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Site-Level Rubbish Collection, Waste Patterns and the Implications for Company Practice

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Abstract

This paper details the data, observations, and lessons learned from rubbish removal on a 29-hectare site. The project commenced in 2024 following the observation of litter in waterways and fields. Over the subsequent two years, I undertook removal efforts and systematically collected relevant data. Although these efforts focus on a small site, they provide valuable lessons that can help shape how sustained eco-friendly practices and change can be implemented in different companies.

Keywords

Rubbish, New Zealand, Data, Plastics, Microplastics, Eco-Friendly Policy

1. Methods

1.1. Number of Collection Events

There was a total of 40 collection events from the 16th of April 2024 to the 21st of May 2026.

1.2. Collection Frequency

The number of collections varied from month to month due to related work factors that prevented me from collecting for longer or handling a greater volume of rubbish. As shown in Table 1, the frequency of collections decreased each year due to these exact factors.

1.3. How Were Individual Pieces Collected and Weighed

At the end of every collection, each bag was weighed on a large scale used for other items. Each bag could hold up to 10 kg of rubbish, compressed and placed inside. Depending on whether there are larger pieces of rubbish or the water has in-

creased in weight. With more lightweight pieces in the bag, like pots, this would decrease to 5 kg.

Table 1. Collection frequency per year.

2024	Number	2025	Number	2026	Number
Apr.	2	Feb.	2	Jan.	1
May	2	Mar.	2	Apr.	4
Jun.	5	Apr.	2	May	2
Jul.	3	Jun.	1	**Total**	**7**
Aug.	2	Jul.	1		
Sep.	2	Sep.	2		
Oct.	1	Oct.	3		
Nov.	1	Nov.	1		
Dec.	1	**Total**	**14**		
Total	**19**				

This is sourced from [1].

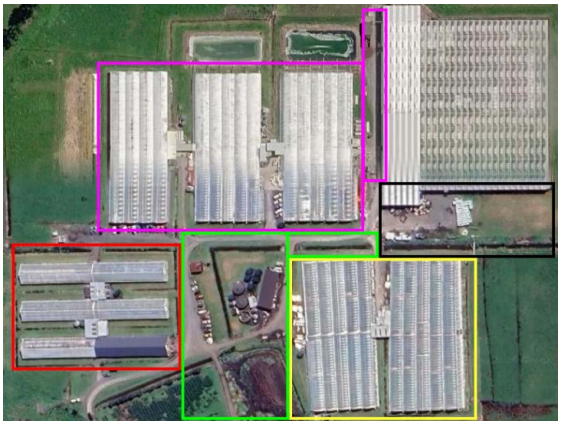
1.4. How Many Individual Pieces Were Collected

Although no exact piece count was available, on average, 250 to 500 pieces were collected per collection, rising to more than 1000 for the larger cleanups. Much of the rubbish, including pots, small plastic items, and plastic sleeves, is smaller than 30 cm in both diameter and length. Leading to a greater number collected despite a smaller increase in weight. The total number ranges from 10,000 to 20,000.

1.5. Area Covered in Each Cleanup

The map below breaks down the site and the different zones that helped to more accurately track where the rubbish in these collections was removed.

As shown in Figure 1, this is a screenshot from Google Maps showing the site location and the designated highlighted zones.



Key: Red: Zone 1, Purple: Zone 2, Green: Zone 3, Yellow: Zone 4, Black: Zone 5.

Figure 1. Screenshot from Google Maps showing the site location and highlighted zones.

1.6. Dates, Zones and the Amount Collected Each Time

See Table 2.

Table 2. List of every collection to date, its location and weight.

Date (2024)	Zone	Amount (Kg)
19/04	4	75
23/04	1, 3	50
02/05	2, 3	50
14/05	1, 2, 3	15
17/05	3, 5	15
31/05	1, 2, 5	35
04/06	2, 5	40
06/06	5	20
18/06	2, 3, 4	50
28/06	1, 3	60
02/07	2, 5	35
08/07	5	20
16/07	5	10
01/08	1, 4, 5	50
20/08	3, 5	10
03/09	5	15
06/09	1, 2, 3, 5	30
03/10	1, 2, 5	140
22/11	2, 5	70
06/12	2, 3, 5	55
Total	--	**845 kg**
Date (2025)	**Zone**	**Amount (Kg)**
20/02	5	30
24/02	5	45
27/03	3, 5	55
30/03	1, 3	20
16/06	3	100
06/07	3	5
19/09	4, 5	70
27/09	5	40
05/10	5	5

Continued

24/10	5	45
31/10	3, 5	20
22/11	5	15
28/11	3, 5	20
Total	--	**470 kg**
Date (2026)	**Zone**	**Amount (Kg)**
09/01	3	35
09/04	3	65
10/04	3	35
17/04	3	55
30/04	4, 5	20
02/05	5	10
21/05	5	5
Total	**--**	**225 kg**

This is sourced from [1].

2. Statistical Data

- The uncertainty measure for this total value of 1.54 tonnes is **0.05 tonnes**.

The absolute uncertainty measure is the margin of error in a measurement expressed in the same units as the measurement itself. Since my example is 1.5, the uncertainty lies in the last decimal place. The standard convention is typically ±0.1 tonnes. Half this, and I got ±0.05 tonnes.

- The calculated confidence interval is 38.7 ± 0.0434.

(38.7 ± 1.9600 × 27.5 divided by 1,540,000 = 38.7 ± 0.0434) [2].

- The standard deviation is $\sigma = 27.5$.

(Count, N: 40, Sum, Σx: 1540, Mean, μ: 38.5, Variance σ^2: 756.5) [3]. The square root of 756.5 is 27.5.

- The standard error of the mean is 4.3481.

(SE) is 27.5 divided by the square root of 40 (6.324) = 4.3481 [4].

Due to not setting the significance level (α) before starting this, I cannot determine the p-value.

3. Relevant Data about the Type of Land

All these cleanups have taken place on a 29-hectare piece of land, consisting mostly of fields, greenhouses, and small streams that run through the highlighted areas, operated by one of the largest agricultural companies in the country. As a result, the rubbish at this specific site reflects the products that are used. Despite this, the impacts, lessons learned, and trends are the same that companies throughout New Zealand are dealing with and attempting to change.

Features of the Land

Located in West Auckland, it has little variation in height, with most fields flat and little tree cover or natural barriers to break the wind and shift rubbish across the land. A series of connected streams running through the site swell in size during heavy flooding. Rubbish gets picked up, then scattered or embedded into the sides of the stream. Sleeves, especially, have become discoloured, proving they have been there for months at a time if not removed right away.

The layout of the large greenhouses and open space creates a wind tunnel that sweeps the lighter pots, sleeves and plastics towards the far end of the main road (beside the biggest greenhouse).

4. Frequency in the Type of Rubbish Collected

All collected rubbish can be organised into specific categories (see Table 3).

Table 3. Frequency of each category of rubbish collected.

Type	Amount	Percentage
Pots	40	100%
Sleeves	31	77.5%
Polystyrene	18	45%
Bags	9	22.5%
Drink Cans	1	2.5%
Tags	7	17.5%
Cardboard	13	32.5%
Straps	3	7.5%
PVC Pipes	2	5%
Plastics	39	97.5%

This is sourced from [1].

5. Limitations with This Data and the Rubbish Collections

Undoubtedly, because the cleanup was undertaken by a single person (me) the entire time, the amount collected and how often it was collected were never standardised as they should have been. Data collection was established when the collection began, but I missed collecting additional information.

If There Were More Support Invested

Given the limits of what I could collect each time, additional hands could have resulted in 50% more rubbish collected in a shorter time span, with less rubbish left in the environment, reducing the chances of microplastics entering the streams. I picked up a large amount because I understood the importance of grassroots cleanups, whether at the workplace or out in the community, enabling me to be as ef-

ficient with what I had.

6. Noticeable Trends

- Because the business primarily uses plastic pots, sleeves, plastic packaging, and polystyrene, these were by far the most abundant compared to other types like cardboard or bag liners.
- Lack of investment in plastic-based and polystyrene-based alternatives contributed to greater amounts entering the worksite.
- Without the full backing of the business, it was harder to implement permanent changes to the position of large rubbish skip bins, moving away from using plastic and wrapping and packaging and a larger collective effort to help my efforts.
- Specifically, once the wrapping plastic broke down enough into near microplastics, it became impossible to remove it with the tools I had. Leaving behind the worst form of plastic that animals could have ingested, been carried downstream or buried beneath the grass.
- There was a clear mismatch between my drive and passion to do these cleanups and getting interest from other workmates, management, making it harder to gain traction and have people believe in my ideas.
- The site layout had a clear impact on moving the lighter pieces out of the bins, from the grass or along the road, and into the water.

7. The Most Impactful Rubbish Types and Their Footprints

- Packaging Plastic was by far the most harmful type. Left exposed within the environment, it quickly became brittle, falling apart into smaller pieces.
- The moment polystyrene touched water, it immediately broke apart, clogging parts of the streams and collecting up against the stream bed, most commonly when a large amount of rain increased the size, capturing more than it usually would with the water at a normal level.

8. Lessons Learned That Can Be Introduced into Other Companies

Clearly defined, site-wide targets and achievable goals related to eco-friendly practices, cleanup efforts, or reductions in harmful impacts on the surrounding environment.

To be effective, the company must, in the beginning, discuss, outline, and write into its policy achievable goals that can lessen its immediate impact on the site it occupies. For example, this might involve initiating weekly site-wide cleanups across the team or achieving a complete reduction in waste sent to landfill (by investing in alternatives that recycle or prevent long-term environmental harm). Often, they can vary in cost, time, and implementation difficulty, but if this can be put in place, it creates a foundation for implementing the rest of these points as well. Effort without an endpoint can create change, but it isn't a sustainable way to operate in the

long term.

Clearly defined implementation of environmental regulations

Firstly, environmental regulations within the company should strike a balance between maintaining process efficiency and actively preventing and protecting the on-site ecosystem. Prevention in the form of investing in plastic alternatives, clean energy and more sustainable raw materials, if possible. Any redundancy within current frameworks could lead to missed opportunities or further environmental harm, simply because it's not fully fleshed out for every scenario.

This can come in various ways, but it has a few specific areas.

Eco-friendly policy

Perhaps the most vital for sustained difference is the company's actual policy and view on the importance of their actions and their impact on their site and in the local community. An example is Spark NZ with its environmental policy. Committing to complying with regulations, reducing greenhouse gas emissions, using natural resources efficiently, engaging employees to empower environmentally responsible choices, and adapting technological models to address environmental issues [5]. At the same time, policy without implementation is essentially pointless, so strict enforcement across the entire company is essential. That adds to the current nationwide environmental and resource management policy.

Eco-friendly infrastructure

Such infrastructure can include company-funded transport services to shuttle employees to and from designated areas. Standardising recycling stations, bins and drop-off locations across the site. Ensuring carbon emissions are reduced or eliminated through greener energy generation, transport (trucks, cars, etc.), and/or resource processing/extraction. Consistent maintenance of green spaces, with the possibility of adding new ones to the job site. Investing in feasible, long-term, eco-friendly infrastructure, such as switching energy generation and transport to fully renewable sources. All of these and more can benefit not only the company's growth but also employee health and safety, work culture, and productivity.

Standardise data collection of all activities within the company

Data collection allows the company to evaluate the bigger picture of its operations, impact, and outlook. Removing the need for guessing and implementing changes without understanding the consequences. Data drives better decisions, more accurate timelines, a complete picture of current practices, and highlights potential areas for improvement. Rapidly expanding technology gives every company the tool to capture and process this data like never before—a completely sustainable and eco-friendly future hinges on the essential understanding of the world around us.

Combine data collection with more efficient practices

Now that you have the data, implementation must occur using the most efficient practices without introducing risks or harm to the company, employees, or environment for which you are responsible. Data is the secret superpower that many companies are not aware of or actively using in their structure. Perhaps the best example is WaterForce, which uses remote IoT sensors to relay soil moisture,

water conditions, and local weather data to inform its decisions. Helping to transform the New Zealand agriculture industry into a collective, more automated and efficient industry that reduces natural resource wastage, specifically when irrigating [6].

Collaborate with local community groups and organisations

For example, I could not do this because it took priority over other tasks and the limited scope of support I had. Nevertheless, collaborating this way amplifies impact by pooling resources, deepening community trust, and ensuring culturally relevant solutions [7]. Having local input, effort and organisation enable a more practical solution to be implemented and supports long-lasting environmental stewardship. The more interest there is, the more people become self-aware of their impact and power to help drive change, which further advances environmentally sustainable efforts. Companies and communities cannot be at odds with each other's best interests; they should work together.

9. Conclusions

Despite the long-term change within the company not advancing as much as hoped with this clean-up and its results, the lessons learned apply to any company throughout the country. To achieve the sustainability goals outlined in the Resource Management Act of 1991, currently under review, companies must continue to evolve their environmental and resource management policies. Important, crucial steps have been taken, but there is still a long way to go. Individual effort creates impact, but community, company, and government effort can leave a legacy and change the way we live for a protected, strengthened, and abundant world free of harm, damage, and destruction.

So please take the lessons you can from my research paper and create the difference needed in your company, community, and life.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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