DUBLIN HIGH SCHOOL 2023

WASTE AUDIT REPORT

SPRING 2023

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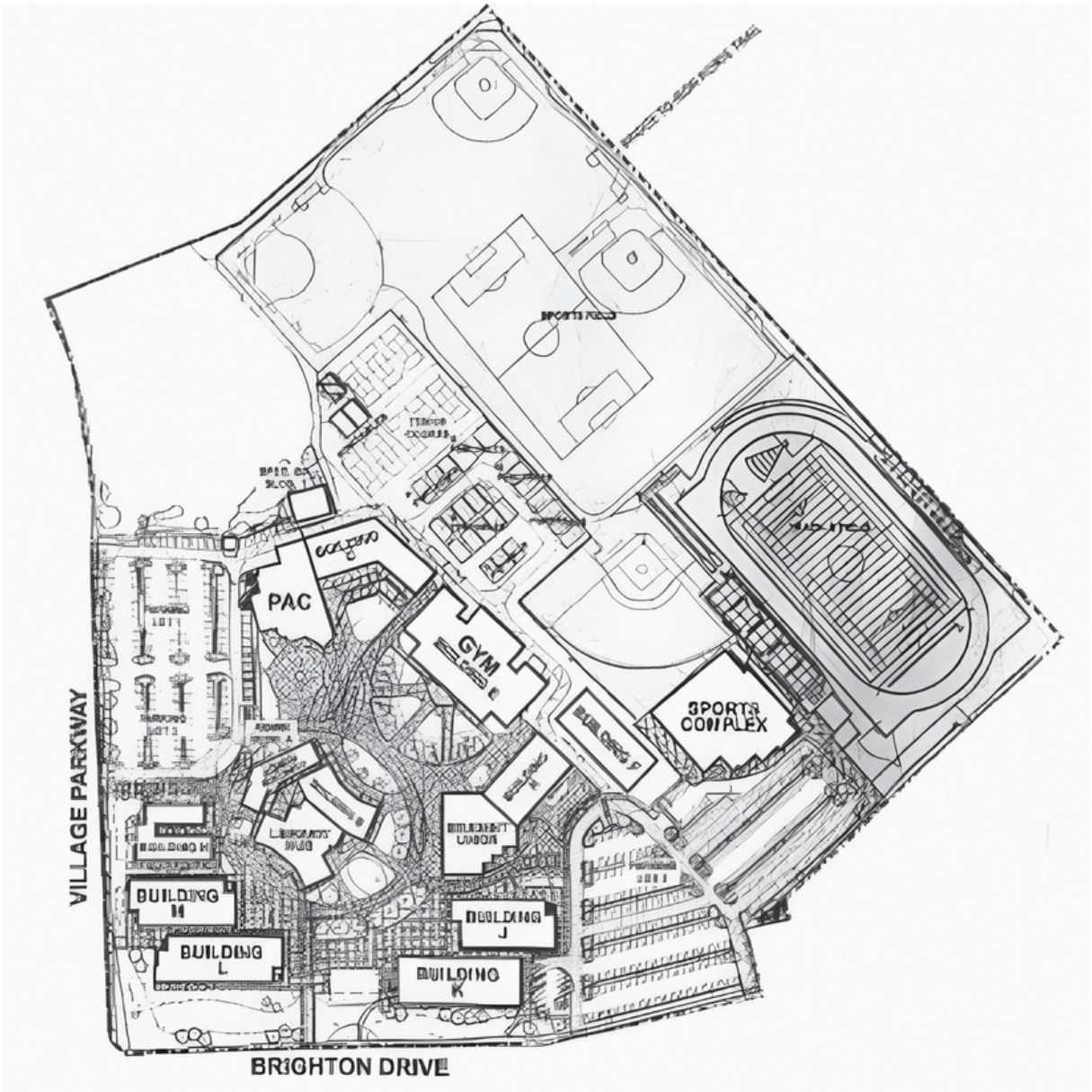
REPORT **SUMMARY**

A waste audit was completed at Dublin High School (DHS) on March 3rd, 2023 by the Student Climate Corps, a student-run club on campus that is focused on environmental advocacy. This audit excluded waste from classrooms and restrooms, looking specifically at the waste generated during school meal service (breakfast and lunch). The report found that a majority of the waste emitted at DHS is either compostable (78.66%) or recyclable (8.84%) It is to be noted that a majority of the waste came from food waste, accounting for nearly 55% of the total emissions. This report specifically looks into the associated environmental impacts of improper waste segregation at this particular school site, as DHS has failed to implement proper organic and recyclables collection. The report further looks into the environmental impact of excess food waste and unsustainable plastic use.

INTRODUCTION

Dublin High School has a population of roughly 3700 students and a campus of about 44 acres [1]. DHS has failed to implement separate waste streams for organic waste and recyclables, and as a result, the waste from twelve different campus buildings is funneled into one large dumpster at the back of the school. It is then collected on Mondays, Wednesdays, and Fridays by Amador Valley Industries (AVI).



TERMINOLOGY

Aseptic Containers: paperboard containers such as juice boxes and milk cartons, made from paper, foil, and plastic [6]

Carbon footprint: the amount of CO2 or CO2 equivalent produced by the activities of a person or persons

CO2 equivalent: the amount of carbon dioxide that world cause the same temperature change over a given time period (typically 100 years) as another emitted gas [4]

Composition: the specific materials and amounts of said materials in an amount of waste [3]

Compostables: materials that can be reprocessed into nutrient-dense soil; materials that can be composted

Cross-contamination: unintentional transfer of materials from one to another [3]

Ecological footprint: the amount of land and water required to sustain the activities of a person or persons [3]

Landfill waste: non-recyclable and inorganic waste; waste that must go to the landfill

Miscellaneous waste: waste that is too low in volume to be sorted into a separate category of waste

Organic waste: biodegradable materials, typically food or drink, but including paper goods and plant matter [3]

Recyclable Waste (i.e. Recyclables): waste that can be reprocessed into new materials for commercial use, typically certain kinds of plastic, paper, or metal

Stream: the separation and collection of materials, leading to a final destination

Waste: materials that have been disposed of; discarded materials

METHODOLOGY

Various safety measures were taken in order to ensure that volunteers were safe throughout the audit. Each volunteer was required to wear an apron, a mask, and gloves to prevent direct contact with the waste. Gloves were switched out often to prevent tearing.

Before starting the process of the waste audit, the DHS Administration and the DHS Custodial Team approved the project. The custodial team assisted during the process by providing insight into the waste management system and providing certain materials required for the audit. The team also supervised the entirety of the event.

To start, each bag was moved from the dumpster to the marking station. At the marking station, the bag was numbered and moved to another location to be placed in order. Then, it was weighed with a luggage scale, recorded, and moved out of the way.

Once all of the bags were weighed, five bags from the lunch period were chosen at random to be sorted. A random number generator was used to eliminate any and all bias in the process. These five bags were dumped out onto a tarp, where the contents of them were separated by hand. The categories of separation were trays, food, aseptic containers, bottles and cans, food wrappers, miscellaneous recyclables, and miscellaneous landfill waste. All of the various types of waste were separated into trash bags, except for the food, which was weighed on the tarp.

RESULTS

A total of 100 bags were weighed during the Waste Audit – comprised of waste from the school meal service on Friday, March 3rd. The total weight of the waste was 309.96 kilograms, assuming the weight of the bags themselves was negligible. The mean weight was 3.10 kilograms (6.83 lbs) and the standard deviation was 1.8150 kilograms (4 lbs).

The total weight of the sampled bags was 21.04 kilograms (46.39 lbs). When all of the components of the sample were dumped, sorted, and weighed out, the total of the components came out to be 19.21 kilograms (42.35 lbs). Of this, the composition was found to be 15.83% trays, 60.80% food, 6.03% aseptic containers, 3.64% water bottles and cans, 6.03% miscellaneous recyclables - containing sauce containers, salad boxes, and various other plastics - 6.40% food wrappers, and 1.25% miscellaneous landfill waste.

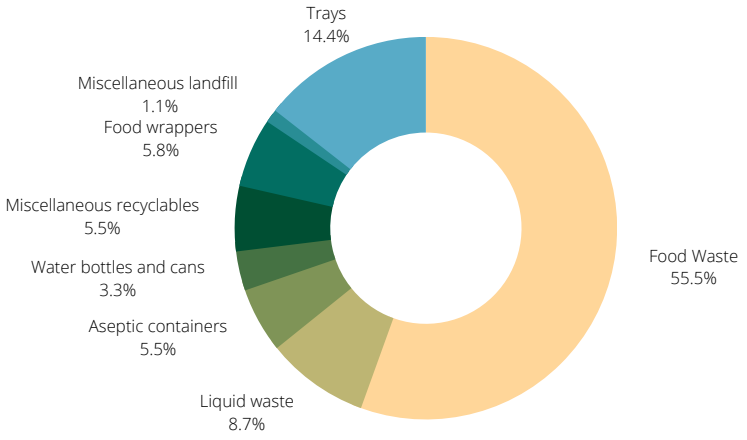
Category	Weight (kg)	Weight (lbs)	Percent of Total
Compostables			
Trays	3.04	6.7	14.449
Food	11.68	25.74	55.513
Liquid Waste	1.83	4.03	8.698
Recyclables			
Water Bottles and Cans	0.70	1.54	3.326
Misc. Recyclables	1.16	2.56	5.513
Landfill			
Food Wrappers	1.23	2.71	5.846
Aseptic Containers	1.16	2.56	5.513
Misc. Landfill Waste	0.24	0.53	1.141
Total			
	21.04	46.39	100.268

The majority of the waste was compostable, with 78.930% of the waste being either food waste or trays. 8.839% of the waste was recyclables and 12.5% was landfill waste. The extra 0.268% can be attributed to rounding errors.

Assuming these results are consistent, the total weight of each component across all 100 bags can be calculated. This amounts to 44.79 kilograms of trays (98.75 lbs), 188.47 kilograms (415.51 lbs) of food waste, 26.96 kilograms (59.44 lbs) of liquid waste, 17.09 kilograms (37.68 lbs) of aseptic containers, 10.31 kilograms (22.73 lbs) of water bottles and cans, 17.09 kilograms (37.68 lbs) of miscellaneous recyclables, 18.12 kilograms (39.95 lbs) of food wrappers, and 3.53 kilograms (7.78 lbs) of miscellaneous landfill waste. This amounts to 243.82 kilograms (537.53 lbs) of compostable waste, 44.49 kilograms (98.08 lbs) of recyclable waste, and 21.65 kilograms (47.73 lbs) of landfill waste.

Once again assuming consistent results, the total waste output of DHS over a school year can be calculated. There are 180 school days over the course of the 22-23 school year, as is standard practice. Of these, twelve days were minimum days, where there is no lunch period. While meal service still occurs on minimum days, it is difficult to say how much waste is produced on those days, so they will be omitted for the sake of simplicity. That leaves 168 days where 309.96 kilograms (683.34 lbs) of waste are outputted, which amounts to 50,213 (110700.72 lbs) kilograms of waste total. Of this, 39,633 kilograms (87375.81 lbs) are compostable, 4,438.3 kilograms (9784.8 lbs) are recyclable, and 6,095.9 kilograms (13359.8 lbs) are landfill waste.

Annual Waste	
Category	Weight (kg)
Compostables	
Trays	8062.2
Food	33924.6
Liquid	4852.8
Landfill	
Aseptic Containers	3076.2
Food Wrappers	3261.6
Miscellaneous	635. 4
Recyclables	
Bottles and Cans	1855.8
Miscellaneous	3076.2
Total	
	50213



POTENTIAL SOURCES OF ERROR

There are many potential sources of error within the audit that could influence the data presented.

First of all, the large presence of liquids causes discrepancies between weights in the bags. Spillage from the bags as they were moved means that not all of the liquid waste was accounted for. The actual waste output is likely higher when this spilled waste is accounted for.

Furthermore, all of the materials were stored together before the audit. Therefore cross-contamination likely occurred. A majority of the materials had food waste residue on them, which could not be properly removed. Considering how many of the materials were affected, this likely caused some discrepancies in the weights of different categories of waste.

Additionally, the small sample size of waste that was sorted likely led to error. Of the 100 bags weighed, only 5 were sorted. The composition of these 5 bags may have been different from the overall composition of the 100 bags. However, due to time and personnel restrictions, a larger sample could not have been sorted.

The day that the audit was conducted may also cause discrepancies in the statistics presented. Different lunch items are served on different days of the week and some of these items are more favored by the student population than others. This can lead to varying amounts of meals being served and thrown away, leading to variation in the amount of waste produced on any given day.

The measuring tool used may have also caused errors in the weights. According to the manufacturer of the device, the weight of the bags may vary by 0.1 pounds. This error isn't a substantial one at the scale of one or two bags, but once the data has been extrapolated to represent a year's worth of waste, the error can become large.

Though all of these potential sources of error may contribute to slightly different percentages, the overarching conclusion is that the waste produced from Dublin High School is quite high and in ratio for the many students who attend. It is also important to understand that this is only a fraction of the waste emitted at DHS because waste from classrooms and restrooms had been completely emitted for the plausibility of this audit.

ENVIRONMENTAL IMPACT

It is not within the scale of this report to calculate all the involved environmental implications of the waste generated at DHS. This report rather seeks to focus on the implications that can be addressed by the district in the near future.

All calculations, with regard to greenhouse gas emissions, have been sourced from the Australian Government's National Greenhouse Gas Accounts Factors 2017 [2]. (refer to page 67 for more information regarding the various factors involved in the calculations)

Roughly 12.5 percent of the waste emitted at DHS, is inorganic, non-recyclable waste, yet most of it, if not all of it, is disposed of at landfills. The lack of a proper waste separation system has dramatic environmental implications.

1. Acceleration of Climate Change

The emitted food waste amounts to more than 58 metric tons of CO_2 equivalent and the trays amount to another 23 metric tons per year [2]. These figures total to around 81 tons of CO_2 equivalent per annum, which equates to 90,732 pounds of coal burned [7]. According to Princeton Sustainable Composting Lab, "composting organic waste versus landfilling can reduce more than 50% of carbon dioxide-equivalent greenhouse gas emissions" [5]. When applied to DHS, the diversion of organic waste towards landfills can help reduce CO_2 equivalent by more than 40 tons per annum.

At DHS, recyclables, composed mostly of single-use water bottles, are diverted toward landfills. These recyclables are made primarily of polyethylene terephthalate or PET. The production, consumption, and disposal of the above materials results in the emission of more than 3.8 metric tons of CO_2 equivalent per annum [2].

Non-recyclable, non-compostable waste, otherwise known as landfill waste is composed of a variety of materials. At DHS, this waste primarily consisted of food wrappers (polypropylene/polyethylene), aseptic containers (paper, polyethylene, aluminum), and other miscellaneous landfill waste. Single-use food wrappers account for nearly 2.6 metric tons of CO_2 equivalent. As stated by Science Direct, aseptic packaging is "typically composed of paper (70%), polyethylene (LDPE) (24%) and aluminum (6%)." Taking these approximations into account, the use of aseptic containers results in the emissions of another 4.15 metric tons of CO_2 equivalent.

2. Ecological Footprint

Current single-use plastic consumption at DHS is unsustainable. The production of plastics involves processes that poison local water with toxins and have detrimental effects on air quality. These effects disproportionately impact the health of low-income families and people of color. The slow decomposition of plastics leads to the leaching of toxic chemicals into the soil and nearby water streams. Improper disposal of plastic waste — which, to be noted, is present at DHS — can lead to the introduction of plastics into local ecosystems. Replacing single-use plastics with reusable and/or organic material can significantly reduce the ecological footprint of the waste emitted.

RECOMMENDATIONS

Separate Streams for Organics & Recyclables: In accordance with SB 1383, “Local education agencies shall provide containers for the collection of organic waste and non-organic recyclables in all areas where disposal containers are located, except restrooms." DUSD has the legal and moral obligation to immediately introduce and maintain separate streams for organic waste and recyclables at all school sites and district offices.

Reduce Food Waste: SB183 further requires that districts reduce organic waste emissions by 75% by 2025. DUSD must work to identify possible solutions to reducing food waste at school sites.

Reduce Single-Use Plastic Consumption: The district should consider compostable and/or reusable alternatives to single-use plastic bottles, utensils, straws, and bags.

Educational Initiatives: It is essential to educate students and staff regarding the importance of the above initiatives. The district holds the responsibility of informing students and staff on how these systems work and what they need to do at school to ensure its success. Actions as simple as including pictures on the bins would be helpful for students to visualize which materials go into which bins. The district must understand that education and awareness are the basis for ensuring progress.

Involving External Organizations and Non-Profits: In its endeavors, schools in the district, as well as the district itself, should be able to work with outside organizations and should actively pursue cooperation with them. Examples of such organizations include Scouts, volunteer organizations, on-campus classes such as Environmental Sustainability or AP Environmental Sciences, and environmental action groups such as the Student Climate Corps. Adopting a communal, grassroots approach to this issue reduces the manual and financial burden of the district.

SOURCES

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