MN02 and MN03 is trucked to the Covanta Essex waste-to-energy facility in Essex, NJ. Refuse brought to the Covanta Essex facility is not sorted prior to incineration. Ash resulting from the waste-to-energy resource recovery process is assumed to be transported from the Covanta Essex facility to landfill sites in Upstate New York, Virginia, or Pennsylvania.⁴⁸ Waste

collected from MN05 is trucked to the Interstate Waste Services facility in Jersey City, NJ and that from MN06 to the Waste Management facility in Fairview, NJ. DSNY waste transported to private transfer stations is also assumed to be transported to one of the landfill locations in Upstate New York, Virginia, or Pennsylvania.

Using the updated inventory and map of public space waste receptacles serviced by USP (refer to Appendix B), the Capstone team was able to estimate the percentage of waste ending at each of the private transfer stations contracted by DSNY. As shown in Table 1 below, it is estimated that approximately 30% of USP’s waste ends up in waste-to-energy, while 70% of the waste goes directly to landfills.

Table 1: Estimated Distribution of USP’s Waste to Transfer Station Location

DSNY Collection District	Primary Transfer Station Location⁴⁹	No. of USP Trash Bins	Estimated % of BID Waste
MN05	IWS, Jersey City, NJ	75	60%
MN06	WM, Fairview, NJ	12	10%
MN02	Covanta Essex, NJ	26	20%
MN03	Covanta Essex, NJ	13	10%
Total		126	100%

2. Task 2: Best-in-Class Approaches for Sustainable Urban Waste Management in the Public Realm

The second task consisted of researching and evaluating best sustainable waste management practices. The Capstone team focused this effort to three sectors - cities, organizations and corporations, and other NYC BIDs. The Team conducted desktop research, as well as direct outreach to a number of local BIDs. Discussed below are specific efforts being undertaken that focus on reducing and diverting waste in public spaces. Refer to Appendix D for a summary of findings for each sector evaluated.

2.1. Waste Management Services, Equipment, and/or Technology

2.1.1. Public Space Recycling

According to Keep America Beautiful, a national non-profit organization, establishing successful recycling programs in parks or other public space locations involves more than simply putting out recycling bins.⁵⁰ To avoid contamination or misplacing recyclables into the trash, the waste and recycling bin arrangement must be designed to encourage people to correctly sort waste items.⁵¹

Keep America Beautiful published a comprehensive guide for designing public space recycling programs.⁵² Their top ten tips best practices are listed below:

- a) *Recycling Must be Simple and Convenient:* Most people are inclined to recycle when presented the opportunity. The key is to remove the primary barriers that stop them, lack of convenience and confusion over what and how to recycle.
- b) *Know Your Waste Stream:* Learn what materials are discarded in the target area before selecting bin locations. Waste audits or even visual surveys of trash bins help inform what the message should be placed on the lid, where to place bins and even what size they should be.
- c) *Place Recycling Bins Directly Next to the Trash Bins:* Bins located by themselves attract both trash and recycling regardless of the label. Options for recycling and trash must be placed immediately next to each other anywhere you want to capture recyclables without excessive contamination.
- d) *Use Restrictive Lids:* Small openings reduce contamination. Restrictive lids large enough for common recyclables (round for containers, narrow for paper) force people to slow down and read what the label says.
- e) *Use Clear, Simple Labels and Signage:* Get the essential information across to users in simple terms. Use key words like “Cans & Bottles” or easy to recognize images. Avoid cluttering the label with too much detail.
- f) *Choose the Right Bin:* Select the bin and accessories that are best adapted to the setting. Capacity, ergonomic design for servicing, resistance to wear and abuse are just some of the factors to consider. Make the recycling bin visually distinct from trash bins. Blue is the most common color used for recycling.
- g) *Be Consistent:* Pick a uniform bin style, color scheme and label message and stick to it. Coordinate with nearby residential recycling programs and other public settings to standardize bin colors, design, and messaging. Familiarity reduces confusion as people move from home to work or just being out and about.
- h) *Keep Bins Clean and Well Maintained:* Dirty and dilapidated recycling bins turn people off. The same is true for overflowing or badly contaminated recycling bins. Keep bins in good working order with fresh labels and regular cleaning.

- i) *Educational Outreach*: Include special signage with the bins. Face-to-Face interaction with frequent visitors trains them for the long term. Recruit people who interact with users to be recycling ambassadors, such as team coaches at athletic fields or attendants at community centers.
- j) *Be Prepared and Ready to Improve*: Pilot your program to learn what works best before investing in the full infrastructure. Monitor the bins and be prepared to make adjustments. Track the quantity and composition of collected material to benchmark and improve the program over time.⁵³

2.1.2. Comprehensive Programs

2.1.2.1. The Phoenix Green Business Leader Program

The Phoenix Green Business Leader program has made advanced strides in establishing practices that reduce, reuse, and recycle waste. Despite changes to the city’s waste treatment practices, landfills in Phoenix, AZ, continue to emit pollutants which negatively impacts the air quality. To address this, the city installed advanced gas capture and control system at the city’s active landfill which has avoided carbon dioxide equivalent emissions of 2,300 metric tons since 2006.⁵⁴ The “Reimagine Phoenix Initiative” is a necessary step towards reaching the city’s goals of diverting 40 % waste away from landfills by 2020 and zero waste by 2050.

Moreover, the initiative converted 50 acres of vacant public land into a Resource Innovation Campus (RIC), a circular economy hub where private manufacturers can lease land from the city and use feedstock from the city’s waste stream to generate economic activity. This facility also established a partnership to divert palm fronds from the waste that was previously being sent to landfills given their unsuitability for waste treatment operations. This initiative where a diversion contractor is hired to manufacture palm fronds into livestock feed material resulted in \$10 million in sales annually and the creation of 12 new jobs.⁵⁵

The city has also actively sought to increase awareness of waste management by providing workshops to over 12,000 residents, delivering over 100 tours to the city’s recovery facilities annually, hosting 70 public events, and setting up about 50 information booths. To enhance outreach efforts, the city partnered with an organization to develop an app to provide information regarding recycling and incentives to more than 35,000 residents.

2.1.2.2. Hennepin County in Minnesota

Hennepin County in Minnesota has pioneered waste management solutions by driving sustainable purchasing initiatives. It has made an effort to lead by example and focus on purchasing products

which can sustainably be recycled or reused. In the aftermath of a resolution adopted in 2001, the county administrator must designate recycled-content products for procurement. The county has partnered with Staples, its office supply contractor, to substitute eco-friendly products.⁵⁶

One such example is the purchase of remanufactured toner cartridges instead of new toner cartridges. This partnership with Staples ensures the reuse of eco-conscious products including products that contain recycled content or are remanufactured, refillable, or rechargeable. In order to minimize health and environmental impacts of maintaining clean facilities, the county requires the use of environmentally friendly cleaning products. These cleaning products must be certified by EPA's Design for the Environment.

2.1.3. Organics Containers

Keep America Beautiful and the United States Composting Council (USCC), along with five other participating nonprofits and government agencies, recommend designating green as the voluntary container color standard for organics collection containers.⁵⁷ Education and identification of containers and proper ways of recycling food scraps helps avoid contamination.⁵⁸ Green is recommended as the preferred container color for organics collection containers for the following reasons:

- A distinct, consistent color for organics containers provides a visual cue for program participants that studies indicate will likely increase recognition of the purpose of the container and the quality of recovered material;
- A distinct color that is different from the colors used for trash and recycling collection containers can increase recovery; and
- Consistency in messaging across jurisdictions – including the use of container color – helps to minimize confusion and contamination.⁵⁹

However, given that DSNY has rolled out brown organics collection containers to residences across New York City, the Capstone team believes that brown may be the preferred container color for organics collection in New York City.

2.1.4. Trash Compactors

In the event that there is not enough sidewalk space to accommodate storage space for waste, a trash compactor could be useful.⁶⁰ For example, the Battery Park City Authority required developers of specified sites to host compactor containers managed by the Battery Park City Authority.⁶¹ Instead of piling bags of refuse on the sidewalk two days a week for pick-up the next

morning, porters from the surrounding buildings could now deliver bags to a shared compactor each day.⁶² The compactors can hold 150 carts' worth of material.⁶³ Each compactor manages material from about 2,000 units and takes about 90 minutes to load each day.⁶⁴ The trash compactors addressed an issue with rats and have also been popular with porters.⁶⁵

2.1.5. Trash Can Sensors

Smart waste collection systems often include sensors that monitor fill level and other indicators, such as temperature and tilt within waste containers, a communication node to transport data, and a software suite for accessing, managing, and analyzing that data.⁶⁶ There are several examples of these systems. For example, TDC, Denmark's largest telecoms company, and Cisco formed a partnership agreement to deploy the IoT City Digital Platform in Denmark.⁶⁷ The Sunshine Coast Council in Australia also partnered with Cisco and Telstra to develop a Smart City Framework in 2014, a portfolio of 13 municipal service areas including waste management.⁶⁸ In addition, Enevo and its Brisbane-based partner, Smarter Technology Solutions successfully deployed Enevo's smart fill level sensors and announced plans to move on to a wider implementation.⁶⁹

Another example of an integrated smart waste collection solution is the solar-powered waste bin equipped with a Wi-Fi unit.⁷⁰ With Wi-Fi-enabled smart bins, cities can run access points by using the solar energy already collected by the bin.⁷¹ For example, in June, solar-powered Bigbelly bins with Wi-Fi units were installed in Sharjah, United Arab Emirates.⁷² Bigbelly bins have also been installed in other locations within New York City.

2.1.6. Anaerobic Digester

An anaerobic digester houses anaerobic digestion, which is the primary process used in most technologies dealing with food waste.⁷³ However, different digesters can use the biological process in different ways, allowing a diverse range of solutions for a variety of industries.⁷⁴ Microbes break down food waste anaerobically—in the absence of oxygen—by producing biogas or methane, some of which powers the process.⁷⁵ The excess can be used as gas or converted to electricity through a combined heat and power system.⁷⁶ Other outputs include nutrient-rich organic solid/slurry that can be used as liquid fertilizer, dewatered into a solid soil amendment or further processed into compost. If biosolids are dewatered, the process also creates an effluent that can be filtered and reused as graywater.⁷⁷

The purpose is to extract maximum usage from food waste by converting into energy and fertilizer and even back into water.⁷⁸ Large equipment (usually contained in full or half-shipping containers) is typically sited on the building exterior. Continuous feeding is allowed, and processing takes 14 to 28 days.⁷⁹ The equipment can accept all food waste, paper and compostable bagging but not compostable plastics.⁸⁰ Paper and compostable bags do not contribute to energy production, so

some vendors discourage their use.⁸¹ Water usage is typically low and can produce rather than use electricity. A sewer connection is required to input wastewater to the system.⁸² They are environmentally friendly as they recover energy and nutrients.⁸³ Cleaned biogas can be used to power a boiler or for cooking gas or be converted directly to electricity and heat in an attached combined heat and power plant.⁸⁴

New York City's Chelsea Market provides tenants the use of digesters that allow food waste to be converted into grey water.⁸⁵ This new byproduct can then be disposed of via any facilities' normal plumbing and eventually cleaned and repurposed at the local waste water treatment plant.⁸⁶ The New York State Research and Development Authority (NYSERDA) offers funding for building renewable energy technologies such as biogas production through anaerobic digestion. Both farms and other commercial establishments can receive funding.⁸⁷

2.1.7. Cardboard Baler

Considerations for an on-site cardboard baler includes space and clearance for servicing the machine and space for the bale to be off-loaded, stored and moved to a set-out location. This is commonly done with a hand trolley, although a forklift and pallet can also be used. Breaking down cardboard and putting into a baler is more labor intensive than putting into a large compactor, but less labor intensive than hand bundling. Compaction rates vary but can be up to 8:1 for cardboard.⁸⁸

2.1.8. On-Site Composting

Composting is the natural process of decomposition where the breakdown of organic material occurs until the nutrient-rich portion remains.⁸⁹ Composting is an important sustainable waste management measure as it diverts food waste from landfills, where the food would decay anaerobically (without oxygen) and create massive quantities of greenhouse gas methane. Therefore, composting is a disruptive technique that reuses food waste and returns vital nutrients into the earth to create healthy soil. It is viewed as a "closed loop" measure and an end-use method to divert landfill contents. Estimates point to an average of two pounds of food waste per day tossed by the average New York City resident, amounting to over 3,000 tons of organic matter going to landfills.⁹⁰

Organics are one of the waste streams that have significant potential for diversion. The use of compostable products facilitated diversion of organics. The resulting compost could be incorporated into potting soil products for purchase. However, in order to get increased organics diverted through this strategy, additional end user infrastructure is needed.

ReFED has extensively analyzed the most cost-effective ways to reduce food waste and the resources needed to implement those solutions at scale.⁹¹ It identified 27 of the best opportunities

to reduce food waste through a detailed economic analysis, using the EPA Food Recovery Hierarchy. This method prioritizes prevention first, then recovery, and then recycling.⁹²

2.1.9. Other Technologies - Automated Vacuum Collection Systems (AVAC)

Another waste management method used in parts around the world is pneumatic tubes known as automated vacuum collection systems (AVAC). AVAC networks have been utilized since the early 1960s, with the first installation in Sweden.⁹³ These networks are effective solutions for dense residential and urban areas, as well as other areas where truck access is limited.⁹⁴ Pneumatic tubes are connected to each building where they transport waste at high speeds to a collection point to be compacted and sent for disposal. This allows for 24/7 availability, 7 days a week, 365 days a year. The availability and ease of use reduces the space needed to store waste onsite and lowers the amount of labor needed to collect and bring waste to the curbside for pickup. AVAC systems also provide other benefits such as the elimination of collection trucks and disruption of service due to inclement weather.⁹⁵

A disadvantage of pneumatic tube networks is the high upfront capital costs of digging earth and laying pipe for the system. This is especially difficult in already developed cities with networks of other pipes and lines below requiring careful planning to not disrupt existing infrastructure. A pneumatic system installation would be easier in new developments such as in Asia and the Middle East where you can reduce the cost of laying pipes by also installing utilities.⁹⁶

Currently, in the United States, there are only two places that utilizes an AVAC waste system, Roosevelt Island, in New York City being one of them. Roosevelt Island's AVAC waste system has continuously operated since in 1975 and has been expanded three times to service new developments.⁹⁷ The system was designed in 1969 by Philip Johnson and John Burgee who envisioned a community without cars. Another AVAC project is currently being discussed in New York City. Closed Loops is engaged in preliminary planning for a pneumatic system proposed for the corridor adjacent to the High Line Park on Manhattan's Far West Side.⁹⁸

2.2. Siting and Street Design for Waste Receptacles

A study published by the Project for Public Spaces sheds light on the various considerations during placement of waste receptacles for a downtown location.⁹⁹ According to the study, this is partly due to the diverse functions waste receptacles serve on a street. Despite being convenient to use and easy to maintain, trash receptacles accommodate a wide variety of added functions, including serving as a location pointer or landmark in a bustling area.

One of the common mistakes made in cities is placing waste receptacles where they are easy to empty, rather than where they are most convenient for people to use. The result is often trash-filled

streets and empty waste receptacles, since people do not often go out of their way to find one. Thus, the challenge remains to determine where one is truly needed based on locations of existing street furniture and type and location of ground-floor land uses such as department stores and fast food joints.

2.2.1. Siting

Good locations for waste receptacles are places that people more regularly access, such as busy intersections close to crosswalks, and next to food vendors, or major building entrances. The number of waste receptacles that are needed depend on the number of people who use the area, the amount of litter generated by the different land uses, and the efficiency of the sanitation and maintenance program.¹⁰⁰

2.2.1.1. Optimization of Receptacles Siting

Many of the best-in-class practices include an optimization of the physical location of receptacles. This approach allows entities to increase the efficiency of their operations using the equipment they already have.

- a) Placing receptacles (of any kind) in corners – the 125th St. (Harlem) BID found that receptacles placed in corners tend to be significantly fuller than those located along a given block.
- b) Strategically placing Bigbelly receptacles - USP owns several Bigbelly receptacles, most of which are located in or around Union Square Park. While these locations are preferable in terms of foot traffic, USP indicated that some of the Bigbelly receptacles do not function properly due to shade on the bin's solar panel.
- c) Possible recommendations: reevaluate the location of Bigbelly bins and maximize corner bins
- d) Communication and messaging are key to the successful implementation of a waste management plan. Multiple BIDs (including USP) use their receptacles (especially Bigbelly receptacles) as a canvas for various waste related messages.
- e) Increasing the amount of receptacles and placing them every 30 feet is another approach that many companies have taken to manage waste. At Disney Parks across the US, trash cans are within 30 paces of each other so patrons never have to hold garbage for too long and are less likely to litter.¹⁰¹

- f) Placing waste cans that do not require people to touch it in order to easily dispose trash.

2.2.2. Design

In choosing a waste receptacle, there are several specifics to look for. However, the main quality is that the waste receptacle looks like a place for depositing litter. Oftentimes, efforts to make them blend into the environment make them inconspicuous and unrecognizable as places that house rubbish. Though waste receptacles should be compatible with other street furniture and fit in the architectural landscape of the city, the primary character of the waste bin as a place to store trash should never be disguised.

Moreover, good waste receptacles are easy to use. This includes not requiring people to have to touch the waste bin or push open a lid to use it.¹⁰² It also requires having the bin wide enough to accommodate various forms of litter. A rule of thumb is that the opening should be at least 10 inches wide, which is large enough to accommodate a folded newspaper or a take-out food container. Having the opening too small can deter people throwing in waste or jamming of items, which further discourage people from throwing in their trash. A waste bin should also not be more than 36 inches above the ground to cater to the disabled population.¹⁰³ Furthermore, the size of waste receptacles should be durable and related to the expected waste at a particular location. A well-managed public space will always have smaller receptacles that are emptied more often rather than one large one that is emptied less frequently. With regard to size, 30 to 50 gallon containers are adequate.¹⁰⁴

2.2.2.1. Innovative Receptacle Design

Changing the design of receptacles from the standard and expected “regular bin” to an innovative and relevant design has been shown to increase a bin’s utilization. For example, Waste Management partnered with a baseball stadium to redesign some of the stadium’s bins as part of a holistic recycling program and the diversion rate increased from just over 70% to 90%.

Figure 7: Innovative Receptacle Design at Baseball Stadium



2.2.3. Case Study

The San Francisco Better Streets Initiatives lists guidelines for design of trash receptacles¹⁰⁵:

- a) Trash receptacles should be considered as a design element, and design should reflect aesthetic as well as functional concerns.
- b) Trash receptacles should be selected from the same or a similar design “family” as other site furnishings (such as benches, bollards, bike racks, etc.) and should be finished or painted to complement other site furnishings.
- c) Trash receptacle construction should use durable, high quality materials, such as galvanized or stainless steel.
- d) Materials should be painted to reflect colors similar to nearby elements. Material and paint selection should be graffiti resistant.
- e) Trash receptacles should include recycling containers and should be able to open from the side to allow easy access for removal of garbage bags.

2.3. Creative Partnerships with City Agencies, Carters, Community Stakeholders, Designers and Others

Various creative partnerships have been implemented with city agencies, carters, community stakeholders, designers, and others. Some of those creative partnerships are discussed below.

2.3.1. City Agencies

2.3.1.1. DSNY

As discussed above, DSNY provides a Public Space Recycling Program. It appears that DSNY has partnered with other BIDs to expand public space recycling.¹⁰⁶ For example, in 2014, Lincoln Square Business Improvement District and DSNY announced the cooperative expansion of a new public space recycling bin program.¹⁰⁷ DSNY also has a Bureau of Recycling and Sustainability that leads initiatives to reduce waste and keep recyclables from reaching landfills.¹⁰⁸ In addition, DSNY speakers offer practical advice and review recycling regulations.¹⁰⁹

2.3.1.2. The New York City Mayor's Office of Sustainability

Building on New York City's ambitious goal of sending zero waste to landfill by 2030, the Mayor's Zero Waste Challenge (ZWC) invited New York City businesses to match the city's zero waste goals by challenging them to divert at least 50 percent of their waste from landfill and incineration by June 15, 2016.¹¹⁰ The ZWC helped all participating businesses separate edible, reusable, recyclable, and compostable material from their trash to ensure that these valuable materials were diverted from landfill and incineration.¹¹¹ Many participating businesses were already source separating, while others used the ZWC as an opportunity to start their zero waste plans and programs.¹¹² The ZWC assisted businesses regardless of their current sustainable waste management practices, to reach, and in most cases, exceed the diversion goals of the ZWC.¹¹³ The NYC Mayor's Office of Sustainability also published a report with results of the ZWC.¹¹⁴

2.3.1.3. New York City Small Business Services

New York City Small Business Services provides oversight and support to New York City's existing BIDs.¹¹⁵ New York City Small Business Services also reportedly shares BID best practices.¹¹⁶ Furthermore, New York City Small Business Services also offers several grants for which BIDs are eligible to apply.¹¹⁷

2.3.1.4. New York City Council

Funding is reportedly available through the New York City Council for projects that help businesses thrive and provide a vibrant mix of goods and services for residents in New York City neighborhoods.¹¹⁸ To cite an example, through a grant from Council Member Helen Rosenthal, Lincoln Square Business Improvement District installed their first Bigbelly solar powered trash compacting and recycling receptacles at key locations to lower the number of unsightly trash bags on street corners.¹¹⁹

2.3.1.5. Foundation for New York’s Strongest

The Foundation for New York’s Strongest, Inc. is the official nonprofit organization of DSNY.¹²⁰ The Foundation leverages non-traditional strategies to promote sustainability and advance the essential services DSNY employees provide by, among other things, forging partnerships with private-sector organizations to move New York City toward sending zero waste to landfills by 2030.¹²¹ In November 2017, the Foundation announced the launch of a Microgrant Program for city businesses looking to address food waste in their operations.¹²² The grants, worth up to \$15,000, aim to help New York City businesses prevent, recycle or recover their food waste.¹²³

2.3.2. Carters

2.3.2.1. Action Environmental Services

Action Environmental Services, the largest waste hauler in New York City, offers its customers single-stream recycling.¹²⁴ Single-stream recycling allows all recyclables to be placed into a single container for collection and processing.¹²⁵ These are then sold as raw materials to create new items such as newspaper, office paper, cardboard, plastic bottles, and even steel and aluminum cans.¹²⁶ Their customers can place all clean recyclable items in one container, without the need to separate plastic from paper from cardboard, and so on.¹²⁷ Action reportedly picks up these “comingled” recyclables and processes them at their award-winning, advanced recycling center in the Bronx.¹²⁸ In 2013, Action Environmental Services also worked with New York City in the Mayor’s Food Waste Challenge.¹²⁹

2.3.2.2. Recycle Track Services

Recycle Track Systems (RTS), a New York-based waste and recycling management technology company, was a participating vendor in the ZWC that supported Whole Foods Market in reducing its waste by 50 percent.¹³⁰ Through on-site education programs with departmental teams, RTS helped Whole Foods Market increase its diversion rate by nearly 10 percent over the course of the ZWC.

In addition, RTS announced an exclusive deal with Citi Field, home to the New York Mets baseball team, to provide a suite of services to enable it to become a more sustainable stadium.¹³¹ The five-year contract will include streamlining Citi Field’s operational efficiencies and increasing food waste recycling.¹³² In addition, RTS will participate in several New York Mets in-game recycling promotions to celebrate sustainability and educate fans about responsible trash and recycling collection.¹³³

2.3.3. Community Stakeholders

2.3.3.1. Lower East Side Ecology Center Food Scrap Collection and Electronic Recycling

The Lower East Side Ecology Center collects food scraps at Union Square Greenmarket (NE Section of Union Square Park) on Mondays, Wednesdays, Fridays, and Saturdays from 8am-5pm.¹³⁴ Through the NYC Compost Project, the Center runs Commuter Compost sites and provides educational programs to Manhattan residents.¹³⁵ These initiatives work towards reducing the city's waste streams and ensure that organic materials are recycled locally.¹³⁶

To participate towards making New York City more sustainable, residents can bring food scraps excluding meat and dairy to a drop-off location at Union Square. Accepted materials include fruit and vegetable scraps, non-greasy food scraps (rice, pasta, bread, cereal etc.), coffee grounds and filters, tea bags, egg and nut shells, pits, cut or dried flowers, houseplants and potting soil. These food scraps are then transported to a compost yard at East River Park where the waste is then processed. Quality compost is available for purchase within three months of the organic waste diversion. This program has witnessed recognizable success through the diversion of hundreds of tons of organic material that would otherwise have reached landfills.

In addition, the Lower East Side Ecology Center organizes electronic waste (e-waste) recycling events throughout New York City where in people can recycle their electronic waste instead of sending it to landfill. The Lower East Side Ecology Center held 74 e-waste recycling events in 2017, many of which took place in collaborations with business improvement districts. A particularly successful event was with the Meatpacking District Management Association.¹³⁷ USP will benefit from the organization of an annual e-waste recycling event for the greater Union Square community and residences.

2.3.3.2. City Harvest

City Harvest collects approximately 59 million pounds of excess food per year and delivers it free of charge to 500 soup kitchens, food pantries, and other community food programs across the five boroughs.¹³⁸ The organization also does last-minute pickups for catering companies stuck with excess food in case of an event being cancelled.¹³⁹ City Harvest typically requires a pickup size of at least 100 pounds.¹⁴⁰ Many food businesses within Union Square, such as Whole Foods, donate surplus food to City Harvest.

2.3.3.3. Union Square Cafe and Billion Oyster Project

Union Square Cafe donates oyster shells to the Billion Oyster Project (BOP).¹⁴¹ BOP is an organization that collects, cleans, seeds, and resources oysters.¹⁴² The organization collects oyster

shells from restaurants and uses them to construct oyster beds, that upon maturity are relocated and placed in the Hudson River. The organization's entire restoration process involves multiple stakeholders including schools and various NGOs. BOP is in need of additional oyster shells from local restaurants.

2.3.4. Designers

Street designers offer an opportunity for USP to build partnerships to better manage waste in the area. With narrow streets and lack of alleys for waste trucks to discreetly collect and transport waste, the city has had to place bags of waste at curbs and along sidewalks. Most buildings are not equipped with adequate storage space for waste generated by its tenants. To cope with these lack of design considerations from the past design flaws, working with street designers will aid the design of well-placed collection points on streets, plazas, and parks.¹⁴³ A way to alleviate this is to incorporate multi-use curbside areas. These areas would have a recessed curb and would allow for roll-off or compactor container drop offs on collection days, and on non-collection days could be used for parking, thereby generating revenue for the city.¹⁴⁴ It would be possible to have these containers utilized for mixed uses such as commercial and residential waste, improving efficiency in trucking routes and allows for the elimination of waste at curbs.

2.3.5. Others

2.3.5.1. Partnerships to Reduce Food Waste

ReFED¹⁴⁵ is a multi-stakeholder nonprofit, powered by an influential network of the nation's leading business, nonprofit and government leaders committed to reducing U.S. food waste. The organization promotes multiple solutions to prevent, recover and recycle food waste. USP can potentially partner with ReFED in two ways. First, USP can consult with ReFED on how to minimize food waste at Union Square events. Second, USP can involve ReFED to present an information session for Union Square businesses community about potential solutions to reduce food waste.

According to ReFED, BIDs have the potential to procure surplus food collection services for restaurants within the BID.¹⁴⁶ In addition to City Harvest, there are several other organizations in NYC such as Food Bank for New York City, that also recover surplus food.¹⁴⁷ For example, Rethink Food NYC repurposes excess food into free and low-cost meals for people in need.¹⁴⁸ Rescuing Leftover Cuisine also picks up small donations of surplus food.¹⁴⁹ Dig Inn currently donates food through Rescuing Leftover Cuisine.¹⁵⁰

2.3.5.2. Partnerships to Collect Food Scraps

Re-Nuble¹⁵¹ is a New York City based company that turns pre- and post-consumed commercial food waste (vegetative, dairy, meat, and fish) into chemical free fertilizer. Re-Nuble's business model works in a manner where they source free materials for fertilizer production, enabling the businesses that provide them feedstock to pay less for waste hauling services. The company's operations are two-fold:

- (1) Waste pickup - the company comes to pick up certain "raw" waste from a given business.
- (2) Pellet pickup - the company connects the business with a third party that produces a waste processing machine that turns waste into small pellets, which Re-Nuble comes to pick up. Re-Nuble prefers this option as the pelletizing machine has a ROI of two years and produces better quality waste.

Re-Nuble have shown great interest in partnering with local businesses in and around the Union Square BID.

2.3.5.3. Partnerships with BID Networks

Partnerships with business improvement district networks may also be useful in coordinating efforts. The NYC BID Association¹⁵² has reportedly been especially effective with respect to policy issues such as successfully opposing significant changes to street vending.¹⁵³ Such partnerships may be particularly relevant with respect to discussions surrounding development of a waste collection system that divides New York City into zones and provides for competitive bidding by carters.¹⁵⁴ In addition, in response to an email inquiry, Faith Broderick, a Research Associate at the International Downtown Association¹⁵⁵ provided information on sustainable waste management best practices.¹⁵⁶

2.3.5.4. Partnerships with Keep America Beautiful

Keep America Beautiful, through a variety of national programs and initiatives with more than 600 community-based affiliates and partner organizations, engages more than 5 million volunteers in its effort to End Littering, Improve Recycling, and Beautify America's Communities.¹⁵⁷ Coca-Cola and the Keep America Beautiful Public Space Recycling Bin Grant supports recycling in communities by providing bins to expand recycling opportunities in public spaces.¹⁵⁸

2.3.5.5. Partnerships between Businesses

Businesses have partnered with each other to exchange excess resources. For example, Graffiti Earth repurposes leftover coffee grounds from the nearby and local Birch Coffee, with whom it

has developed a great relationship. In addition, Graffiti Earth has a partnership with Dirt Candy wherein Graffiti Earth makes use of any excess florets from Dirt Candy's famed broccoli dog.¹⁵⁹

2.3.5.6. Partnerships with EcoDistricts

The EcoDistricts framework provides a branded, systematic approach to engage BID stakeholders, government agencies, and service providers.¹⁶⁰ The DowntownDC Business Improvement District (BID) greatly expanded its role as a key facilitator and catalyst for sustainability implementation by formally establishing the Downtown DC EcoDistrict. According to Faith Broderick at the International Downtown Association, other cities including Vine City, Atlanta, Seahold District, Austin, and Little Tokyo, LA, have emulated the EcoDistricts' framework.¹⁶¹

2.3.5.7. Partnerships to Reduce Wasted Corks

ReCORK¹⁶² is an organization that collects, recycles and gives new life to wine corks. The company provides businesses with collection units, which once full, are picked up by ReCORK. ReCORK grinds the corks and upcycles them into blocks for yoga and traction pads for surfboards. USP can help facilitate partnerships with local restaurants for cork collection as well as partner with ReCORK during USP's outdoor events (e.g., Harvest in the square).

2.4. External Communications

2.4.1. Sustainability Goals

With the USP taking proactive steps to measure and manage their waste the organization now has a baseline to see how they are currently performing under existing practices and will help facilitate the BID in identifying the necessary steps to reach the zero by thirty plan outlined by New York City. One way to communicate to people is to send periodic progress updates. Other BIDs in New York City provide annual reports where they relay key performance metrics such as number of garbage bags collected, pounds of salt spread during the winter, and graffiti removed.

Another way to communicate is through campaigns and education. To minimize waste, increase recycling, and achieve zero by thirty, the USP has its work cut out. In order to successfully achieve this, USP will need the help of the people who reside in the area and commuters who pass through for work, dining, or shopping. To get them involved they need to be educated and made aware of ongoing campaigns in the area and New York City as a whole. To do so, the USP should implement initiatives with taglines that engage people. This approach provides stakeholder engagement to foster a sense of community commitment and increases awareness of waste management issues.¹⁶³

Education is key to waste minimization and recycling efforts. In Germany, students are taught from a young age about waste minimization and recycling; also educating residents and businesses on the reduction of waste and recycling is a business as usual practice of the government.¹⁶⁴ They even have a specific word (“abfallberatung”), which professionalizes waste education extending it outside of the classroom and to the country at large.¹⁶⁵ This practice has proven to work; Germany and Sweden for example, are exceedingly diligent when it comes to recycling efforts. Germany recycles around 65%¹⁶⁶ of all waste and Sweden at 99%,¹⁶⁷ compared to the United States at 35%¹⁶⁸ and New York City at 17%.¹⁶⁹ Germany and Sweden are frontrunners in the zero waste movement and have begun to import waste from other European Union countries and the Middle East to keep their waste to energy and recycling plants operational.¹⁷⁰ As the Capstone team observed in the research, education can help establish the building blocks for a more sustainable city and instill in younger generations the ability to actively think about the lifecycle of the products and services they use.

3. Task 3: Interest in Additional Waste Management Solutions Among Larger Union Square Community

The third task asked that the Capstone team assess existing interest in zero waste programming within the USP BID. To understand the existing waste practices of the businesses within the USP BID, in addition to conducting research, the Capstone team contacted multiple business owners. Furthermore, as part of this task, the Capstone team was asked to showcase a business within the Union Square community that undertakes best-in-class efforts to move toward zero waste. One exemplary business is Breads Bakery. A profile on this business and their sustainable waste management practices is provided in Appendix E.

3.1. Key Pain Points Experienced

Businesses within the USP BID experience key pain points with respect to waste management. By way of background, New York City is striving to reduce commercial waste disposal by 90% by 2030.¹⁷¹ To achieve this goal, all businesses are required to recycle metal, glass, plastic, beverage cartons, paper, and cardboard.¹⁷² The city also announced new rules requiring larger restaurants, chain restaurants, and grocery stores to divert their organic food waste to beneficial uses.¹⁷³

Individual businesses are required to hire their own service providers to pick up waste and comply with the city’s mandates. New York City’s Business Integrity Commission licenses waste carters, recyclers, and organic waste carters.¹⁷⁴ Having to hire their own private carters can raise several issues for businesses, some of which are especially acute for small businesses:

- a) Small businesses lack market leverage, pay higher prices, and have fewer recycling options than large waste generators.

- b) Most small businesses do not have an enforceable contract with which to ensure high-quality service and fair pricing from waste carters.
- c) Almost all small businesses pay a flat fee to their hauler, decoupled from the actual weight or volume of the waste they generate.
- d) Fees charged by waste carters are non-transparent and often arbitrary.
- e) Recycling services are limited for small businesses.
- f) The rising cost of landfilling and incinerating waste is passed on to small businesses.
- g) Prices for small businesses do not incentivize waste reduction and recycling.
- h) Almost all businesses do not receive any discount for recycling.
- i) Customer service is inconsistent and highly problematic.¹⁷⁵

Conversations with Annabelle Bladon from Dig Inn highlighted some of these issues. Although no formal contract exists, Dig Inn is reportedly charged a flat monthly fee for trash pickup decoupled from the actual weight or volume of the waste. In addition, despite Dig Inn separating its recyclables, it appears that the recyclables are combined with non-recyclable trash when both are picked up by the hauler. According to Bladon, there is no transparency and it is difficult to know which hauler can be trusted to appropriately dispose waste in separate streams.

It can also be challenging for businesses to make sure that recyclables are separated. New York City's commercial recycling rate is estimated to be only 22 percent.¹⁷⁶ It is often a challenge to convey the message to the public about what is recyclable and where items should be placed in order to be appropriately recycled.¹⁷⁷ It can also be difficult to house separate containers for recyclables given space restrictions.¹⁷⁸ Another challenge that exists for disposal is contamination.¹⁷⁹ Specifically, even if recyclables are separated from other trash, food waste disposed together can often soil and contaminate other waste in the same bag or receptacle.¹⁸⁰

Similarly, it can also be difficult to separate and store organic waste. In addition, haulers do not always have the capacity to handle high volumes of organic waste.¹⁸¹ Dos Toros for example, preps items to have the least amount of waste possible.¹⁸²

Wasting edible food is another systemic problem. It is estimated that 40% of food in the world is wasted.¹⁸³ According to Matthew Lum, Manager, Food Sourcing at City Harvest, there is a general willingness of businesses to donate leftover food. However, challenges arise to do with storing the food waste until it is picked up.¹⁸⁴

Finally, the storage of trash poses another issue.¹⁸⁵ Businesses often have no place to store trash until it is picked up, leading to them bagging and leaving trash on sidewalks in the vicinity of their establishments.¹⁸⁶ In turn, neighbors often end up combining their trash with the businesses' trash.¹⁸⁷

3.2. Areas Where Additional Support Could be Beneficial

3.2.1. Waste Carters, Recyclers, and Organic Waste Carters

Additional support could be beneficial with respect to waste carters, recyclers, and organic waste carters. This is of interest to individual businesses within the USP BID, other BIDs within New York City, as well as carters.¹⁸⁸ Although New York City's Business Integrity Commission provides a Carting Customer's Bill of Rights,¹⁸⁹ some individual businesses have difficulty selecting a carter and/or do not have transparency with their selected carters. Coordination amongst businesses and carters may lead to increased efficiencies, including the sharing of best practices, coordinated pickups to reduce truck traffic and environmental impacts, reduced rates for individual businesses, and new customers for carters.

3.2.2. Promoting Innovative Waste Reduction Organizations to USP Businesses

Additional support could also be beneficial in educating businesses about new ideas to reduce waste. There are a number of innovative organizations working throughout New York City to reduce waste. Several of these organizations, including Rethink Food NYC, City Harvest, and Re-Nuble, expressed enthusiasm in increasing their presence within the USP BID. Rethink Food NYC, for example, offered to conduct food waste audits for restaurants within the USP BID.¹⁹⁰

3.2.3. Platform to Share Waste Management Best Practices

Interviews with multiple stakeholders among the Union Square community revealed that many of them are interested in increasing current sustainability practices and are actively trying to improve their waste stream and reduce their environmental footprint. One group in particular, the restaurants throughout Union Square, expressed similar challenges they experienced when attempting to do so. These challenges include but are not limited to: implementing or increasing compost rate, repurposing leftovers, diverting waste from landfills, improving transparency from waste haulers, and educating customers on proper waste handling (i.e., "what food goes into what bin"). As such, collectively, there is a lot of knowledge that was gained either through experience or by working with waste consultants. Nevertheless, at the moment, there is an absence of knowledge sharing platform that enables businesses to come together and share their experiences of waste management to act as enablers to collectively improve waste management.

Creating a platform for businesses to share their best practices and challenges would be beneficial and conducive for improved sustainability. Furthermore, this platform can serve a way for businesses to work together and gain leverage over waste haulers and other organizations.

3.2.4. Infrastructure

Additional infrastructure could also be beneficial in improving waste management within the USP BID.¹⁹¹ For example, an anaerobic digester and a trash compactor could be useful in reducing the overall volume of waste within the USP BID.

A refrigerated storage area could also be useful in proving storage until food donations can be picked up. The food court at Grand Central Terminal reportedly utilizes a shared refrigerator storage area where restaurants can leave food donations for City Harvest to pick up.¹⁹²

Finally, a community composting facility within USP could also process food scraps to reduce waste while at the same time providing organic compost for Union Square Park and residents in the vicinity. According to Faith Broderick, a Research Associate at the International Downtown Association, composting efforts have taken root in business improvement districts.¹⁹³ For example, the Westchester business improvement district started a pilot program in partnership with local restaurants that have been able to divert more than 44 tons of waste from landfills to a local composting facility.¹⁹⁴ According to Broderick, certain other BIDs support and encourage home composting pickup or have a single point source or transfer point where residents can drop off their compost.

RECOMMENDATIONS AND NEXT STEPS FOR USP

The fourth and final task called on the Capstone team to distill the insights and case studies generated throughout the project into a series of short-term and long-term strategies for USP.

1. Assessment of USP's Existing Sanitation Services, Including Reach of Services, Benefits Generated, and Priority Areas for Improvement

From the assessment of USP's existing sanitation services and through interviews with the operations director at USP, StreetPlus, and during time spent with the Clean Team in the BID, a series of conclusions have been drawn about the current state of USP's existing sanitation services. The Clean Team is really an operations team, handling everything from event set up and teardown, to bistro season furniture management, and snow removal, in addition to their daily roles. The team takes a lot of pride in their work and goes above and beyond to be sure the BID is sparkling clean.

From the research completed by the Team through interviews and observations, it was found that Bigbellys do not provide significant value to managing waste besides serving the purpose of marketing, since they do not substantially reduce litter and more often than not malfunction. Furthermore, since the Bigbellys require people to physically touch them, this further deters people to use them to deposit litter.

2. Recommended Services, Equipment, and/or Solutions USP Could Implement in Union Square Park and Adjacent Public Spaces Realm to Augment its Sanitation Services and Improve Overall Sustainability

There are several opportunities for USP to augment its sanitation services and improve overall sustainability within Union Square Park and the adjacent public spaces realm. An initial list of recommendations is set forth below.

2.1. Coordinate with DSNY to Introduce Public Space Recycling Program within the BID

It is recommended that USP work with DSNY to introduce DSNY's Public Space Recycling Program within Union Square Park and the adjacent public spaces realm. As discussed above, over 50% of the waste collected during the pilot waste characterization study consisted of recyclable material, namely, glass, plastic, metal, and paper. A recycling program can have an immediate and significant impact on waste reduction. Indeed, numerous other New York City business improvement districts have already implemented public space recycling. For example, in

November 2017, the Downtown Alliance celebrated 1,000 tons of recycling in Lower Manhattan.¹⁹⁵

Initial conversations with Thomas Milora, the Executive Assistant to the DSNY Commissioner suggest that it may be possible to expand DSNY's Public Space Recycling Program within Union Square Park and the adjacent public spaces realm. DSNY is mandated to expand its public space recycling program which has already been implemented in numerous locations throughout the city. According to Milora, DSNY is trying to collect as much recyclable material as possible.

Working with DSNY will enable USP to benefit from DSNY's established recycling infrastructure. As discovered over the course of the project, DSNY currently picks up the majority of waste from Union Square Park and the adjacent public spaces realm. Milora expressed the possibility of DSNY also picking up recyclable material. If DSNY picked up the recyclable materials, USP could rest assured that the materials are in fact being recycled through the city's channels. USP may not have such confidence if it has to rely on a private hauler to pick up the recyclable materials. In addition, using DSNY's designated recycling bins could increase participation since the messaging would be consistent throughout the city.

To the extent that funding is needed to implement a public space recycling program, as noted above, other business improvement districts have received grants from New York City Council members. New York City Small Business Services also reportedly offers grants to business improvement districts. In addition, Keep America Beautiful may also be a source of funding. In any event, working with DSNY will be the most cost-effective way to implement a public space recycling program.

2.2. Organic Collection Program Near Bistro Seating

It is also recommended that USP pilot an organic collection program near the bistro seating area. As discussed above, over 15% of the waste collected during the pilot waste characterization study consisted of food waste. An organics collection program can also have an immediate and significant impact on waste reduction. The amount of food waste generated is expected to increase as the weather becomes warmer, bistro seating becomes available, and more New Yorkers spend time in and around Union Square Park. Although an organic collection program throughout the USP BID may be a long-term goal, it is expected that organic collection near the bistro seating area is an appropriate start.

As noted above, the Lower East Side Ecology Center currently collects food scraps at the Union Square Greenmarket on the northeast section of Union Square Park several days a week. The Capstone team contacted Lower East Side Ecology Center about potentially expanding their collection program to the bistro seating area. Although Lower East Side Ecology Center expressed

enthusiasm at the idea of a bistro organic collection program, they unfortunately cannot collect meat or dairy products, which will likely be a large component of the food waste.

In the alternative, USP could consider hiring a private organic waste carter such as Royal Waste,¹⁹⁶ which was recommended by the Lower East Side Ecology Center. Royal Waste would typically provide a 64-gallon toter to collect food scraps, including meat and dairy products. Royal Waste would collect the organic matter as necessary and deliver it to their facility. They would then rake through the organic matter to ensure that no other materials (plastic, paper, etc.) are in the load. Royal Waste then transports the raked organic matter to McEnroe Farms in Millerton, New York, where it is turned into topsoil for the farm.¹⁹⁷ John Reali in the Sustainability Management Department and Sales Department at Royal Waste expressed enthusiasm in establishing organic waste collection in the Union Square Park area. Pricing would depend on how frequently the organic matter would be picked up. Reali provided a very rough estimate of \$500/month for pickup of a 64-gallon toter twice a week.

It should also be noted that DSNY runs an organic collection program that includes meat and dairy products, in addition to other food scraps. Although DSNY's organic program is currently limited to residential units, discussing the potential with DSNY for an organics collection partnership is also recommended. DSNY also permits nonprofit organizations to request collection service from DSNY but it is unclear whether such collection service would include organic collection.¹⁹⁸ Partnering with DSNY could also enable USP to use the brown organic collection containers that New York City residents are becoming increasingly familiar, which could lead to increased participation. In the long-term, USP could also consider onsite composting to process the food waste.

2.3. Increase Public Education in Coordination with DSNY

USP could engage in delivering public education to increase awareness in the community. This could include information sessions, tours around Union Square, and setting up information booths. This would result in increased community action and awareness as well as potentially improved waste practices and educating the public through campaigns focused on topics important to USP.

2.4. Articulate Signage on Waste Cans

USP could engage in simple measures to articulate signage on their waste cans. For example, placing labels on each trash can that says "Going to Jersey" or "Going to Virginia" to indicate which landfill trash from that basket will eventually end up at may encourage more effective waste management at the source.

2.5. Community Beautification Event

Engaging the USP community by forming partnerships with volunteers, residents, and business to encourage them to be involved in beautification efforts can further USP's waste management agenda while reducing costs. The beautification event can involve volunteers to help with StreetPlus services including plant flowers around the park, picking up litter and painting street furniture. Furthermore, beautification events can include art aspects where citizens are encouraged to create original arts and/or slogans depicted around the park that can raise awareness of waste reduction initiatives. Volunteer-led projects such as these are a quick way to inspire more community spirit, increase socializing, and drive action. A visually appealing community kept up by its citizens will increase property values, attract more business, and further improve the BID's image.

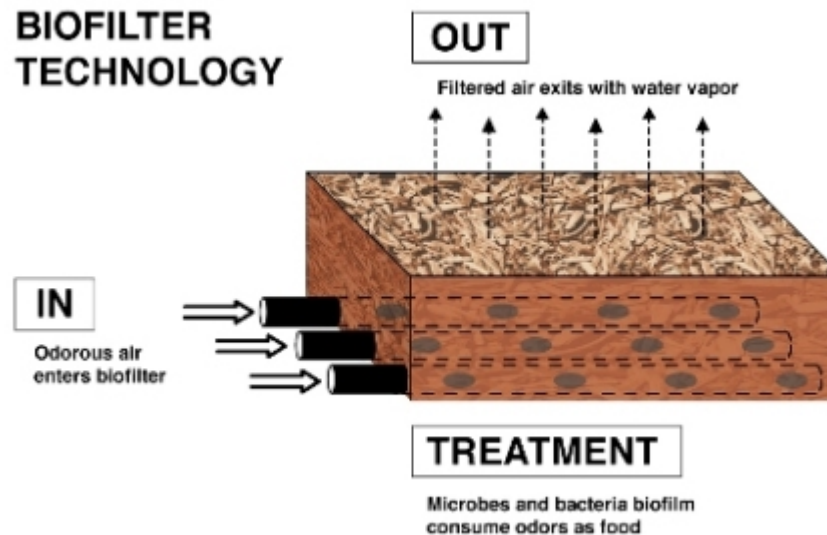
The beautification events can be planned by the USP BID office or the BID can partner with NGO's like Keep America Beautiful¹⁹⁹. Affiliates of Keep America Beautiful get access to replicable framework documents for community education and hands-on stewardship that seek to end littering, improve recycling and beautify communities for a nominal fee of less than \$5,000.

2.6. Solution for East Side Park Bag Pilling

One of the findings during the study was the large pileup of trash that occurs on the east side of the park where the Clean Team piles bags of trash to be picked up for disposal. This pile is an eyesore to the area, creates unpleasant odors, attracts vermin, and leaks free liquids onto the sidewalk. After speaking to and watching the Clean Team in action, once the bags are collected a member must go back to the area to clean up the area after the pick up by DSNY has been completed.

In order to alleviate these issues, the Capstone team recommends that the USP explores the option of an underground storage area equipped with a biofilter. The underground storage area is part of a long-term solution for USP to manage their waste. This storage area would provide the Clean Team with a space to safely store filled trash bags until pick-ups occur, thereby eliminating the eyesore from the pile of trash, reducing the likelihood of vermin tearing through the bags, containing the free liquids, and eliminating odors. To eliminate the odors, the installation of a biofilter is recommended, see Figure 8 below. Biofilters use moist organic materials such as soil or chipped wood with microorganisms to absorb and degrade odorous compounds. To get the odorous air to pass through the filter media, the storage area must be equipped with an intake fan to suck the odorous air out of the storage area and through a series of perforated pipes to evenly distribute the air over the media for longevity of the microorganisms. The air passes through the media, removing odor causing compounds before releasing the treated air into the atmosphere. These biofilters are expected to be a success as they are low maintenance and it is cheap to replace the media from decay.

Figure 8: Biofilter Technology²⁰⁰



2.7. Zero Waste Event Guidelines for USP Events

USP organizes several annual events, including Harvest in the Square, Annual Meeting, Sweat Fest, Summer in the Square, and It's My Park Day. Incorporating the recycling and waste reduction strategy in annual events that USP organizes is another way to increase business and community engagement with regards to waste. For example, showcasing food waste reduction communications in the Harvest in the Square is a good way to introduce USP's waste strategy to the community. Using compostable tableware or edible utensils will encourage visitors to think and talk about how they can be more sustainable in their daily lives. The idea is to provide stimuli that will eventually lead to a change in behaviors as people become more aware and conscious of the impacts of their consumption and disposal on the environment. USP should also consider adding a food waste exhibit which displays trends, metrics and approaches related to food waste which can serve to educate and engage the community. Additionally, USP should seek to make recycling and composting a priority during their events. When a community's recycling program is continuously advertised and well supported, a greater number of people will be encouraged to participate at a higher rate. By establishing social norms and conveying the ease of recycling, the recycling program is likely to be more successful.

2.8. Waste Management During L Train Shutdown

The L Train shutdown in April 2019 will lead to an increase in the pedestrian traffic in the Union Square area. To accommodate pedestrian traffic, USP should consider adding additional trash containers along the pedestrian route. Desktop research from Disney has shown, increasing the number of receptacles and placing them every 30 feet in high traffic areas can considerably reduce

littering. Though adding waste bins will address littering, it is important to note that it may increase the quantity of waste being generated as residents may use trash cans to dispose residential waste. Conversely, the BID should work to implement a recycling program before the L train shutdown so it can capture a larger number of recyclables and reduce excess waste going to a landfill.

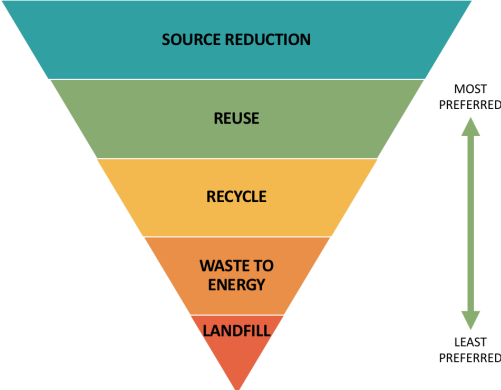
While the L Train shutdown may cause a disruption to pedestrian traffic and waste services in the Union Square area, it is also an opportunity to engage with various people that would not be exposed to the BID. Considering the recycling program and its' communications can be completed by this time; the BID can use exposure from the L train shut down to increase awareness of their waste management efforts.

3. Key Performance Indicators that USP can Utilize to Assess its Impact, as well as Potentially Integrate into the Organization's Contract with a Waste Hauler

3.1. Build a Waste Management Plan

The objective of a waste management plan is to set out a framework for a waste management strategy in the USP BID. The initial step to the waste management plan should include developing a waste hierarchy. A waste hierarchy can serve as a guide for BID members to follow when managing waste and implementing projects to minimize waste. EPA has developed a waste hierarchy pictured below, that can serve as a framework for the BID to base its implementation strategies on. The hierarchy gives top priority to waste reduction and reuse, followed by recycling and composting, moving to less desirable waste management practice of energy recovery, with landfill disposal as the least desirable practice. Members of the BID should tackle waste in a way that channelizes them towards a goal of moving up the waste hierarchy. Primarily, the goal should be to reduce waste at the source, and dispose the remaining volumes of trash through reuse, recycling and principles of circularity. Moving waste up the hierarchy will allow for USP to progressively ensure that zero waste goes to a landfill.

Figure 9: Waste Management Hierarchy



3.2. Perform a Waste Characterization Study

In order to track progress against the waste management plan, it is important to first understand the baseline. To form the baseline regarding the composition and tonnage of waste coming out of the USP BID, a larger and on-going waste characterization study must be performed. To achieve statistical significance at the BID level, samples must be distributed across various streets of the USP BID, and track waste weekly across all seasons of the year. The terms, frequency and process of a waste characterization study should be a part of the waste management contract. A company such as Cascadia Consulting Group,²⁰¹ a market leader for waste characterization and analysis can be engaged to conduct the waste characterization study. Quantifying the amount and streams of waste being generated by USP BID is a vital component to a waste management plan. While a waste characterization study may be a cost and time intensive process, it is vital to help identify and target reductions in waste management costs, estimated to surpass \$1 million in 2018.

In addition to a waste characterization study, USP should seek to improve the amount and type of data it receives from StreetPlus. Currently, StreetPlus does not provide any quantifiable data regarding the amount of waste handled by the clean team. The monthly invoices presently do not reflect hours or details regarding a breakdown of time spent by the Clean Team to perform tasks identified in the initial stages of this report.

3.3. KPI's

Key performance indicators baselined during the characterization and data collection process will help verify the adequacy of management procedures, whether targets have been met and how far they are from being achieved.

- Continuous quantification of total tonnage of waste collection
 - Weekly
 - Monthly
 - Year
- Percentage of the waste defined in the waste hierarchy with further details by category
 - Document waste components by USP street area
 - Document waste components by season
- Monthly and annual hours spent by Clean Team
 - To pick up litter
 - To bag trash
- Tonnage of trash recycled compared to baseline (if recycling program is implemented)
- Tonnage of food waste collected compared to baseline (if composting/food collection program is implemented)

4. Suggested Programs and Services that the Organization Could Provide to the Business and Property Management Communities in the Longer-Term

4.1. Convene Meeting Between USP Businesses and Service Providers

There is an opportunity for creation of a forum with the business community on sustainable waste management within the BID given the identified business interest. It is important to connect in person, and for the different businesses to brainstorm, ideate, and gauge actual interest and feasibility of various possibilities. The insights documented here represent only a moment in time and have been identified as the most significant areas of opportunity. Establishing a working group of engaged business partners who meet quarterly is key to longer term strategy development and implementation. The Capstone team envision USP using its unique position within the BID to serve as a facilitator, set agendas, and invite relevant attendees as usual. Establishing a forum will lead to solutions that will relieve current areas of frustration, generate ideas for scaling for impact across the BID, and reduce waste in the medium to long term. An example agenda is provided in Appendix F.

CONCLUSION

Over the course of the semester, the Columbia University Master of Science in Sustainability Management Capstone team worked to identify several short and long-term recommendations which would strengthen USP's current waste program. The Capstone team approached USP's trash project through three main methods. First, extensive desktop research was conducted to understand best practices within New York, globally, and in different types of organizations. The Capstone team then set up several interviews with BID stakeholders including Clean Team, StreetPlus leadership, DSNY as well as multiple businesses in USP. Finally, a pilot waste characterization study was undertaken to understand the composition and primary drivers of the waste flowing through the BID.

While several recommendations have been identified by the Capstone team, the most important initiative will be for USP to conduct a detailed and long-term waste characterization study. Research in the desktop phase has shown that understanding the true quantity and the composition of waste is first and fundamental step of every successful waste strategy. Once waste metrics are quantified and understood, the BID and all its members can implement specific programs based on data collected in the waste characterization study to work towards a more sustainable waste management strategy.

The goal of every recommendation put forth is ultimately to help USP get closer to achieving a zero waste to landfill strategy that aligns with New York City's *One New York: The Plan for a Strong and Just City*. Furthermore, the recommendations and the waste strategy proposed by the Capstone team were envisioned to support USP's overall mission to enhance the neighborhood's quality-of-life to create a cleaner, safer and more enjoyable environment for its residents, businesses and visitors.

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APPENDICES

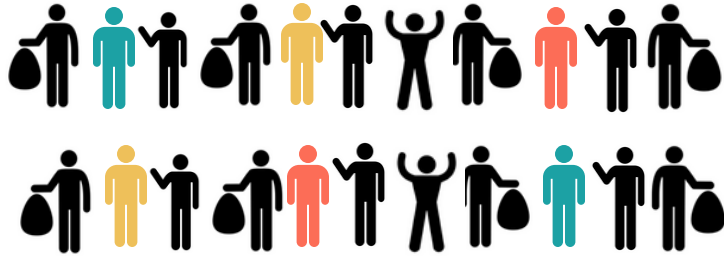
APPENDIX A	USP Sanitation Services and Impact Metrics
APPENDIX B	Inventory and Map of Public Space Waste Receptacles, March 2018
APPENDIX C	Pilot Waste Characterization Analysis
APPENDIX D	Summary of Best-in-Class Sustainable Waste Management Programs
APPENDIX E	Breads Bakery Profile
APPENDIX F	Draft Agenda for Small Business Waste Management Quarterly Meeting

APPENDIX A
USP Sanitation Services and Impact Metrics

SANITATION SERVICES BY THE NUMBERS

22

PERSON ALL STAR
CLEAN TEAM



\$1 MILLION
IN SANITATION
EXPENSES



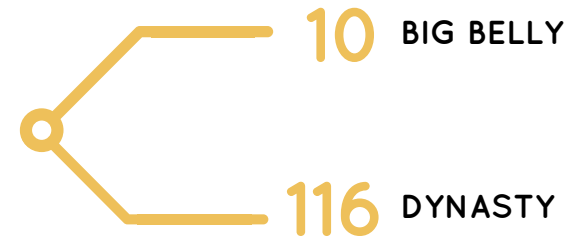
29

CITY BLOCK FACES
CLEANED



126

TRASH CANS
SERVICED



175,000
ANNUAL BAGS OF TRASH
COLLECTED



1,000+
PIECES OF BISTRO
FURNITURE
CLEANED



98.6%

OF SURVEYED COMMUNITY
MEMBERS IN 2017 APPROVE OF
USP'S WORK

WASTE STAKEHOLDERS & LIFE CYCLE

STREETPLUS & THE CLEAN TEAM



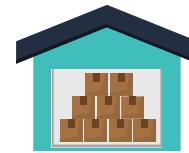
NYC DEPT OF SANITATION



LOCAL BUSINESSES



DSNY PICKUP



TRANSFER STATION



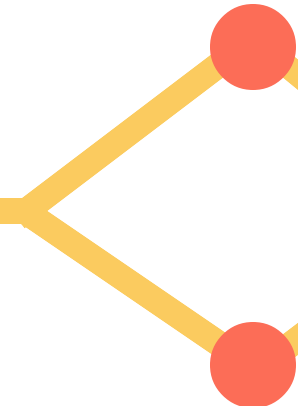
LANDFILL



TRASH CANS



WAITS FOR PICKUP



STREETPLUS PICKUP



70%

30%



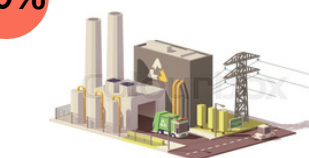
NY



PA



VA



COVANTA WASTE TO ENERGY - ESSEX

PILOT WASTE CHARACTERIZATION RESULTS



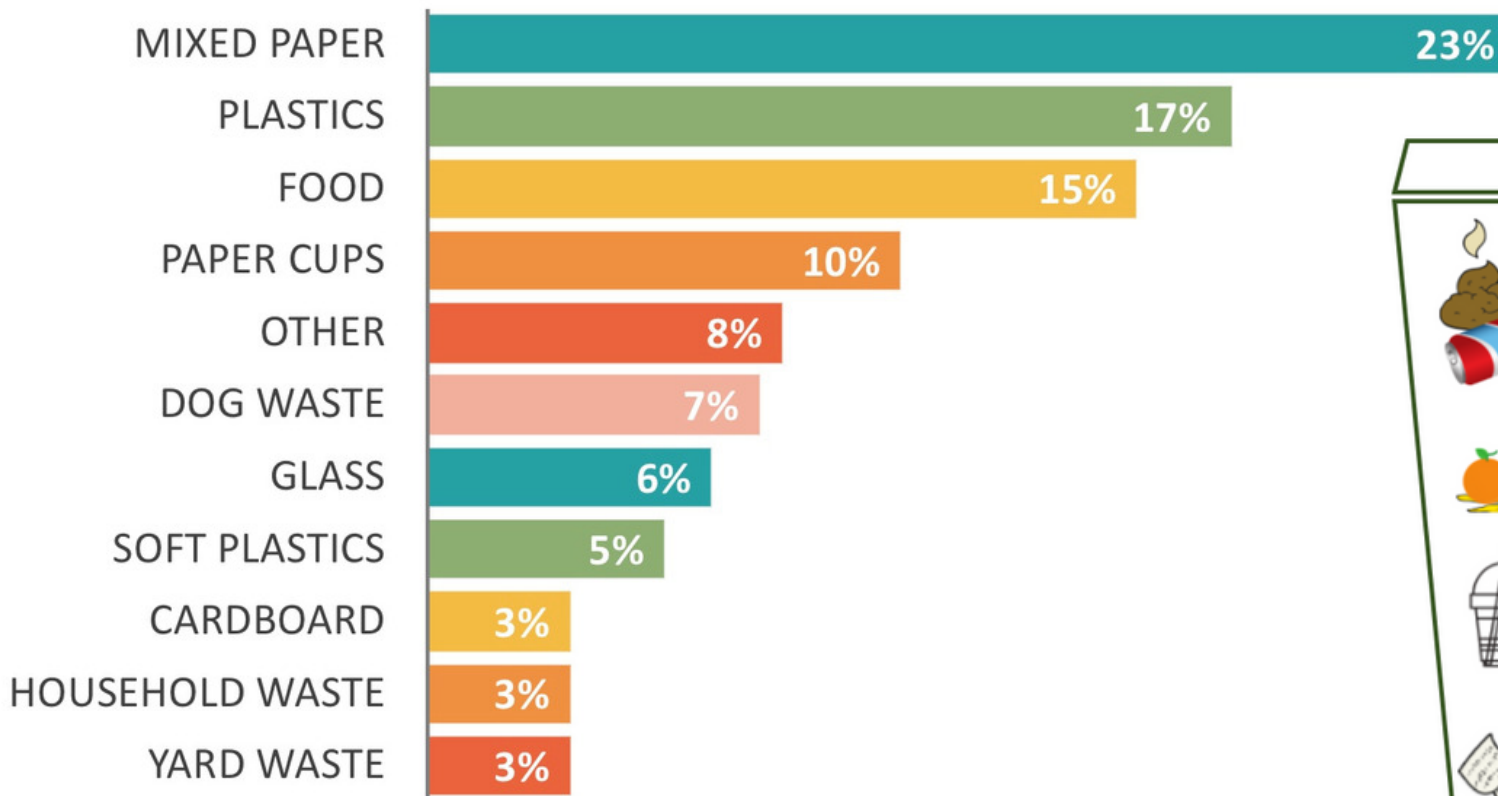
47 BAGS ANALYZED



600 POUNDS COLLECTED



OVER 50% RECYCLABLE CONTENT



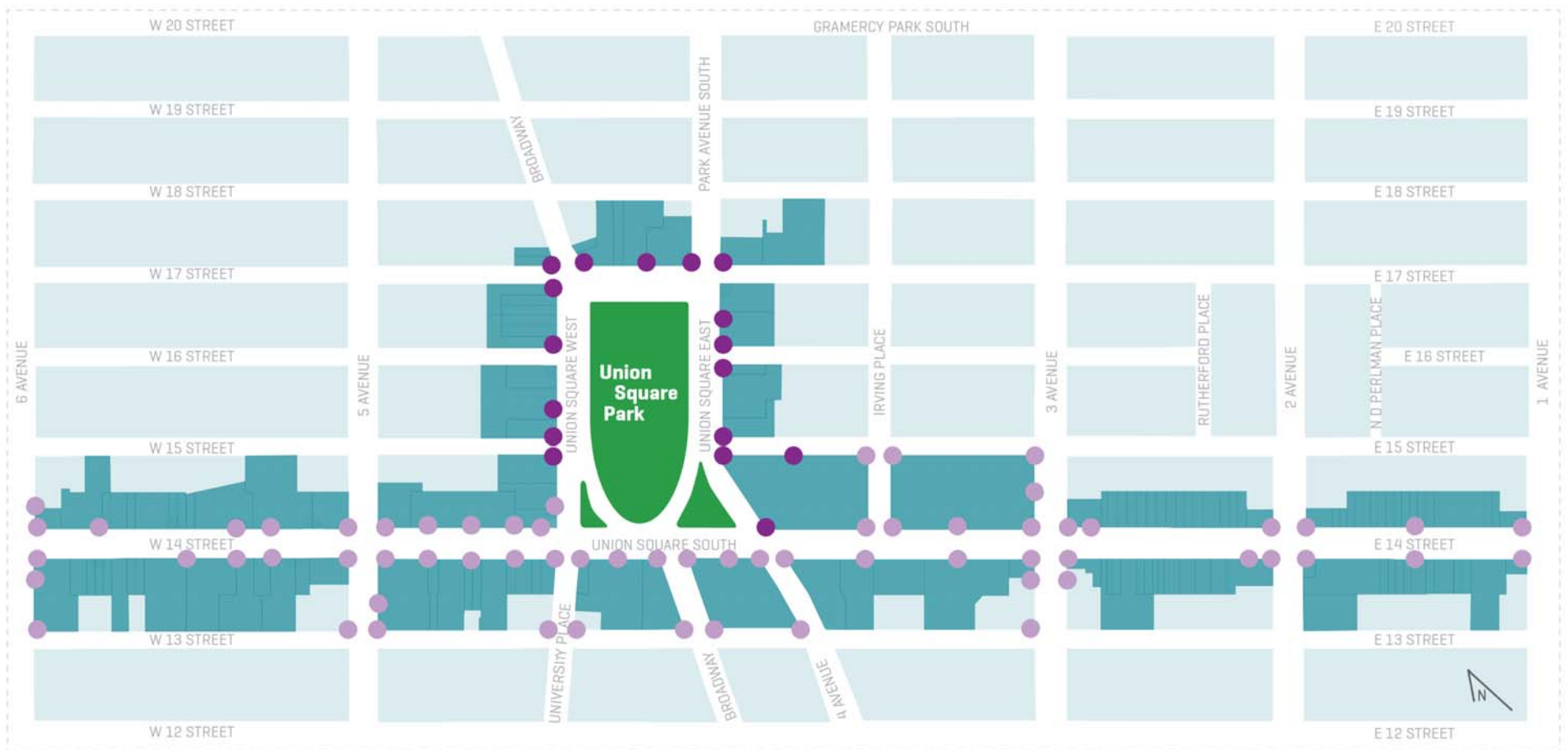
APPENDIX B
Inventory and Map of Public Space Waste Receptacles, March 2018

UNION SQUARE PARTNERSHIP TRASH CANS

MAY 2018
TOTAL: 82

TRASH CAN:

- NEW USP LOGO
- OLD USP LOGO
- USP BID BOUNDARY
- GREATER UNION SQUARE AREA



UNION SQUARE PARTNERSHIP TRASH CANS

MAY 2018
TOTAL:82

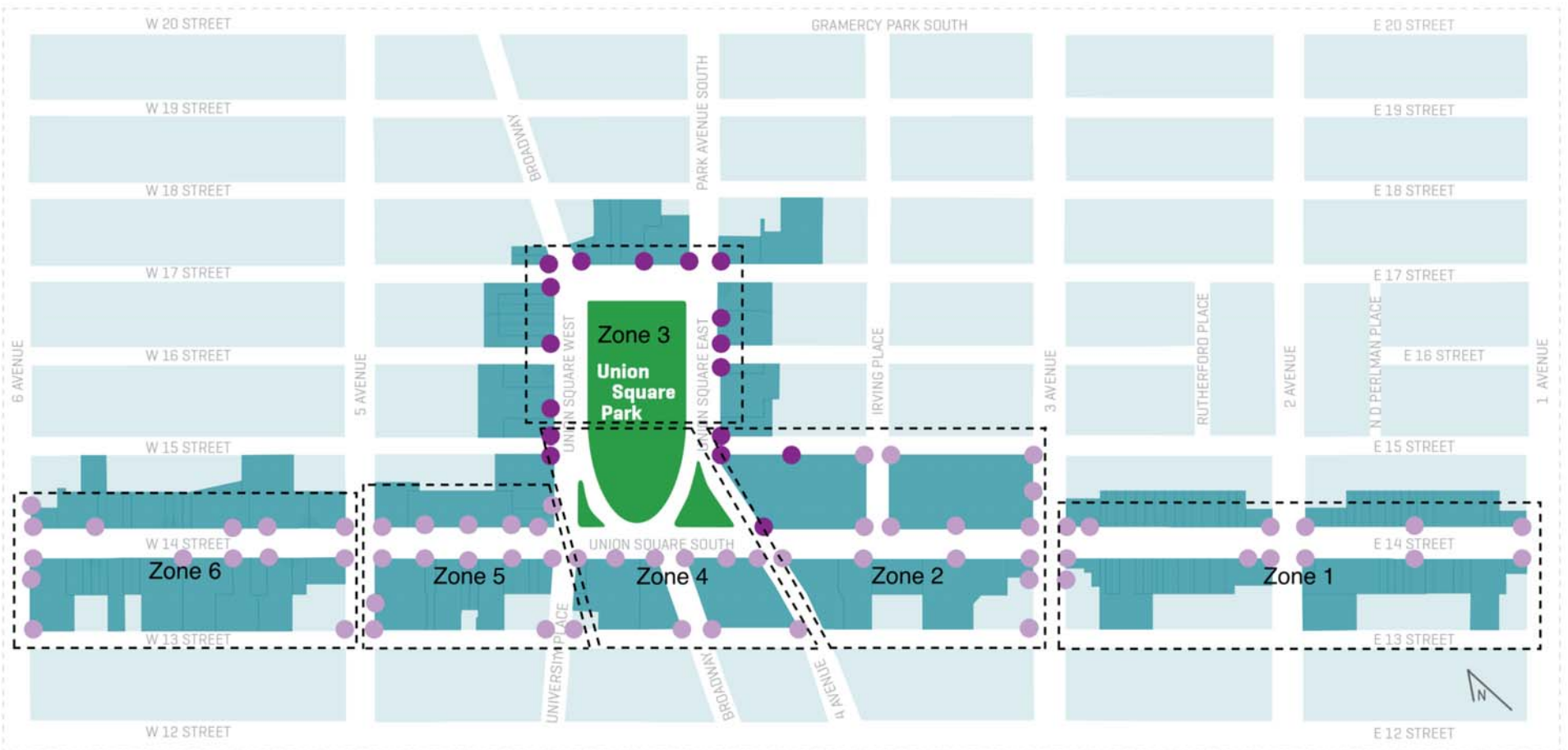
TRASH CAN:

● NEW USP LOGO

● OLD USP LOGO

■ USP BID BOUNDARY

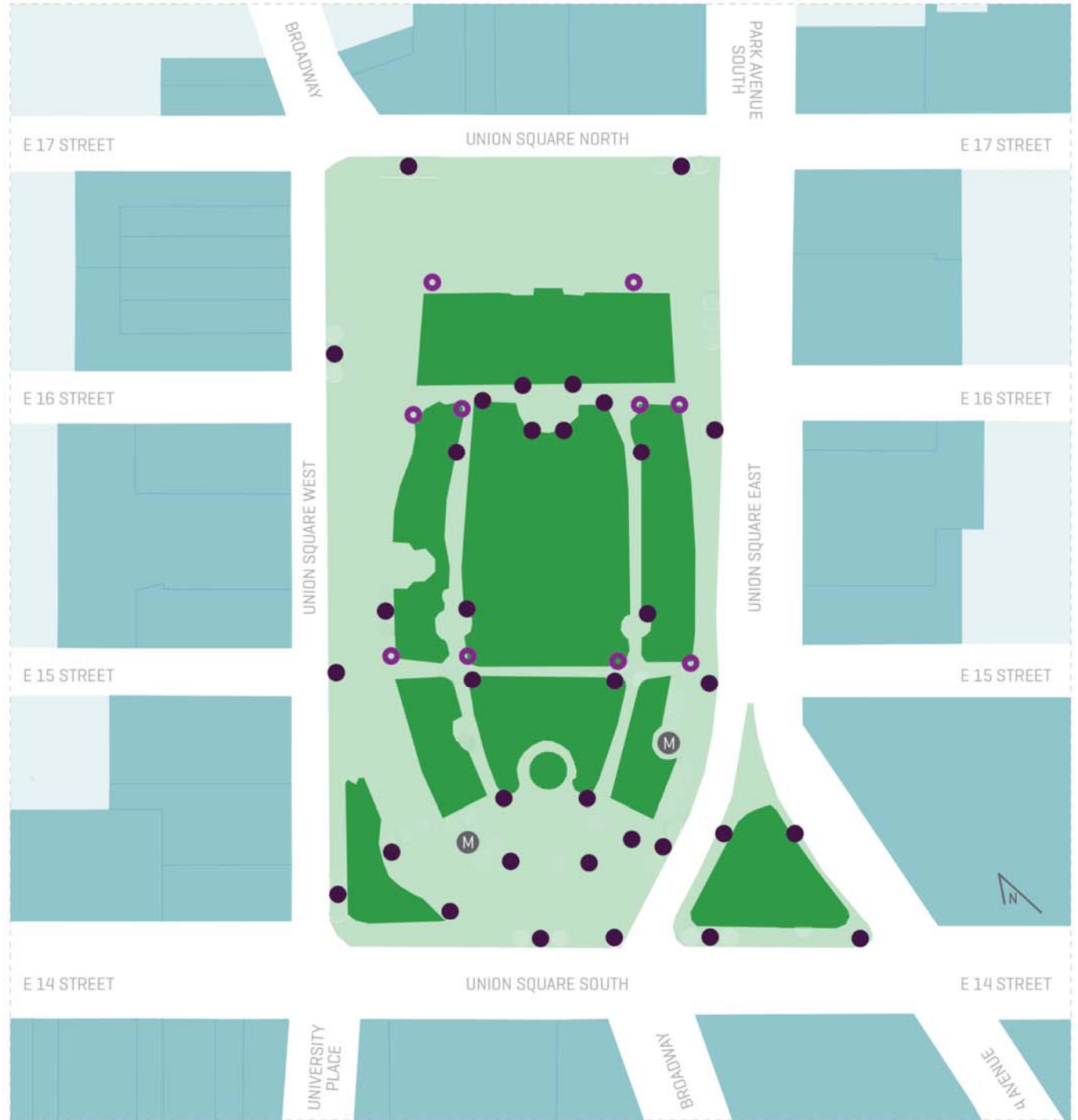
■ GREATER UNION SQUARE AREA



UNION SQUARE PARTNERSHIP TRASH CANS

TRASH CAN TYPE:

- OLD LOGO ● NEW LOGO
- BIG BELLY [10]
- GREEN DYNASTY [34]
- USP BID BOUNDARY
- GREATER UNION SQUARE AREA



MAY 2018

TOTAL: 44

APPENDIX C
Results of Pilot Waste Characterization Analysis

FIGURE C.1: AVERAGE WEIGHT OF WASTE BIN BY LOCATION

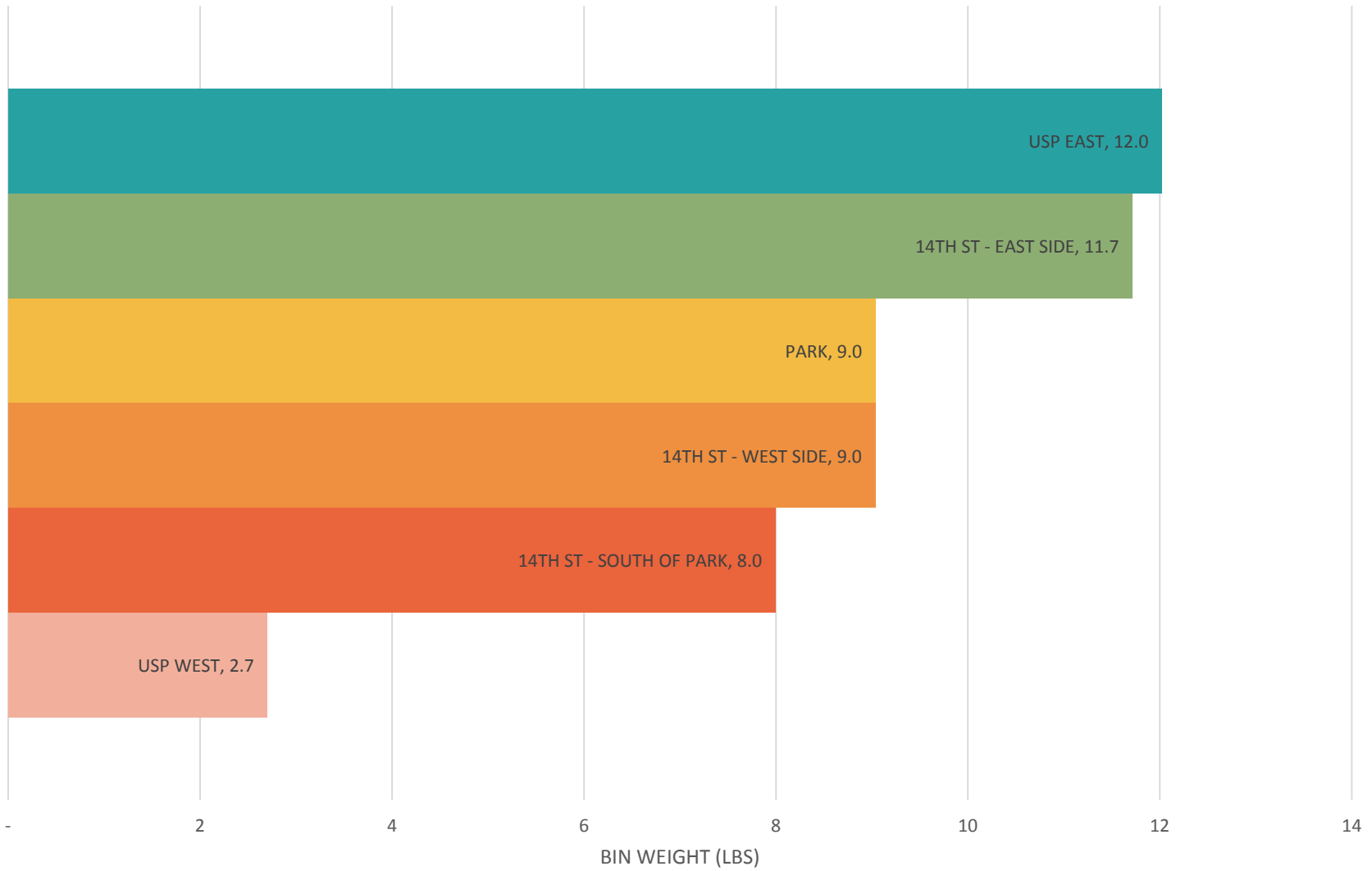


FIGURE C.2: OVERALL WASTE TYPES BY WASTE BIN LOCATION

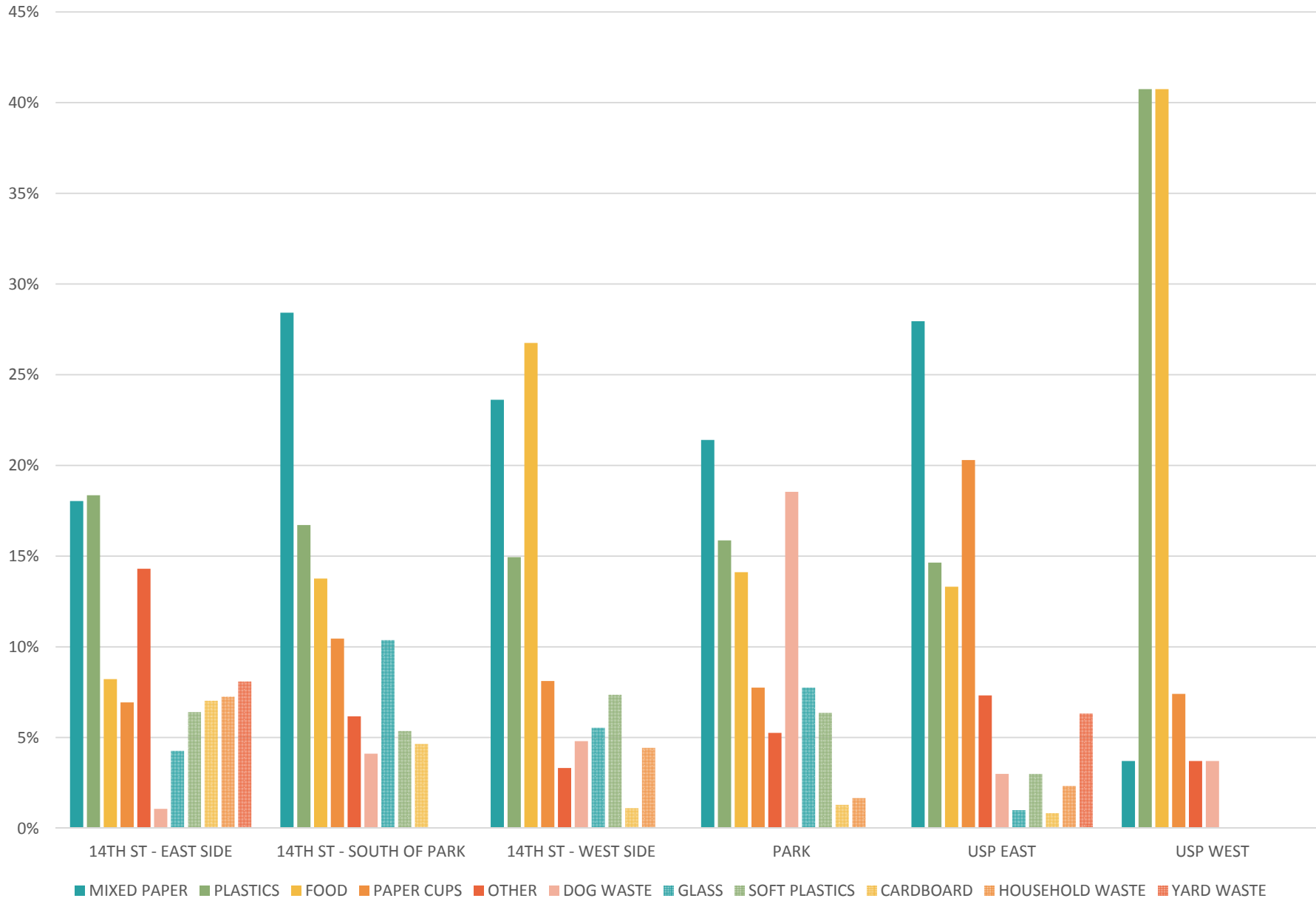


FIGURE C.3: OVERALL WASTE TYPES, PARK VS. NON-PARK LOCATIONS

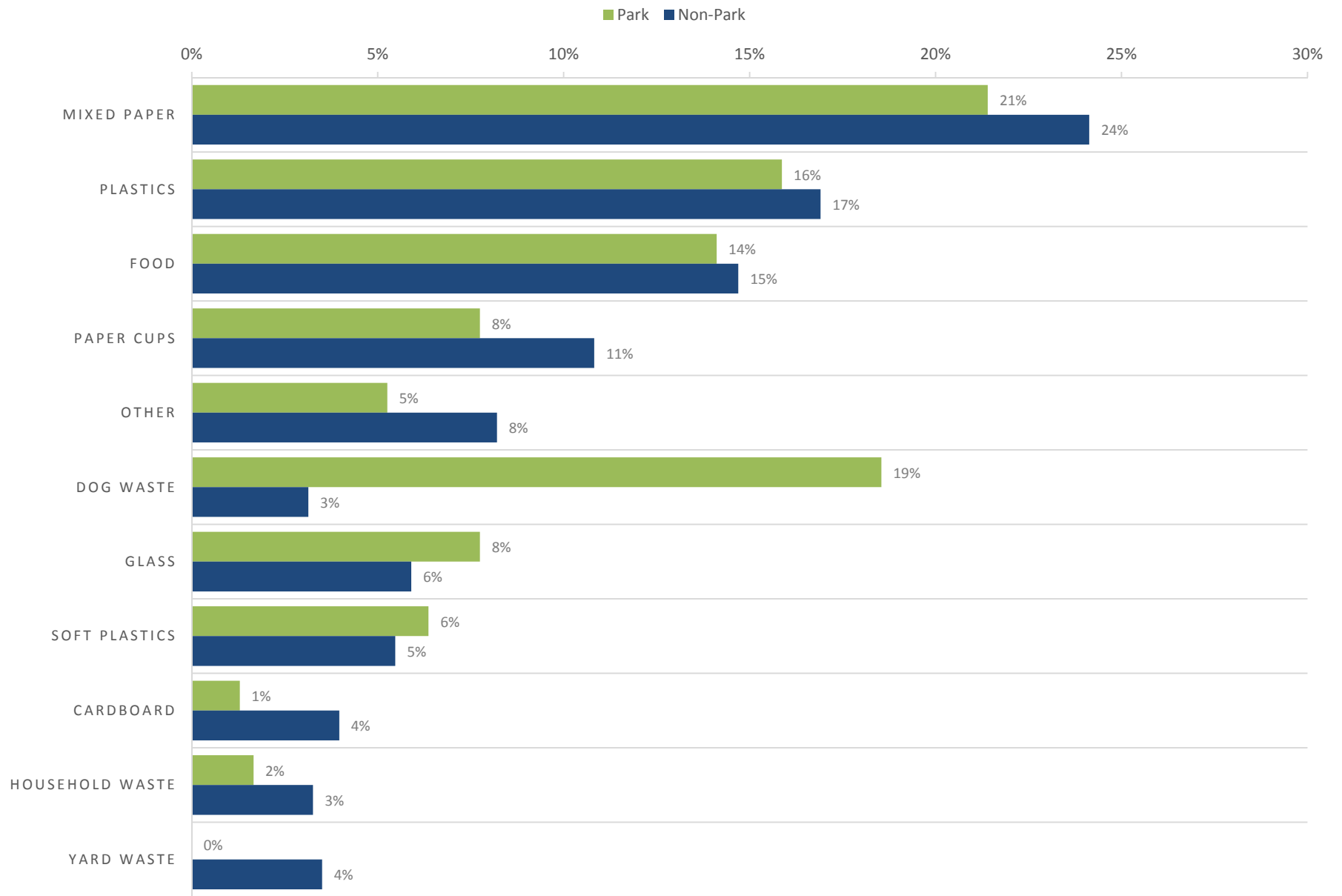


FIGURE C.4: OVERALL WASTE TYPES, WEEKDAY VS. WEEKEND

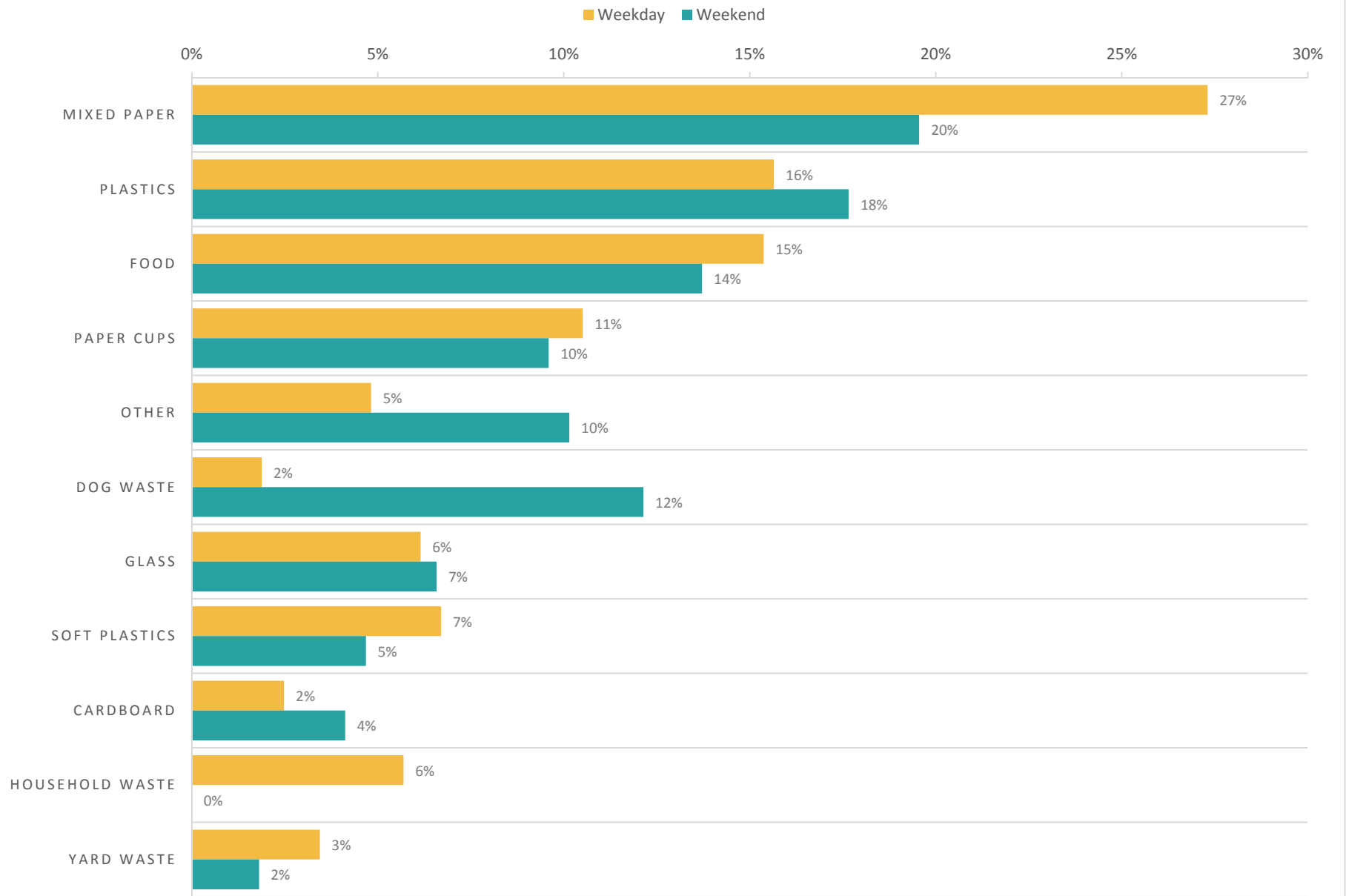


FIGURE C.5: OVERALL WASTE TYPES, BIGBELLY VS. DYNASTY TRASH BINS

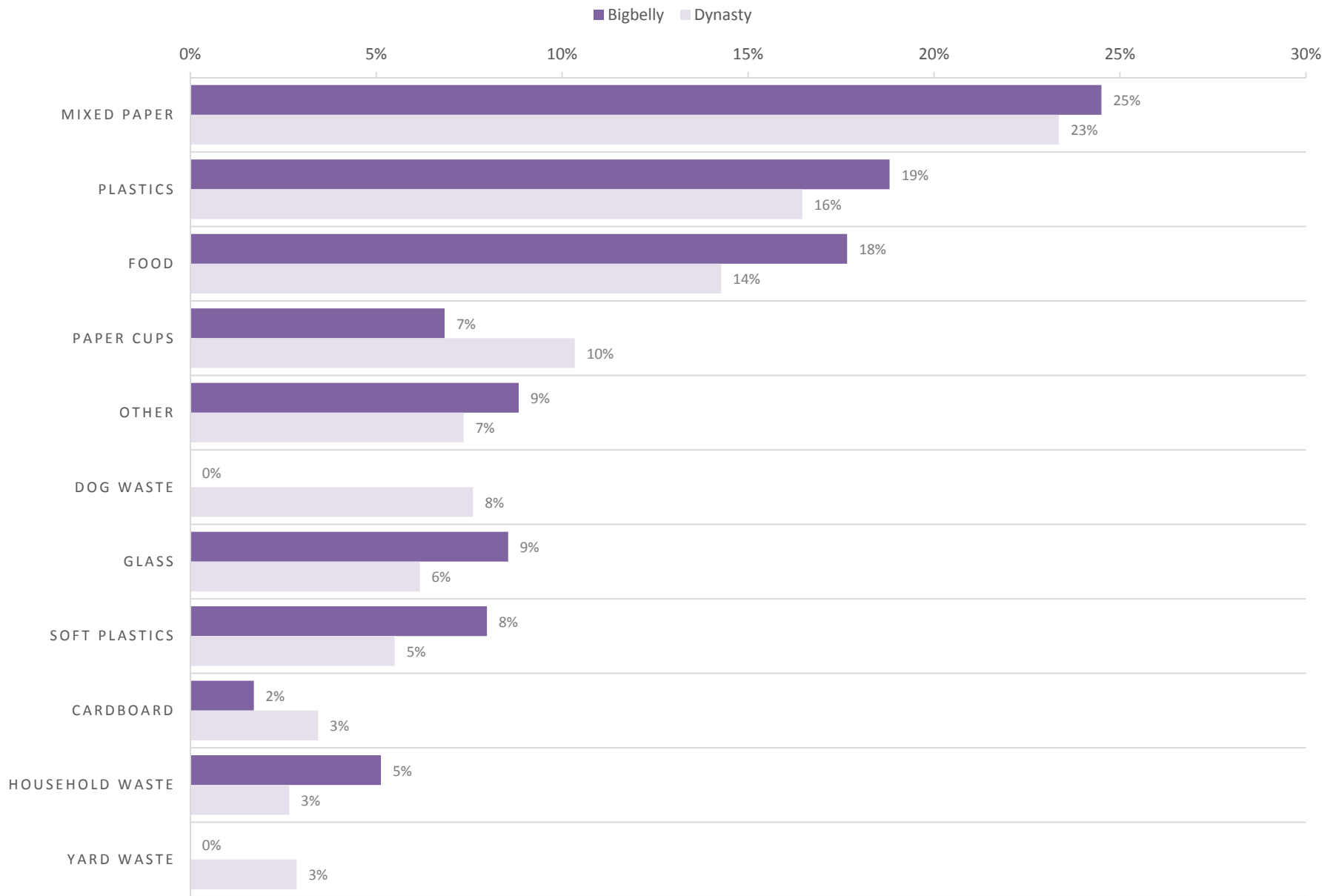


FIGURE C.6: OVERALL WASTE TYPES, BIGBELLY VS. DYNASTY TRASH BINS, BISTRO AREAS

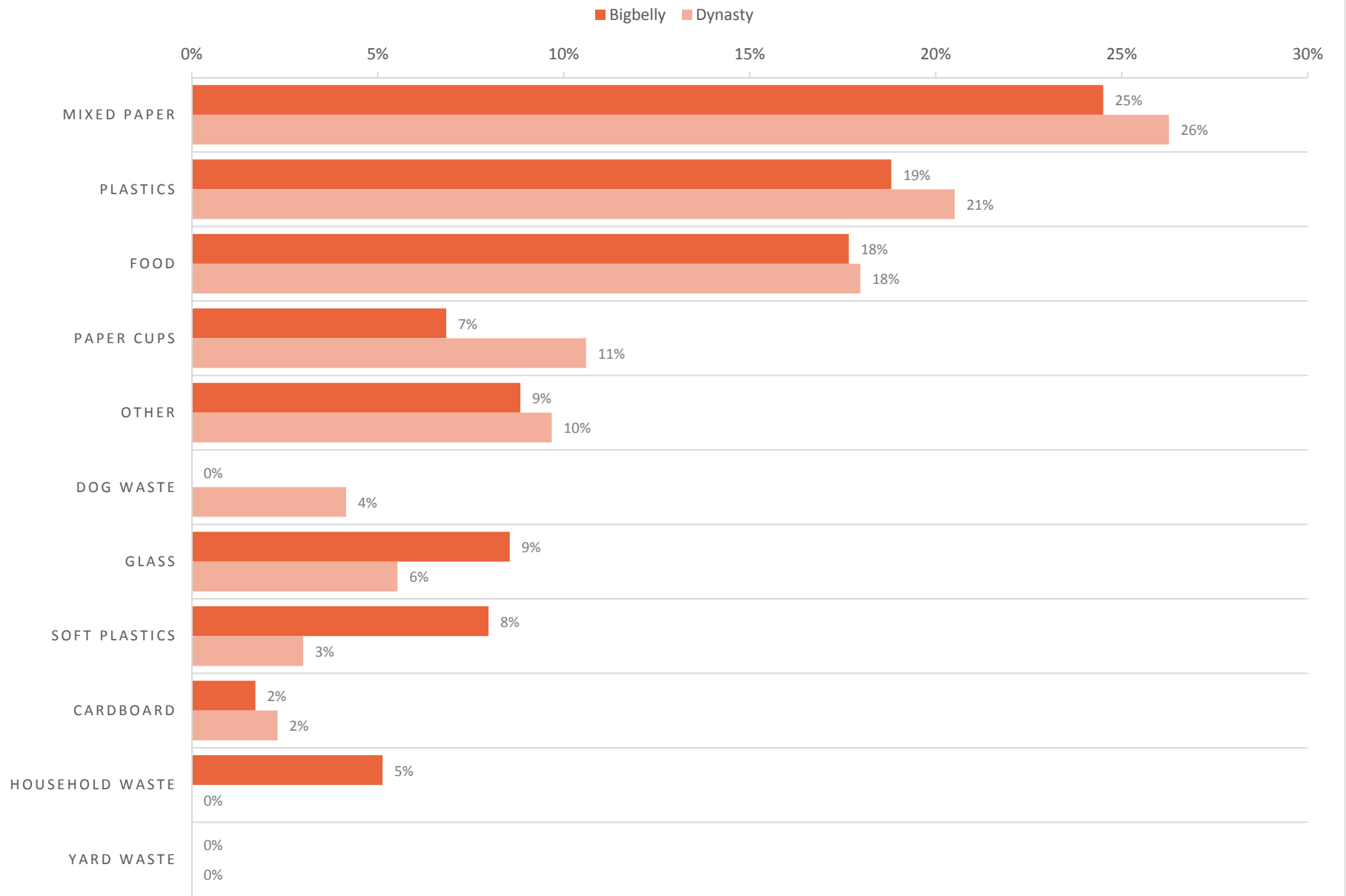
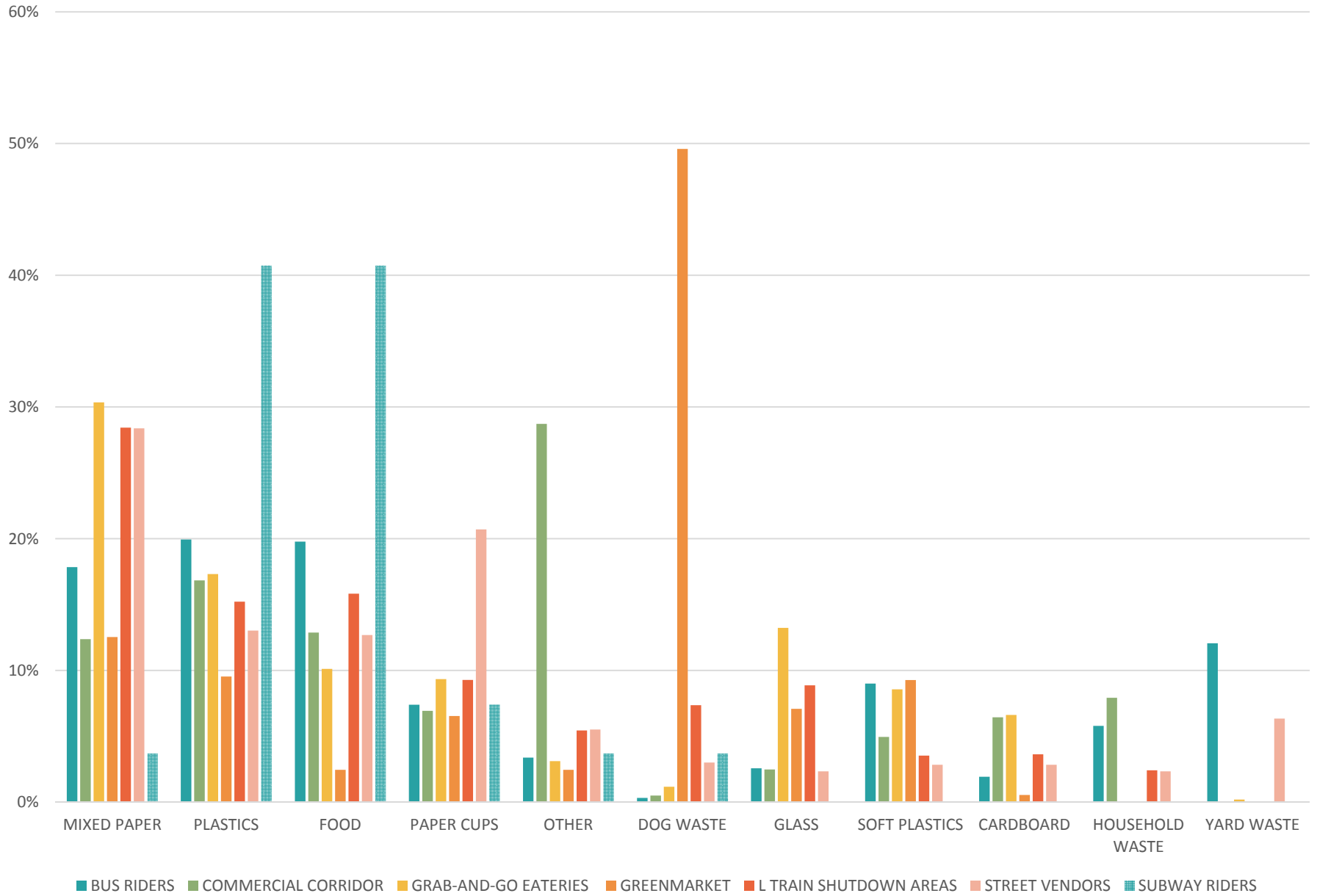


FIGURE C.7: OVERALL WASTE TYPES BY SAMPLING LOCATION CONSIDERATIONS



APPENDIX D

Summary of Best-in-Class Sustainable Waste Management Programs

BIDs in NYC

Key Takeaways Summary:

- Other NYC BIDS are recycling
- Most established (old buildings) are not planning to do anything crazy
- There is an opportunity to become a leader in NYC BID world

Name of Organization	Current (Best) Practices	Noteworthy Innovations	KPIs/ Data/ Metrics
Hudson Yards/Hells Kitchen Alliance	as of now there isn't much data available, sent inquiry to BID to obtain information	-In talks about pneumatic system sending waste about 45mph to 12th avenue, eliminating use of garbage trucks -A drainage and stormwater storage system will also keep the plaza's 28,000 plants irrigated while saving energy.	
Bryant Park Corporation	As of now there isn't much data available, sent inquiry to BID to obtain information		
Downtown Alliance (Lower Manhattan)	Implemented recycling. Works with partners, including NYC Department of Sanitation, NYC EDC and City Council members.	-340 big belly receptacles	-33% of waste diverted to recycling -663 tons of glass, plastic, and metal collected -349 tons of paper collected -1009 tons of recycling diverted since 2014 -132,509 bags of trash removed in 2016 -100% graffiti free
125th St. Harlem	- Clean team responsible for standard cleaning. - Partnerships with Columbia University for various studies - 4 Big Belly bins No known additional initiatives (waiting for BID's confirmation)	No unique innovations	- # of trash bags collected - # of hours logged - # of incidents per year
Meatpacking BID	- Clean team responsible for standard cleaning (sweeping the sidewalks, changing bags in the litter cans, removing graffiti, and shoveling snow"). - E-waste event each year with the Lower East Side Ecology Project	No unique innovations	
Woodhaven			% graffiti removal

CORPORATIONS/ COLLEGES/ ETC.

Key Takeaways Summary:

- Organizations often start with a trash/waste characterization study - this is not necessarily sophisticated
- Organizations are setting zero waste goals
- Colleges/ Corporations have control over purchasing, practices, have higher control
- To get to 0 waste, organizations start with basics (paper/plastics/aluminum) and then move on to organics
- Effective communication plans to change behavior are useful

Name of Organization	Current (Best) Practices	Noteworthy Innovations	KPIs/ Data/ Metrics
Google	<ul style="list-style-type: none"> - Regular waste audits - Campus-wide composting - Now uses a 4 stream desk-side bin, sized accordingly to the waste stream - Clear signage 		<ul style="list-style-type: none"> - Landfill diversion rate [Worked to go from a landfill diversion rate of 63% in 2008 to 86% in 2015]
UCLA	<ul style="list-style-type: none"> - Started with paper, then added aluminum and plastic bottles - Composting - In 2010, they switched to commingled or single stream recycling collection on the campus grounds, significantly simplifying the process for users. Waste haulers have great technology that will separate everything out at a later point 		<ul style="list-style-type: none"> - Landfill Tonnage [This is better than diversion rate, because amount sent to landfill can increase even if diversion rate increases] - Landfill Diversion Rate [currently at an 80% diversion rate]
US National Parks	<ul style="list-style-type: none"> - Performed waste characterization study - Added recycling containers, used Recycle Across America signs (standard) - Increased and trained staff, improved signage - Started composting - Developed catchy communication "#don'tfeedthelandfills" 		
Professional Sports Teams (NFL, MLB, etc.)	<ul style="list-style-type: none"> - Single stream recycling - Consistent signage and containers - Trained staff - Catchy slogan "It's Time for some Serious Trash Talk" 		<ul style="list-style-type: none"> - Landfill diversion rate
Unilever	<ul style="list-style-type: none"> - Achieved ZWTLF Internationally - Targets to continuously reduce total waste even after achieving ZWTLF - Measures reuse, recycling, reduction, WTE rates - Considers Waste to Energy solutions to achieve ZWTLF 		<ul style="list-style-type: none"> 100% ZWTLF for non hazardous waste across all 240 manufacturing sites internationally

Disney	<ul style="list-style-type: none"> - Use phones to track waste bin levels, the phone, using GPS, will alert nearby employees when trash and recycling bins need to be emptied - electronic sensors will be used to determine when trashcans are three-quarters full and need emptying, or when a bathroom needs cleaning - Employee involvement to take pride in their work creating a healthy competition to do better - interactive exhibit called "Don't Waste It," a collaboration between WM and Walt Disney Imagineering, showcases the latest advances in waste disposal and the company's "green" approaches to handling garbage. - Garbage cans every 20-30 paces 		
Lancaster University	<ul style="list-style-type: none"> • Undertake food waste segregation/treatment feasibility project and waste composition analysis. • Commence permanent upgrade of external bin stores to reduce fire safety risk. • Develop temporary central waste storage compound. • Formalise and fully document waste procedures. • Review and tender waste and recycle contracts. • Extend compulsory recycling across campus for all student resident accommodation. 		Target: 67% waste reused/recycled
Cornell University	<ul style="list-style-type: none"> -Continue plate waste studies and awareness raising to reduce personal food waste. -Evaluate and refine existing strategies to reduce food waste in selected dining units. -Work to engage other food providers on campus, as well as Cornell Dining, to implement practices to reduce food waste in their operations. -Collaborate with the Cornell chapter of Food Recover Network to recover food from Cornell Dining venues and redistribute to food pantries and feeding programs - "Taste, Don't Waste" - goals of the campaign were to encourage students to take smaller portions and consider the impact of their own food waste on the economy and environment. 		All of Cornell's solid waste recycling is tracked and measured as part of an aggressive program to cut waste to an absolute minimum while maximizing recycling, composting, and the reuse of materials.

COUNTRIES/ CITIES

Key Takeaways Summary: EUROPE

- Where waste streams are of lower quality, citizens may lack incentives to prevent and sort waste
- Some countries (Germany, Netherlands) have already met their EU zero waste goals
- Heavy emphasis on waste prevention as a starting point followed by recycling and then waste to energy incineration. Trends include proportion of recycling increasing and landfills decreasing
- Strong policy support: most countries have existing environmental action plans and framework of legislation (EU Waste Brochure)
- Correlation observed between landfills and landfill tax (Netherlands)

Name of City/ Country	Current (Best) Practices	Noteworthy Innovations	KPIs/ Data/ Metrics
Portland, OR	- Measures performance of cleaning crews over time		Measures quantity of: - graffiti tags removed - bags and tonnage of trash collected - number of needles - amount of biohazards collected
San Francisco, CA	- Local law requires development of objective and measurable of Citywide Street & Sidewalk Maintenance Standards	Third-party inspectors conduct annual evaluation	Parameters: - cleanliness and appearance of public streets; - sidewalks (trash bins, illegal dumping); - presence of hazards (human waste, needles, broken glass) and graffiti; - trees and landscaping
Minneapolis, MN	- Transparency in operating budget - Measures performance of cleaning crews over time - Contracts with Block by Block for Clean Team; operate using "ambassador zones"; services include: litter and graffiti removal, power washing, and snow removal.		Measures quantity of: - bags of trash (not tonnage?) - graffiti tags removed - gum spots removed Includes cleanliness concerns in annual public perception survey
Copenhagen, Denmark	- Direct incineration for energy recovery. Landfill fee higher than incineration costs, waste separation at collection point leads to higher recycling rates - Very strong policy support including waste tax and municipality regulation; - Turning landfills into recycling centers with recreational activities; - Less than 2 % to landfills	Using kids/teens are gatekeepers of waste at public places	-Measuring progress by how much energy is created -How many citizens are using recreation facilities
Ljubljana, Slovenia	- One of the highest recycling rates in EU. Waste is categorized into 8 waste streams (paper, plastic, glass, household hazardous waste, metal, electrical and electronic, kitchen waste, and garden waste) initiatives taken at user end; - Landfill tax in place - Life-cycle GHG emissions from municipal waste have been decreasing continuously since 1994, mainly driven by reduced methane emissions from landfills and increasing avoided emissions from recycling;		- Measuring progress by how much landfill is avoided - Quantity of methane reduction from landfills
Dusseldorf, Germany	-Landfill ban since 1990s, tremendous policy support. - Mandatory separation of bio-waste; - Producer pays principle (similar to the Netherlands) - The EU target for 50 % recycling by 2020 has therefore already been met - No increase in recycling but incineration has increased - No national waste management planning in Germany. Instead, each Federal State develops a waste management plan for its area		- Increase in incineration facilities

The Hague, Netherlands	<ul style="list-style-type: none"> - Frontrunner in EU, Out of the 9.8 million tonnes of MSW generated, 5 million tonnes were recycled, 3.2 million tonnes were incinerated (with or without energy recovery) 0.03 percent waste in landfills (2010) -The basic principles of the hierarchy follow the lines of avoidance of waste as much as possible, recovery of the valuable raw materials from waste, generation of energy by incinerating the residual waste and only then landfilling what is left over, but in an environmentally sound way -Municipal waste per capita dropped below 600 kg to the level of 595 kg per capita (2010) -Landfill tax (1995) 	Pay-as-you-throw-scheme for municipal waste	- Drop in waste per capita
Stockholm, Sweden	<ul style="list-style-type: none"> - Less than 1 per cent of Swedish household waste was sent to landfill last year or any year since 2011. - Imports waste from UK and other countries to keep their recycling facilities going - Incineration used to heat homes in winter 	Extremely advanced underground automated trash management system (Automated vacuum collection: AVAC)	<ul style="list-style-type: none"> - Tonnage of reduced CO2 emissions, which is a result of reduced waste-collecting vehicle traffic. - Users who quantify reduced waste-collecting vehicle traffic as a more pleasant and safe environment for people living in the area where the AVAC system is in use.
Tianjin Eco-city, China	<ul style="list-style-type: none"> - Waste reduction. - Waste collection through pneumatic solid waste collection system. - Material recovery and recycling (target 60%, China overall 20%) - Incineration for non-combustible wastes - Shuangkou CDM landfill 	Pneumatic waste collection system	<ul style="list-style-type: none"> - Per capita domestic waste generation - Overall solid waste recycling rate - Treatment of hazardous and domestic non-toxic waste <p>These are based on various domestic and international benchmarks and standards</p>
Songdo International Business District, South Korea	<ul style="list-style-type: none"> - Truck free garbage collection. Waste from residences, businesses, marketplaces, etc., all sucked through underground pipes to the 'Third Zone Automated Waste Collection Plant'. - The waste is then automatically sorted, deodorized, recycled, buried, or burned for fuel based on its type. - There are no street-corner trash cans or garbage trucks. - This system employs only 7 people for the entire city. - AVAC or Automated Vacuum Waste Collection- trash deposited in intake hatches, three kinds for waste, recycling and compost. Waste then pulled through pipes, only one waste type moves through the system at a time. Deposited in containers equipped with sensors that compress and indicate when full. Further transported to the sorting facility and final disposal site. 	Highly advanced Automated Vacuum Waste Collection (AVAC) system	Unclear.
Singapore City, Singapore	<ul style="list-style-type: none"> - All strategies formulated by the Singapore National Environment Agency (NEA) - Four waste to energy plants - Offshore sanitary landfill for disposal of ash and non-combustible waste - Integrated Solid Waste Management Plant (ISWM) that incorporates recycling, collection and disposal. - Each block is provided with single stream recycling bins, doorstep collection uses color coded bags for different wastes . - Most non-recyclable wastes are incinerated. 	Integrated Solid Waste Management Plant	<ul style="list-style-type: none"> - Volume of waste minimized - Volume of waste recycled - Public participation in programs through awareness - Volume reduction through incineration
Seoul, South Korea	<ul style="list-style-type: none"> - Waste management hierarchy completely followed - Waste reduction at source - Utilization of waste (recovery of material, stored energy and waste heat recovery) - Volume Based Waste Fee (VBMF) for municipal solid waste 	Volume Based Waste Fee (VBMF) for municipal solid waste	<ul style="list-style-type: none"> - Volume of waste reduced - Volume recycled - Energy obtained from waste - Carbon emissions reduced form CDM technologies
Masdar, United Arab Emirates (UAE)	<ul style="list-style-type: none"> - Operational waste management - Composting initiative - Construction waste management - Hazardous waste disposal 		<ul style="list-style-type: none"> - Total operational waste generated - Total waste diverted from landfill (86% C&D waste diverted from landfill) - Percentage of waste recycled (75%)

APPENDIX E
BREADS BAKERY™ Profile



BREADS BAKERY



18 East 16th St, New York, NY 10003
Serving Union Square, Chelsea, and Greenwich Village

The Business

Breads is a bakery dedicated to producing artisanal, handmade breads using traditional baking techniques. The bakery has won various awards including the “Best Chocolate Babka - 2013” by New York Magazine and the “Best Baguette Special Jury Prize - 2016” by French Morning.



Sustainable Waste Management

Breads is a leader in sustainable waste management practices in the Union Square community. The bakery currently diverts about 89% of its waste from landfills and is attempting to reach over 90%! Breads composts all of its pre-consumer food waste as well as most of its post-consumer food waste. The bakery uses a single stream recycling system that is collected by Action carting. Furthermore, any leftover baking goods or food are donated through City Harvest.



Breads Bakery used the waste management consultant the Foodprint Group, which they highly recommend, to help design and improve the bakery’s waste stream. In addition to its waste management efforts, the company also engages in several interesting projects that support sustainability, such as partnering up with urban beekeepers to create rooftop hives, and incorporating NY heritage local grains into their product line.

APPENDIX F

Draft Agenda for Small Business Waste Management Quarterly Meeting

- Review findings from SUMA Report
 - Waste Characterization
 - Shared Concerns
- Case Studies & Articles
 - Westchester BID restaurant composting
 - Trashed: Inside the Deadly World of Private Garbage Collection
- Share Best Practices
 - Dos Toros upfront reduction method
 - ReFed food waste expertise
- Visiting Service Provider: Rethink Food NYC
- Discuss Potential Solutions
 - Private hauler consolidation
 - Infrastructure
 - BID-wide Coffee Cup Reduction Program
 - BID-wide organics composting

