

2019 New Jersey Waterways Litter Survey

A Survey of Litter along
94 Riparian Areas and Catch Basins

Conducted for

**New Jersey
Clean Communities Council**

by

Environmental Resources Planning, LLC
in alliance with
Ocean Conservancy

Final Report

February 2020



ER PLANNING

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2019 New Jersey Litter Survey

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Acknowledgments

Thanks to the New Jersey Clean Communities Council, Inc. (NJCCC) and Sandy Huber, Executive Director, for her support and oversight of this project.

Thanks to the New Jersey Department of Transportation (NJDOT) for researching and providing a list of all NJDOT catch basins along with their GPS coordinates.

Thanks to Ocean Conservancy, who reviewed and approved the methodology, site selection, data and report. Their support of this project was invaluable.

Thanks to other environmental groups and their staff who either assisted or served as observers during portions of this survey.

Thanks to the local Clean Communities Coordinators- Rebecca Turygan, Atlantic County Utilities Authority; Corporal Michael Ross, Ocean County Department of Corrections; Chris Sikorski, Middlesex County Solid Waste Management; and Joseph Slomian, Monroe Township (Middlesex County) who participated in the field surveys.

Thanks to the American Chemistry Council and the New Jersey Department of Transportation for funding this project.

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Executive Summary

In Fall 2019, Environmental Resources Planning, LLC (ERP) conducted a comprehensive litter survey of waterway-related sites throughout the State of New Jersey to evaluate the amount and composition of litter tallied on 94 representative waterway sites.

The methodology used to conduct this litter survey was the same one used in 2017 and consisted of tallying each littered item observed and making note of its material composition. This is the methodology typically used with statistically-based litter surveys conducted throughout the U.S. and Canada.

Methodology Overview

A variety of waterway-related sites including catch basins were selected, generally within the same area as the 2017 land-based sites, which had been selected using a stratified random selection process, taking roadway locales as well as population and traffic densities into account. For this survey, litter was tallied in areas as close to the waterway as was feasible. Items in the waterways themselves were not tallied.

The optimal site size was the same as the 2017 survey. Due to nuances in topography this occasionally varied. In those cases, the resulting data was extrapolated to reflect the optimal site size (9,000 square feet). All items of litter one inch or larger were tallied, which excluded cigarette butts. Litter was characterized by item type (125 components) and material composition. Items designated as recyclables were materials that are generally accepted in local recycling programs.

Litter Survey Results - Highlights

Overall, *Beverage Containers* represented the most littered category (25.5 percent) followed *Cup-Related* items (11.4 percent). *Water Bottles* (8.4 percent) were the single most littered component followed by *Sweet Snack Packaging* (5.7 percent).

Litter by Category

1. *Beverage Containers* (25.5 percent)
2. *Cup-Related* (11.4 percent)
3. *Candy/Snack Packaging* (9.5 percent)
4. *Paper* (9.2 percent)
5. *Vehicle/Construction* (9.0 percent)

Litter by Component

1. *Water Bottles* (8.4 percent)
2. *Sweet Snack Packaging* (5.7 percent)
3. *Misc. Paper* (4.8 percent)
4. *Beer Cans* (4.6 percent)
5. *Misc. Hard Plastics* (4.4 percent)

The portion of littered items that could have been recycled was 36.7 percent. This included paper, boxes and beverage containers along with home bottles, cans and jars.

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Introduction

In Fall 2019, Environmental Resources Planning, LLC (ERP) conducted a comprehensive litter survey of water-related sites throughout the State of New Jersey to evaluate the amount and composition of litter tallied on 94 waterway sites located the 2017 sites.

The methodology used to conduct these litter surveys was the same as that used in 2017 and consisted of tallying each littered item observed and making note of its material composition. This is the methodology typically used with statistically-based litter surveys conducted throughout the U.S. and Canada.

Methodology Overview

A variety of waterway-related sites and catch basins were selected for the 2019 litter survey. To the extent feasible, each of the water-based sites was located generally within the same area as the equivalent land-based sites from 2017 which had been selected using a stratified random selection process, taking roadway locales as well as population and traffic densities into account.

The site lengths and areas surveyed were similar to those used in 2017. All items of litter one inch or larger were tallied, which excluded cigarette butts. Each item was characterized by item type (125 components) and material composition. Items made of multiple materials (e.g., toys, vehicle parts and certain home articles, etc.) were classified as *Composite*. Each site was photographed and documented.

The portion of littered items that could have been recycled was 36.7 percent. This included paper, boxes and beverage containers along with home bottles, cans and jars.

Waterways - Litter Survey

Waterways - Sampling Methodology

The first task was determining which sites would be surveyed. It was decided that surveying water-related sites near the land-based sites surveyed in 2017 could provide unique insights into patterns of littering state-wide. The 94 sites surveyed were selected based on a stratified random selection process, similar to the 2017 survey.

As in 2017, items one inch or larger were tallied and characterized by component and material composition. The components and categories used in this survey were similar to those used in 2017. The 125 detailed components were rolled-up into 15 categories. The optimal site lengths and widths for each site were similar to those used in the 2017 survey (500 feet long and 18 feet wide). When site restrictions did not allow the full site size to be surveyed, the actual site dimensions were recorded and the data extrapolated into what would have constituted a full site size (9,000 square feet).

Litter was characterized and analyzed by site type, county, region and category. The regions breakdown is shown in Figure 1.

2019 New Jersey Litter Survey

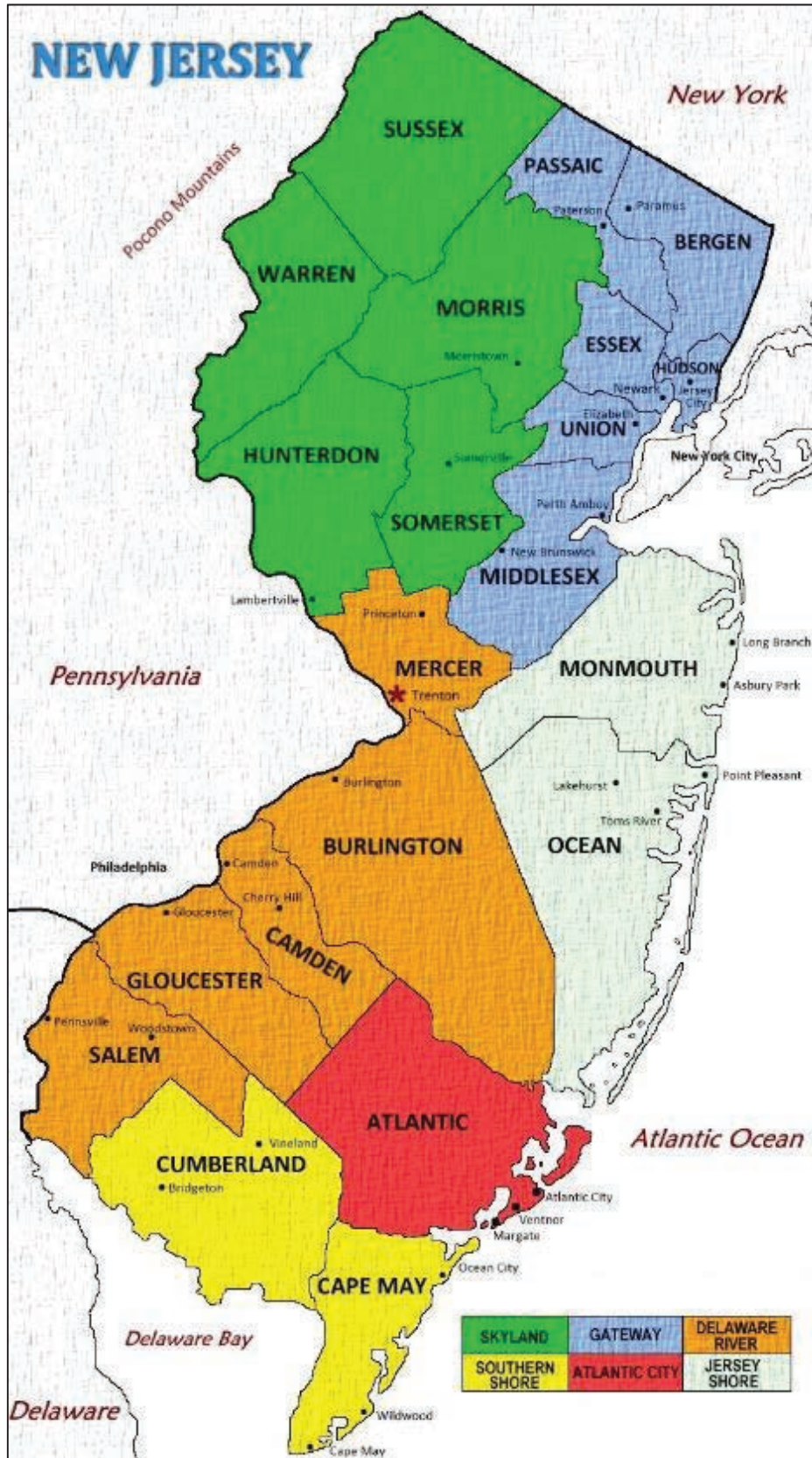


Figure 1 - Map of New Jersey by Region

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The number of sites represented in each area of the state is based, in part, on factors such as population density, traffic levels and roadway mileage and the proportion of motorist or pedestrian exposure to each.

For each site, the closest waterway was selected except in instances when a broader variety of site types was needed, in which case the closest waterway of a different type was selected. All waterways were classified by titles with which they were mapped. Some may exhibit specific litter profiles than others. The waterways represented in this survey are defined below.

1. Bay: A coastal body of water enclosed by land on three sides and open to the ocean on one side.
2. Brook: A small stream shallower and smaller than rivers and creeks.
3. Canal: A long, narrow channel of water typically used for boat travel.
4. Creek: A small to medium sized stream characteristically smaller than a river, but larger than a brook.
5. Lake: A relatively still body of water localized in a basin and surrounded by land.
6. Reservoir: A lake whose outlet is dammed to control the outgoing flow of water.¹
7. River: A large natural flowing stream that either flows into the ground or into an ocean, sea or large stream.
8. Run: A small river.²
9. Catch Basin: An artificially lower area located near the edge of a street designed to provide efficient water drainage for roadways.

¹ Only one Reservoir was selected and surveyed. It was deemed similar to a Lake and classified as such for analytical purposes.

² Only one Run was selected and surveyed. It was deemed similar to a Creek and classified as such for analytical purposes.

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Litter Survey Results

Categories and Components

Items of litter tallied were organized by 125 individual components which were then rolled up into 16 major categories. Each component was also classified by material type (e.g. paper, plastic, metal, composite, etc.). The major categories are listed below along with a description of their components:

1. Beverage Containers: 22 individual components including beer, soda, sports and energy, water, wine and liquor, juice and tea.
2. Beverage-Related: beverage caps, seals, cartons and six-pack rings. These tend to be minor components of litter but were classified separately to avoid confusion with the beverage containers themselves.
3. Cup-Related: cups used for hot or cold drinks, cup pieces and lids found without cups. Straws and wrappers were also included in this category.
4. Take-out Food Packaging: food and condiment wraps, utensils, plates, clamshells and trays.
5. Candy/Snack Packaging: wrappers from sweet snacks (candy, cakes), salty snacks (chips, crackers) and gum.
6. Bags: paper, plastic and reusable bags separated by those used for shopping and those used for trash or leaves. Those with brand names were separately tallied from generic bags such as "thank you" bags.
7. Industrial Plastic Wraps: industrial and other commercial bags or film products (e.g. shrink wrap, dry cleaner bags, ice bags, etc.).
8. Napkins/Tissues: branded and unbranded napkins and tissues.
9. Home Food Containers: food jars, cans, bottles, cartons, lids and tea packets.
10. Paper: all paper items except for paper trash or good bags. This included newspapers, magazines, books, advertising signs, cards, flyers, lottery tickets, business, home, school, receipts, packaging, paperboard, corrugated boxes, unidentifiable paper and paperboard.
11. Vehicle/Construction: automobile parts from accidents, do-it-yourself car maintenance debris and tire debris. This rollup category also included construction and demolition debris (e.g. shingles, wood, electrical, drywall, Tyvek, foam insulation, industrial tarps, etc.).
12. Cloth/Fabric: clothing, carpet, non-clothing fabric such as rags.
13. Home Items: lamps, clothes, toiletries, home packing materials and medicine-related items.
14. Tobacco-Related: lighters, packages and matchbooks along with any cigarette or cigar butts that were one inch or larger.

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- 15. Other Hard Plastics: pieces of hard plastics not otherwise classified.
- 16. Other Items: any items not otherwise classified.

Litter rates were examined from a number of different perspectives and the 94 sites were assigned to geographical designations (e.g., site type, county, region) for the purpose of making these comparisons. In each case, the mean count of littered items was calculated for each designation. Where appropriate, tests were performed to determine if observed differences in litter rates were statistically significant.

Statewide

A total of 7,702 littered items were tallied on the 94 sites, or an average of about 82 items per site. That is 17 percent less than in the 2017 land-based survey (96 items per site).

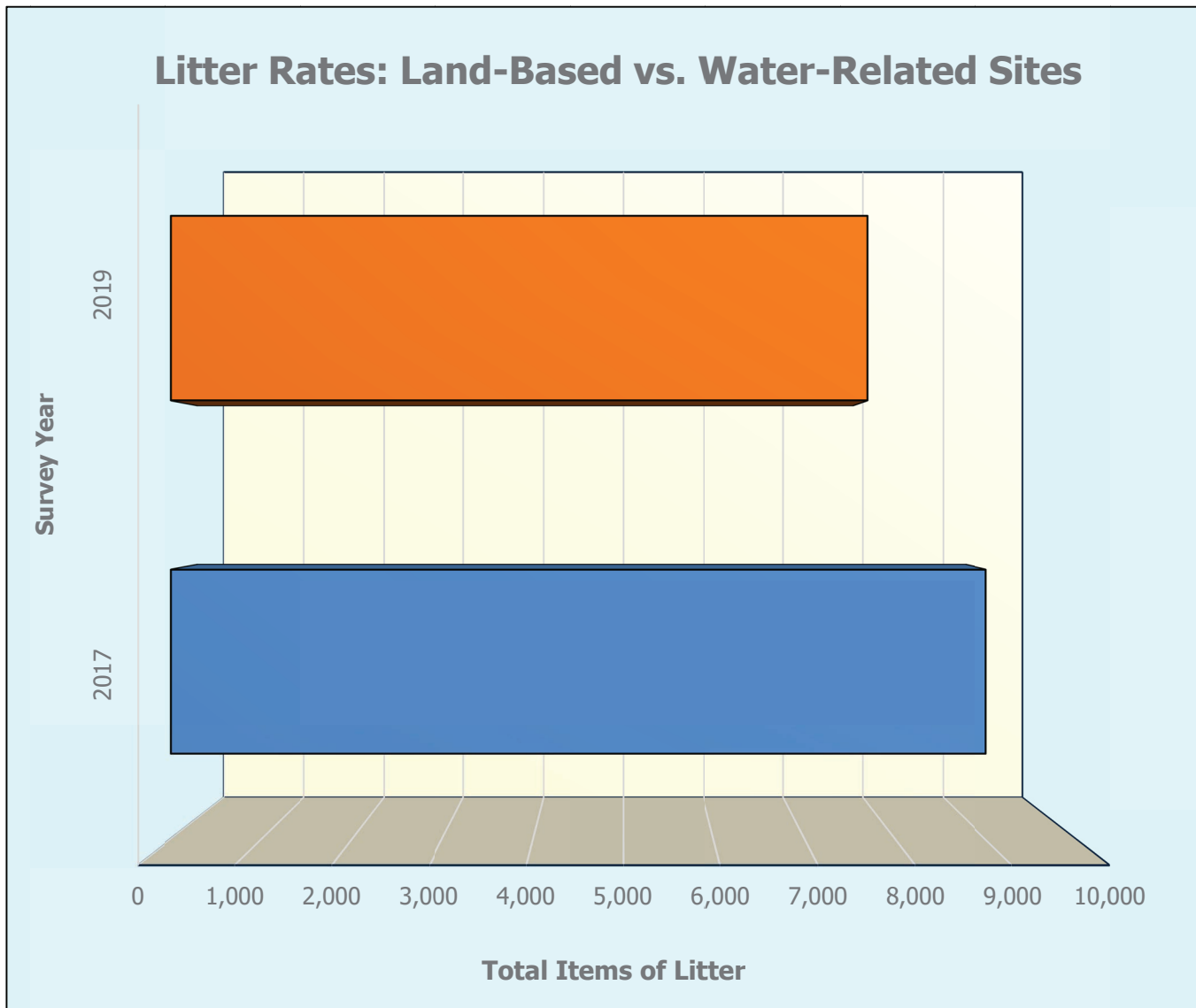


Figure 2 - Litter Rates: Land-Based vs. Water-Related Sites

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Litter by Site Type

The number of sites for each waterway type is shown in Table 1. Rivers and basins showed the highest average litter per site, while the remaining sites showed similar littering rates.

Table 1 - Litter by Site Type

Type	Sites	Avg Tally
Basin	30	77
Bay	4	39
Brook	8	57
Canal	4	45
Creek	11	42
Lake	13	44
River	24	149

Litter by Region

The 94 surveyed sites were classified by one of six regions (shown in Figure 1), which matches the allocation used in the 2017 land-based litter survey. The regions and the counties they include are: Atlantic City (Atlantic), Delaware (Burlington, Camden, Gloucester, Mercer and Salem), Gateway (Bergen, Essex, Hudson, Middlesex, Passaic and Union), Jersey Shore (Monmouth and Ocean), Skyland (Hunterdon, Morris, Somerset, Sussex and Warren) and Southern Shore (Cape May and Cumberland).

After the litter tallies were calculated for each site, the data was averaged by region and compared with the results of the 2017 land-based survey. All regions showed lower litter rates except for the Gateway Region, which yielded the largest average litter tally per site of all regions. This is not unexpected since the Gateway Region has the highest population of any region in New Jersey.

As this survey was conducted later in the year than the 2017 survey, lower litter rates would be expected overall, so it is interesting to note that the litter rate in the Gateway Region was the only region with a higher litter rate in 2019. In addition, Gateway also yielded the highest litter rate in the 2017 survey.

Table 2 - Litter by Region

Region	Sites	Avg Tally	2017	Delta
Atlantic City	3	27	51	(24)
Delaware	16	44	74	(30)
Gateway	44	120	110	10
Jersey Shore	14	57	81	(24)
Skyland	13	49	106	(57)
Southern Shore	4	50	91	(41)

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Litter by County

When the data is broken down further, 16 of New Jersey's 21 counties showed lower litter rates at the waterway sites. As shown in Table 3, five counties showed higher litter: Bergen, Burlington, Essex, Somerset and Union. The higher litter rates in these counties may be due in part to the number of Basin and River sites in each of them.

Table 3 - Changes in Litter by County

County	Sites	2019	2017	Delta
Atlantic	3	27	51	(24)
Bergen	10	98	50	48
Burlington	3	49	42	7
Camden	5	32	71	(39)
Cape May	2	67	78	(11)
Cumberland	2	32	105	(73)
Essex	7	126	61	65
Gloucester	3	53	69	(16)
Hudson	6	183	305	(122)
Hunterdon	1	3	132	(129)
Mercer	4	46	102	(56)
Middlesex	10	115	130	(15)
Monmouth	8	42	61	(19)
Morris	6	68	165	(97)
Ocean	6	78	108	(30)
Passaic	6	99	67	32
Salem	1	49	91	(42)
Somerset	3	69	32	37
Sussex	2	8	70	(62)
Union	7	115	69	46
Warren	1	5	26	(21)

Litter - Largest Components

The 10 components of litter most frequently found along waterway sites in New Jersey during this survey are shown in Table 4. *Water Bottles*, a growing component of litter, were the largest component by far (8.4 percent), followed by *Sweet Snack Packaging* (5.7 percent), *Misc. Paper* (4.8 percent) and *Beer Cans* (4.6 percent).

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Table 4 - Litter - 10 Largest Components

#	Item	Percent
1	Water Bottles	8.4%
2	Sweet Snack Packaging	5.7%
3	Misc. Paper	4.8%
4	Beer Cans	4.6%
5	Misc. Hard Plastics	4.4%
6	Industrial Plastic Wraps	3.5%
7	Tire Scraps	3.0%
8	Salty Snack Packaging	3.0%
9	Unbranded Napkins	2.8%
10	Home Articles	2.6%

Once litter components were rolled-up by product type, *Beverage Containers* (25.5 percent) were the most prevalent category of litter, followed by *Cup-Related* (11.4 percent) and *Candy/Snack Packaging* (9.5 percent) as shown in Table 5.

Table 5 - Litter by Category

Item	Percent
Beverage Containers	25.5%
Cup-Related	11.4%
Candy/Snack Packaging	9.5%
Paper	9.2%
Vehicle & Construction	9.0%
Bags (Paper/Plastic Trash & Leaf)	5.5%
Industrial Plastic Wraps	4.7%
Take-Out Food Packaging	4.7%
Other Hard Plastics	4.4%
Home Items	3.8%
Napkins/Tissues	3.2%
Packing Materials	2.8%
Tobacco-Related	2.5%
Other Items	1.6%
Cloth & Fabric	1.5%
Other Beverage-Related	0.8%

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Recyclables in Litter

The percentage of recyclables in litter along waterways was 36.7 percent, a much higher percent of overall litter compared to the 2017 land-based survey (28.9 percent). For the purposes of this comparison, the items evaluated were those typically acceptable in curbside recycling programs statewide.

The largest category of these recyclables in 2019 was *Beverage Containers* (25.5 percent), which were PET containers. The remaining recyclable items were primarily paper (10.3 percent), food and household non-beverage metal cans along with PET, HDPE and glass bottles (1.0 percent) that would have been recyclable when discarded (9.9 percent). This includes paper bags and packing materials but excludes take-out food packaging.

Figure 3 shows each recyclable component and its percentage of total litter.

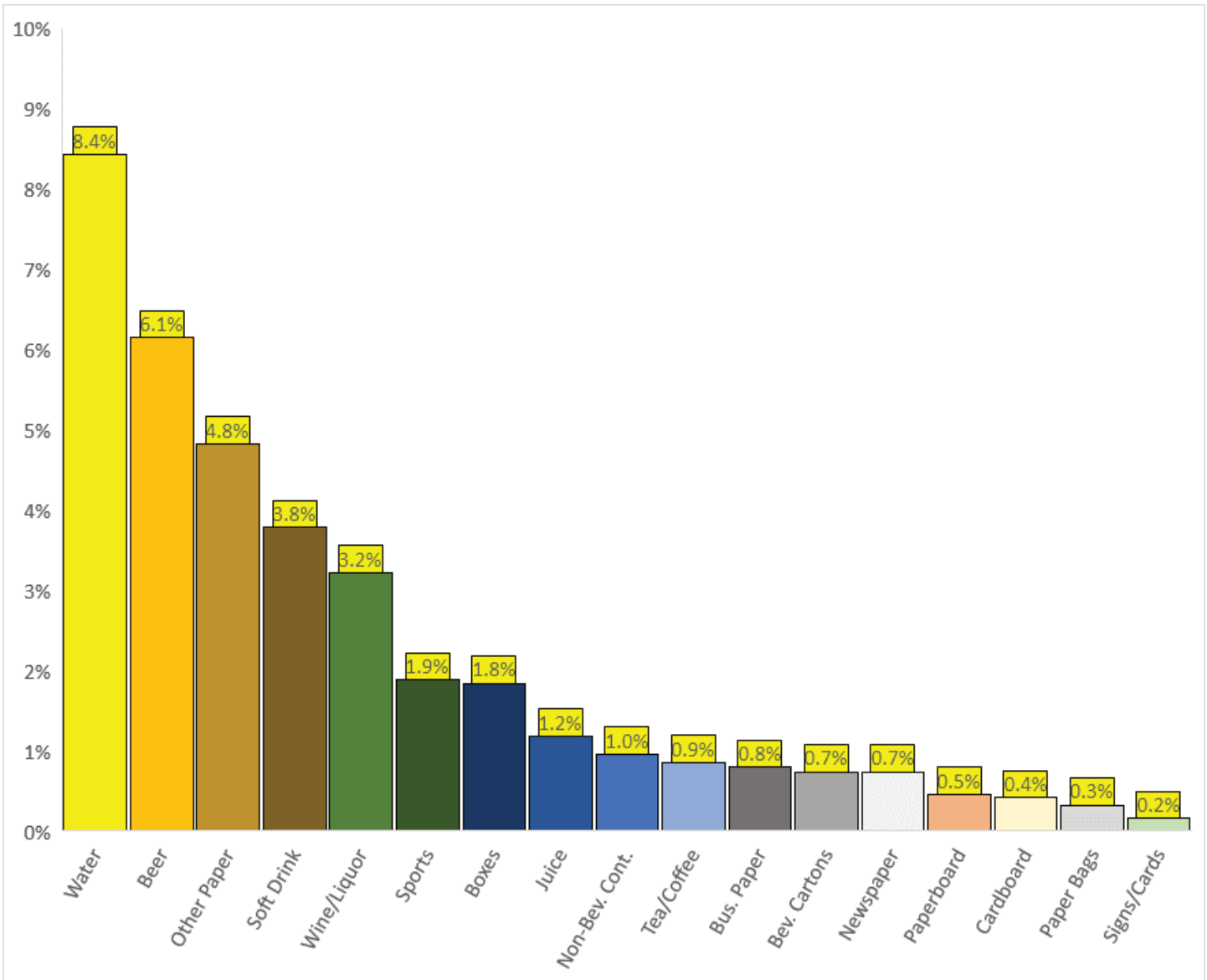


Figure 3 - Recyclables in Waterway Litter

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Figure 4 shows litter in a vegetated area at the edge of Clam Creek near Absecon Inlet (site S-32). This site is located in Atlantic City behind the intersection of N. Rhode Island Drive and Huron Avenue. The Golden Nugget Casino, two parking areas, a large marina and a construction site were all located directly adjacent to this site, providing some insights into the sources of the litter observed.



Figure 4 - Site S-32 in Atlantic County

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Figure 5 shows litter next to the bank of the South River under the Main Street bridge in Middlesex County (site N-49). The site is located near 10 Washington Road in Sayreville.



Figure 5 - Site N-49 in Middlesex County

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Figure 6 shows litter at Robinson's Branch of the Rahway River in Union County (site N-41). The site is located under the W. Grand Avenue bridge in Rahway.



Figure 6 - Site N-41 in Union County

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Figure 7 shows litter along the bank of Crystal Lake in Essex County (site N-36). The site is located behind Eagle Rock Lanes in West Orange.



Figure 7 - Site N-36 in Essex County

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Statistical Tests

A series of correlation analyses were conducted to evaluate whether the proximity of establishments such as convenience stores, schools, etc. was associated with the amount of litter found at the sites surveyed. These types of variables are called proximity indicators.

A correlation analysis is a type of statistical test that yields a correlation coefficient, a number (statistic) used to measure the strength of a relationship between two variables. A correlation coefficient can be positive or negative but is never less than -1 and is never greater than +1. A positive correlation means that high scores on one variable are associated with high scores on the other variable, while low scores on one are associated with low scores on the other. On the other hand, a negative correlation means that high scores on one variable are associated with low scores on the other.

A correlation of zero, or close to it (either positive or negative), suggests that there is little or no relationship between the variables. Any result between -0.1 and 0.1 would be considered very weak. The closer you get to +1 or -1, the stronger the relationship.

The statistical significance of a given correlation depends to a large extent on the size of the sample (that is, the number of measurements). In these analyses, there is a sample size of 94, representing the number of sites surveyed. This number is large enough that correlations over .20 will be statistically significant at the .05 level. For the remainder of this section, "significant" should be taken to mean "statistically significant."

Analyses were performed on 14 proximity indicators, to determine their correlations with each of 12 litter categories, in addition to total litter.

Proximity Indicators

The proximity indicators utilized were:

1. Shopping centers
2. Residential areas
3. Commercial areas
4. Industrial areas
5. Bus Stops
6. Convenience stores
7. Fast food establishments
8. Restaurants
9. Recycling facilities
10. Hotels and motels
11. Churches
12. Schools
13. Public facilities
14. Interstate highways

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The categories of litter utilized in this analysis were:

1. Beverage Containers and Related Items (e.g. caps, cartons, 6-pack holders)
2. Cup-Related (e.g. paper and plastic cups, lids, pieces, straws and wrappers)
3. Take-Out Food Packaging (e.g. food wraps, clamshells, plates, utensils, condiments)
4. Candy/Snack Packaging (e.g. candy, snacks, ice cream, popsicles)
5. Bags (e.g. paper and plastic trash and leaf bags, shrink wrap, industrial wraps)
6. Napkins/Tissues (e.g. paper napkins, paper towels and tissues)
7. Paper (all paper except for food-related, trash bags and packing materials)
8. Vehicle/Construction (e.g. tire scraps, auto parts, construction debris)
9. Packing Materials (e.g. bubble wrap, packing peanuts, block foam)
10. Tobacco-Related (e.g. match books, lighters, cigarette packs)
11. Home Items (e.g. games, CDs, recreational equipment, toiletries, home food pkg.)
12. Other Items (all other littered items not covered in the above categories)

This analysis combined certain related categories: (1) Beverage Containers and Related Items, (2) Bags and Industrial Plastic Wraps and (3) Home Items and Home Food Packaging. Categories such as Cloth/Fabric were not evaluated because they comprised a too small a portion of litter in this survey to provide meaningful results.

Table 6 - Correlations between Litter Categories and Proximity Indicators

Correlation Tests	Res.	Comm.	Conv.	Restaurant	Rec. Fac.	Schools	Interstate
Bev. Containers/Rel.	-0.10	0.17	0.21	0.17	0.21	-0.03	0.00
Candy/Snack Pkg.	0.08	0.16	0.22	0.16	0.16	0.11	0.00
Napkins/Tissues	0.09	0.14	-0.01	-0.01	-0.10	0.20	0.00
Paper	0.00	0.30	0.05	0.14	-0.08	-0.01	0.00
Vehicle/Construction	-0.12	-0.03	-0.07	-0.09	-0.05	-0.07	0.31
Packing Materials	0.00	0.21	0.23	0.22	-0.05	-0.01	0.03
Tobacco-Related	0.25	0.25	-0.01	0.08	-0.09	0.08	0.07
Home Items	-0.07	0.17	-0.04	0.08	0.24	0.09	0.09
Other Items	-0.10	0.24	0.04	0.15	0.35	-0.03	0.10
Total	-0.05	0.20	0.16	0.15	0.14	0.03	0.09

Table 6 highlights the principal findings, which only includes categories and indicators that yielded significant results. No significant correlations were obtained for the following seven proximity indicators: shopping areas, industrial sites, bus stops, public facilities, hotels, churches, and fast food establishments; values for these indicators are therefore not reported. Statistically significant correlations are highlighted and bolded.

Similarly, no significant correlations were obtained for three of the litter categories: Cup-Related, Take-Out Food Packaging and Bags. Therefore, these categories are also not included in Table 6. The proximity indicators and litter categories which yielded at least one statistically significant correlation are all included in Table 6.

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Looking at residential areas, one statistically significant correlation (0.25) is found: tobacco-related. This result indicates that significantly more tobacco-related litter was found in residential areas than in non-residential areas. Interestingly, the “total litter” correlation for residential is negative (-0.05), meaning that slightly less (but not significantly less) total litter was found in residential areas than in non-residential areas: tobacco was the notable exception.

For survey sites in proximity to commercial establishments, a number of significant results were found. In four litter categories, there was significantly more litter found at these sites than elsewhere: paper, packing materials, tobacco-related, and other items. Furthermore, this was the only proximity indicator which yielded a statistically significant correlation for total litter: thus, there was significantly more total litter found at these sites than elsewhere.

At sites near convenience stores, three categories of litter were prevalent: beverage containers (and related items), snack wrappers, and packing materials. In each case, there was significantly more of these items found near convenience stores than at other sites. Note that for the other litter categories, the correlations with this proximity indicator are all close to 0 (zero).

The correlation analyses for proximity to restaurants yielded a significant value for only one litter category: packing materials. However, the analyses for recycling centers yielded three: beverage containers (and related items), home items, and other items. And curiously, the proximity analyses for schools produced a significant result only for napkins.

The final proximity indicator reported in Table 6 is Interstate, which should be understood to include a major thoroughfare such as the Garden State Parkway. Here, most of the correlations are very close to 0 (zero). However, one litter category stands out, as might well be expected: there was significantly more vehicle/construction debris found at interstate sites than at other sites.

Finally, it should be noted that every significant correlation resulting from the proximity indicator analyses was a positive value. That is, in each of these cases there was *more* of a certain type of litter found at the indicated sites. In no instance did sites associated with a given proximity indicator have *significantly less* litter of the given category.

Beautification

A separate correlation test was run to evaluate the impact of beautified areas on littering rates. In this case, every category of litter was **significantly** lower in beautified areas except for vehicle and construction debris, the one type of litter that is less likely to be intentionally littered except for instances of illegal dumping. The results of this correlation analysis are shown in Table 7.

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Table 7 - Correlations between Litter Categories and Beautification

Correlation Tests For Beautification	
Bev. Containers and Related	-0.30
Cup-Related	-0.37
Take-Out Food Packaging	-0.27
Candy/Snack Packaging	-0.31
Bags	-0.31
Napkins/Tissues	-0.21
Paper	-0.24
Vehicle/Construction	-0.08
Packing Materials	-0.22
Tobacco-Related	-0.23
Home Items	-0.30
Other Items	-0.29
Total	-0.35

This suggests that planting and maintenance of greenery-related projects can help to reduce littering and thus enhance neighborhoods and public areas.

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Broader Study Aspects

The scope of ongoing litter abatement was broadened in 2017 to include development of a curriculum focused on litter surveying and abatement. This curriculum was designed by a project team that included the NJCCC, ERP and Rutgers Office of Continuing Professional Education. This included workshops and field training, used to instruct county and municipal coordinators, students and other interested stakeholders on the proper methods of conducting their own follow-up litter surveys based on Visible Litter Survey (VLS) procedures. The curriculum then focused on how to interpret the data, develop and implement plans to effectively reduce litter in their areas.

Based on that, a number of coordinators conducted a VLS in their area and submitted reports to ERP in 2018 and in 2019. ERP analyzed the resulting data for both sets of studies and provided a summary of the results to NJCCC.

In 2019, coordinators surveyed 41 hotspot sites statewide compared to 62 sites in 2018. However, they tallied 29,161 items in 2019, an increase of 33 percent over the previous year (21,969). Table 7 compares the top 10 items identified in the coordinators' surveys in 2018 and 2019.

Table 8 - Coordinators Litter Survey Top 10 Items: 2018 vs. 2019

2019 Coordinator's VLS: Top 10 Items		2018 Coordinator's VLS: Top 10 Items	
Item	Percent	Item	Percent
Cigarette Butts	14.6%	Cigarette Butts	12.5%
Candy/Snack Wrappers	8.3%	Straws/Wrappers/Stirrers	8.9%
Bottle Caps	7.2%	Beer Containers	8.7%
Non-Container Plastic Pieces	6.8%	Candy/Snack Wrappers	6.1%
Beer Containers	6.5%	Fast Food Wrappers	5.8%
Plastic Grocery Bags	6.0%	Plastic Grocery Bags	5.0%
Water Bottles	4.6%	Water Bottles	5.0%
Cups	4.0%	Cups	4.8%
Construction Materials	3.4%	Soft Drink	4.2%
Straws/Wrappers/Stirrers	3.3%	Construction Materials	3.1%

Although the site types surveyed by coordinators were different from those surveyed by ERP, it is of interest that both sets of surveys found similar items to be some of the most pervasive littered in 2019: water bottles, snack packages and beer containers.

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Conclusions

Jurisdictions within the State of New Jersey have significant litter abatement, recycling and waste diversion programs in place that have proven to be effective.

- A significant portion of littered items (36.7 percent) would have been recyclable before they were littered. These items include beverage containers, papers and boxes and home bottles, cans and jars typically accepted in curbside recycling programs.
- Beverage containers comprised 25.5 percent of all litter along waterway sites, more than one out of every four items of litter tallied. These items could have easily been recycled.
- Water bottles comprised 8.4 percent of all litter, the highest percentage of any recent litter survey.
- Combined, recyclable water bottles and beer containers comprised 14.1 percent of all littered items.
- Sites in the Gateway Region averaged more than twice the litter compared to the other five regions.
- Sites adjacent to rivers had significantly more litter than all other sites. Basins were the second most littered site type.
- There was 17 percent less litter that accumulated on waterway sites than in similar sites located on roadways throughout the state.
- If compared with the 2017 land-based survey, Essex County showed the greatest increase in litter between 2017 and 2019 while Hunterdon County showed the greatest reduction in litter.
- Beautified areas had significantly lower litter rates than other sites.

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Recommendations

The following recommendations, similar to those noted in 2017, will help contribute to more effective litter abatement strategies in New Jersey.

- Develop programs to address the categories of items most littered, such as beverage containers, while focusing outreach to the identified age groups of litterers.
- Focus litter abatement efforts on areas that still show high amounts of litter and other hotspots that have also been identified.
- Continue to forge litter abatement partnerships that include all stakeholders such as governmental entities, NGOs and industry. Anti-littering efforts that exclude stakeholders limit the opportunity for successful litter abatement considerably.
- Continue promoting programs such as Adopt-a-Highway and Adopt-a-Beach. Ensure that relevant metrics (such as the bags of litter collected and the most frequently found items) are tracked. This will help to direct the focus of litter abatement programs more effectively.
- Monitor and enforce littering violations caused by trash and recycling collection vehicles. Littering can result when these vehicles are improperly secured during the collection and transportation process.
- Track number of citations issued vs. number of fines paid. This will give an idea of the importance both law enforcement and the judiciary system place on the seriousness of litter. Income from fines and enforcement actions should go directly into municipal and county Clean Communities accounts.
- Expand the use of hidden cameras in areas where wide-spread littering and illegal dumping occur. This will allow officials to record the license plates of offending vehicles for enforcement activities.
- Ensure that all funds generated by material restriction taxes or fees continue to be dedicated solely to litter abatement programs.
- Work with local municipalities to replace 13-gallon recycling bins with closed top recycling carts. This will help reduce the incidence of unintentional litter due to overflow and wind/rain.
- Expand opportunities to recycle beverage containers away from home.
- Encourage beautification projects to help reduce littering.
- Consider amendments to the 2008 Clean Communities Program Act that will support recommendations and ensure a stable future for New Jersey Clean Communities.

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Appendix

Appendix A - Litter by Item, Material and Percent

Appendix B - Litter Categories and Descriptions

Appendix C - List of Roadway Sites

Appendix D - GIS Map of All Sites

Appendix E - Firm Qualifications

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Appendix A – Litter Components

Table 9 - Litter Components by Percentage

Litter Component	Percent
Water Plastic Bottles	8.6%
Plastic Sweet Snack Pkg	5.3%
Other Paper	5.0%
Other Plastics - Hard	4.5%
Tires	3.7%
Beer Cans	3.6%
Shrink Wrap/Dry Cleaner Bags, etc.	3.5%
Plastic Salty Snack Pkg	3.0%
Towels/Napkins - No Brand	2.9%
Packs, Matches, Lighters	2.8%
Home Articles	2.6%
Paper Cups	2.4%
Plastic Cups	2.3%
Plastic Cup Lids	2.3%
Soft Drink Plastic Bottles	2.3%
Construction Debris	2.3%
Plastic Straws/Wrappers	2.2%
Foam Cups	2.2%
Vehicle Parts	2.2%
Auto Foam Insulation	2.1%
Corrugated Boxes	2.0%
Plastic Retail Bags - No Brand	1.9%
Block Foam	1.8%
Plastic Leaf/Trash Bags	1.7%
Wine/Liquor Plastic Bottles	1.7%
Sports Drink Plastic Bottles	1.4%
Plastic Retail Bags - Brand	1.4%
Soft Drink Cans	1.1%
Wine/Liquor Glass Bottles	1.1%
Beer Bottles	1.0%
Foil Food Wrappers	0.9%
Business Paper	0.9%
Zipper Bags	0.9%
Rags	0.8%
Plastic Condiment Pkg	0.8%
Juice Plastic Bottles	0.7%
Plastic Food Jars/Bottles/Cups	0.7%
Clothing	0.7%
Newspaper	0.7%
Peanut Foam	0.6%
Paperboard	0.5%
Foam Plates	0.5%

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Litter Component	Percent
Non-Beverage Glass	0.5%
Sports Drink Cans	0.5%
Paper Clamshells	0.5%
Other plastic shells/boxes	0.5%
Toiletries/Drugs	0.5%
Paper Beverage Cartons	0.4%
Other (Describe)	0.4%
Napkins - Brand	0.4%
Construction Foam	0.4%
Plastic Utensils	0.3%
Gum Wrappers	0.3%
Paper Sweet Snack Pkg	0.3%
Cardboard	0.3%
Paper Food Wrappers	0.3%
Container Lids	0.3%
Tea Plastic Bottles	0.3%
Syringes/Drug-Related Items	0.3%
Paper Fast Food Carrying Bags	0.3%
Paper Plates	0.2%
Paper Straws/Wrappers	0.2%
Broken Glass Bottles	0.2%
Foam Clamshells	0.2%
Ads/Signs/Cards	0.2%
Soft Drink Glass Bottles	0.2%
Tea Glass Bottles	0.2%
Air-Filled Plastic Cushions	0.2%
Plastic Food Wrappers	0.1%
Juice Aseptic Containers	0.1%
Six-Pack Rings	0.1%
Paper Salty Snack Pkg	0.1%
Paper Retail Bags - No Brand	0.1%
Metal Food Jars/Bottles/Cups	0.1%
Paper Packing	0.1%
Aerosol Cans	0.1%
Juice Composite Containers	0.1%
Juice Glass Bottles	0.1%
Tea Cans	0.1%
Glass Food Jars/Bottles/Cups	0.1%
Non-Food Foil	0.1%
Games, CDs, Rec. Equipment	0.1%
Paper Retail Bags - Brand	0.1%
Water Glass Bottles	0.1%
Tea Aseptic Containers	0.1%
Plastic Plates	0.1%
Sweet Snack Sticks	0.1%
Retail Food/Non-Food/Ice Bags	0.1%

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Litter Component	Percent
Take-Out Food Boxes	0.0%
Juice Cans	0.0%
Coffee Cans	0.0%
Plastic Clamshells	0.0%
Plastic Trays	0.0%
Foam Trays	0.0%
Reusable Bags	0.0%
Paper Leaf/Trash Bags	0.0%
Appliances	0.0%
Other Food Storage Items	0.0%
Water Cans	0.0%
Wine/Liquor Cans	0.0%
Plastic Bottle Caps/Seals	0.0%
Paper Bottle Seals	0.0%
Metal Bottle Caps	0.0%
Beverage Cartons - Other	0.0%
Cups - Composite	0.0%
Plastic Cups - Pieces	0.0%
Metal Cups	0.0%
Paper Trays	0.0%
Paper Condiment Pkg	0.0%
Metal Utensils	0.0%
Salty Snack Pkg - Other	0.0%
Plastic Fast Food Carrying Bags	0.0%
Tissues	0.0%
Plastic Food Wrappers/Cartons	0.0%
Paper Food Wrappers/Cartons	0.0%
Lg Plastic Milk/Juice Containers	0.0%
Lg Aseptic Milk/Juice Containers	0.0%
Magazines	0.0%
Books	0.0%
Carpet	0.0%
Peanut: Non-Foam	0.0%
Furniture	0.0%
Yard Waste	0.0%
Non-Food Containers	0.0%
Ceramic	0.0%
Food	0.0%

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Appendix B – Litter Categories

Table 10 - Litter Categories and Descriptions

#	Litter Category	Type	Composition
1	Beverage Containers	Beer	Metal
2	Beverage Containers	Beer	Glass
3	Beverage Containers	Juice	Metal
4	Beverage Containers	Juice	Plastic
5	Beverage Containers	Juice	Composite
6	Beverage Containers	Juice	Aseptic
7	Beverage Containers	Soda	Glass
8	Beverage Containers	Soda	Metal
9	Beverage Containers	Soda	Plastic
10	Beverage Containers	Sports	Metal
11	Beverage Containers	Sports	Plastic
12	Beverage Containers	Tea	Glass
13	Beverage Containers	Tea	Metal
14	Beverage Containers	Tea	Aseptic
15	Beverage Containers	Tea	Plastic
16	Beverage Containers	Water	Metal
17	Beverage Containers	Water	Plastic
18	Beverage Containers	Water	Glass
19	Beverage Containers	Wine/Liquor	Glass
20	Beverage Containers	Wine/Liquor	Plastic
21	Beverage Containers	Wine/Liquor	Metal
22	Beverage Containers	Broken Bottles	Glass
23	Beverage-Related	Bottle Caps/Seals	Plastic
24	Beverage-Related	Bottle Caps/Seals	Paper
25	Beverage-Related	Bottle Caps	Metal
26	Beverage-Related	Six-Pack Rings	Plastic
27	Beverage-Related	Beverage Cartons	Comp/Other
28	Beverage-Related	Beverage Cartons	Paper
29	Cups-Related	Cups	Comp/Other
30	Cups-Related	Cups	Plastic
31	Cups-Related	Cups Pieces	Plastic
32	Cups-Related	Cups	Paper
33	Cups-Related	Cups	Foam
34	Cups-Related	Cups	Metal
35	Cups-Related	Cup Lids	Plastic
36	Cups-Related	Straws/Wrappers	Paper
37	Cups-Related	Straws/Wrappers	Plastic
38	Take-Out Food Packaging	Food Wrappers	Paper
39	Take-Out Food Packaging	Food Wrappers - Foil	Metal
40	Take-Out Food Packaging	Clamshells	Paper
41	Take-Out Food Packaging	Clamshells	Plastic
42	Take-Out Food Packaging	Clamshells	Foam
43	Take-Out Food Packaging	Boxes	Paper

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#	Litter Category	Type	Composition
44	Take-Out Food Packaging	Plates	Paper
45	Take-Out Food Packaging	Plates	Plastic
46	Take-Out Food Packaging	Plates	Foam
47	Take-Out Food Packaging	Trays	Plastic
48	Take-Out Food Packaging	Trays	Foam
49	Take-Out Food Packaging	Trays	Paper
50	Take-Out Food Packaging	Condiment Packaging	Paper
51	Take-Out Food Packaging	Condiment Packaging	Plastic
52	Take-Out Food Packaging	Utensils	Metal
53	Take-Out Food Packaging	Utensils	Plastic
54	Candy/Snack Packaging	Sweet Snack Packaging	Wood
55	Candy/Snack Packaging	Sweet Snack Packaging	Composite
56	Candy/Snack Packaging	Sweet Snack Packaging	Plastic
57	Candy/Snack Packaging	Sweet Snack Packaging	Paper
58	Candy/Snack Packaging	Salty Snack Packaging	Paper
59	Candy/Snack Packaging	Salty Snack Packaging	Plastic
60	Candy/Snack Packaging	Salty Snack Packaging	Composite
61	Bags	Retail - Brand	Plastic
62	Bags	Retail - Brand	Paper
63	Bags	Retail - No Brand	Plastic
64	Bags	Retail - No Brand	Paper
65	Bags	Reusable	Plastic
66	Bags	Non-Retail: Leaf/Trash	Paper
67	Bags	Non-Retail: Leaf/Trash	Plastic
68	Bags	Retail Food/Non-Food/Ice	Plastic
69	Bags	Fast Food Carrying Bags	Plastic
70	Bags	Fast Food Carrying Bags	Paper
71	Bags	Zipper Bags	Plastic
72	Bags	Shrink Wrap/Dry Cleaner Wraps	Plastic
73	Napkins/Tissues	Napkins - Brand	Paper
74	Napkins/Tissues	Towels/Napkins - No Brand	Paper
75	Napkins/Tissues	Tissues	Paper
76	Home Food Containers	Food Jars/Bottles/Cups	Glass
77	Home Food Containers	Food Jars/Bottles/Cups	Plastic
78	Home Food Containers	Food Jars/Bottles/Cups	Metal
79	Home Food Containers	Food Wrappers/Cartons	Plastic
80	Home Food Containers	Food Wrappers/Cartons	Paper
81	Home Food Containers	Large Milk/Juice Containers	Plastic
82	Home Food Containers	Large Milk/Juice Containers	Aseptic
83	Paper	Newspaper	Paper
84	Paper	Magazines	Paper
85	Paper	Books	Paper
86	Paper	Ads/Signs/Cards	Paper
87	Paper	Corrugated Boxes	Paper
88	Paper	Lottery Tickets	Paper
89	Paper	Other Paper	Paper
90	Vehicle/Construction	Construction	Foam

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#	Litter Category	Type	Composition
91	Vehicle/Construction	Construction	Plastic
92	Vehicle/Construction	Construction	Metal
93	Vehicle/Construction	Construction	Glass
94	Vehicle/Construction	Construction	Composite
95	Vehicle/Construction	Construction	Wood
96	Vehicle/Construction	Vehicle	Plastic
97	Vehicle/Construction	Vehicle	Metal
98	Vehicle/Construction	Vehicle	Glass
99	Vehicle/Construction	Vehicle	Rubber
100	Vehicle/Construction	Vehicle	Composite
101	Cloth/Fabric	Clothing	Cloth
102	Cloth/Fabric	Carpet	Cloth
103	Cloth/Fabric	Non-Clothing Fabric	Cloth
104	Packing Materials	Air-Filled Plastic Cushions	Plastic
105	Packing Materials	Block Foam	Foam
106	Packing Materials	Peanut Foam	Foam
107	Packing Materials	Peanut: Non-Foam	Foam
108	Packing Materials	Paper Packing	Paper
109	Other Metal	Aerosol Cans	Metal
110	Other Metal	Appliances	Metal
111	Other Metal	Container Lids	Metal
112	Other Wood	Furniture	Wood
113	Other Wood	Yard Waste	Wood
114	Tobacco-Related	Packs, Matches, Lighters	Composite
115	Other Hard Plastics	Other Hard Plastics	Plastic
116	Other Items	Non-Food Containers	Plastic
117	Other Items	Ceramic	Other
118	Other Items	Food	Plastic
119	Other Items	Food	Composite
120	Other Items	Games, CDs, Recreational Equip.	Composite
121	Other Items	Glass	Glass
122	Other Items	Home Articles	Composite
123	Other Items	Toiletries/Medicines	Composite
124	Other Items	Syringes/Drug Paraphernalia	Composite
125	Other Items	Other (Describe)	Other

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Appendix C – List of Sites

Table 11 – Waterway Sites, Types and Descriptions

#	City/Twp.	Site Description	Type
N-01	Hackettstown	Musconetcong River bank near Hwy 46	River
N-02	Sparta Twp.	015S15.46: Rt 15 South/Lafayette Road @ Wilson Dr.	Basin
N-03	Hamburg Bor.	094N35.40: Rt 94 North/Ames Blvd @ Walkkill Ave.	Basin
N-04	Riverdale	023N12.92: Rt 23 @ I-287	Basin
N-05	Parsippany	Lake Parsippany near Lakeshore Dr and I-287	Lake
N-06	Parsippany-Troy Hills	287S42.88: I-287 South @ US-202/Parsippany Blvd.	Basin
N-07	Parsippany	Troy Brook at Forge Pond in Parsippany-Troy Hills	Brook
N-08	Chester	206N86.80: US-206 North @ Shopping Center	Basin
N-09	Flanders	Drakes Brook inlet near Hillside Ave in Mt. Olive Twp.	Brook
N-10	Butler	Pequannock River behind Butler Printing	River
N-11	West Milford	Banks of Brook behind 1200 W Brook Rd.	Brook
N-12	Paterson	Passaic River next to County Rt 640	River
N-13	Woodland Park	080W57.17: Squirrelwood Rd. entrance loop to I-80 W	Basin
N-14	Wayne	202S62.89: Rt 23 @ Greenwood Ave near US-202	Basin
N-15	Haskell	Rainbow Lake next to walkway near Doty Rd.	Lake
N-16	Englewood	Boat dock at Englewood Boat Basin at Hudson River	River
N-17	Englewood	Ross Dock Picnic Area - Riverfront at Hudson River	River
N-18	Tenafly	Hudson River at Palisades Interstate Riverfront Park	River
N-19	River Edge	Hackensack River under walking bridge from New Bridge Rd.	River
N-20	Oakland	287N58.86: I-287 North x58/Rt 202 @ Ramapo Valley Rd.	Basin
N-21	Mahwah	Ramapo River next to Halifax Rd 1720 feet west of Rt 202	River
N-22	Hawthorne to Wyckoff	Edge of Deep Brook under SR-208 in Hawthorne	River
N-23	Palisades Park Bor.	005W0.47: Rt 5 West @ Delia Blvd and Gatewood Blvd.	Basin
N-24	Upper Saddle River	017N22.55: Rt 17 North @ Mountainview Rd under E Crescent Ave.	Basin
N-25	Edgewater	Hudson River near Chase Mortgage on River Rd.	River
N-26	Union City	Hudson River at Weehawken Recreation Pier	River
N-27	Jersey City	Hudson River at Liberty State Park near NJ Terminal	River
N-28	Jersey City	Hackensack River behind Marshalls & Home Goods	River
N-29	Kearney	Hackensack River off of Belleville Turnpike (Hwy 7) near I-95	River
N-30	Jersey City	Upper Bay of NY Harbor Pier at 2 Chapel Ave.	Bay
N-31	Jersey City	Morris Canal Basin at Warren St. Pier past Pier House Condo	Canal
N-32	South Orange	Branch Brook Lake along walkway parallel to Branch Brook Park Dr.	Lake
N-33	Bloomfield	Third River next to Park Drive in Nutley	River
N-34	Jersey City	001TS4.13:US-9 exit loop	Basin
N-35	Livingston	Canoe Brook at 93 County Route 634 (Laurel Ave.)	Brook
N-36	West Orange	Crystal Lake behind Eagle Rock Lanes @ 424 Eagle Rock Ave.	Lake
N-37	Newark	021N2.83: Rt. 12 N at Lombardy Street exit near Passaic River	Basin
N-38	Bloomfield	Third River underneath walking bridge behind Oakes Pond	River
N-39	Scotch Plains	Shackamaxon Lake under bridge at 100 Tillinghast Turn	Lake
N-40	Berkeley Heights Twp.	078E44.75: I-78 E/Phillipsburg-Newark Expwy @ Glenside Ave.	Basin
N-41	Rahway	Robinson's Branch of Rahway River under W Grand Ave.	River

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#	City/Twp.	Site Description	Type
N-42	Union	Elizabeth River at Elizabeth River Park in Hillside	River
N-43	Summit	Lake Surprise Boat Launch off W R Tracey Dr.	Lake
N-44	South Amboy	Raritan Bay at Raritan Bay Waterfront Park next to walkway	Bay
N-45	East Brunswick	Raritan River bank at Edison Boat Basin and River Walk	River
N-46	Piscataway Twp.	Raritan Canal bank at Delaware and Raritan Canal State Park Trail	Canal
N-47	Woodbridge	Smith's Creek bank from 536 Cliff Rd.	Creek
N-48	Monroe Twp.	Lake Manalapan from Thompson Park	Lake
N-49	East Brunswick	South River bank under Main Street bridge near 10 Washington Rd.	River
N-50	Edison	Roosevelt Park Lake bank next to walking path near Oak Dr.	Lake
N-51	Old Bridge Twp.	Deep Run Lake behind Deep Run Drive behind trash dumpsters	Lake
N-52	New Brunswick City	018S41.14: Rt. 18 South/Burnet Street/Memorial Pkwy.	Basin
N-53	Plainsboro Twp.	001N12.34: US-1/Brunswick Pike near Hospital Dr.	Basin
S-01	Asbury	Spruce Run Reservoir near Spruce Run Rec. Area	Reservoir
S-02	Basking Ridge	Black Brook on 442 New Vernon Road in Gillette	Brook
S-03	Warren	Dead River off Dead River Road near I-78 in Bernards	River
S-04	Bedminster Twp.	078E29.95: I-78 East/Phillipsburg-Newark Expwy in the median	Basin
S-05	Trenton	Indian Run /Indian Lake at 99 Church Street in Allentown	Run
S-06	Lawrence Twp.	Delaware and Raritan Canal at 207 Bakers Basin Rd.	Canal
S-07	Robbinsville	Miry Run near East Lake Park next to 258 Hutchinson Rd.	Lake
S-08	Trenton	Delaware and Raritan Canal at 599 W Hanover St.	Canal
S-09	Belmar	Polypod Brook at 353 Monroe Avenue in Spring Lake	Brook
S-10	Colts Neck	Trout Brook at 600 Lovett Rd in Middletown	Brook
S-11	Hazlet	195E27.17 #1: I-195x28A/Plover Brook @Rt. 9	Basin
S-12	Wall Twp.	Mill Run near Allaire Village	Run
S-13	Belmar	Shark River behind walkway at the back of Maclearie Park	River
S-14	Freehold	Manasquan River under County Rt 23 near Strickland Rd.	River
S-15	Neptune City	Jumping Brook near Green Grove Rd near Rt. 66	Brook
S-16	Millstone Twp.	195E16.71 #2: I-195 East @ Monmouth Rd.	Basin
S-17	West Creek	Cedar Creek at 1347 E Bay Ave/Rt 50 in Stafford Twp.	Creek
S-18	Stafford Twp.	072E21.45: Rt 72 East/Barnegat Road @ entrance ramp	Basin
S-19	Seaside Park	Barnegat Bay behind Island Beach State Pk. Marina	Bay
S-20	Brick Twp.	070W56.10: Rt 70 North/JD Rockefeller Mem. Hwy @ Van Zile Rd.	Basin
S-21	Lacey Twp.	Stouts Creek/Barnegat Bay behind Sunrise Beach Pavilion	Creek
S-22	Toms River	037E4.02: Rt 37 East @ Bananier Drive/Romana Ln.	Basin
S-23	Medford	070E12.50: I-70 East @ Old Marlton Pike	Basin
S-24	Evesham	073N25.75A: I-73 North @ Lincoln Dr.	Basin
S-25	Pemberton	North Branch Rancocas Creek under 172 Hanover St. bridge	Creek
S-26	West Berlin	073N16.04: Jackson Road @ Rt 73 N	Basin
S-27	Haddon Heights	Newton Creek next to 7 Kendall Blvd.	Creek
S-28	Oaklyn	Newton Lake near Newton Lake Park near 1013 Lakeshore Dr.	Lake
S-29	Cherry Hill	Cooper River stream behind 1728 Haddonfield-Berlin Rd.	River
S-30	Waterford Twp.	073N15.47: Rt 73 N/Fredrick St. after bridge on right side	Basin
S-31	Penns Grove	Kates Creek under 145 County Road 551/N Hook Rd.	Creek
S-32	Egg Harbor Twp.	Clam Creek near Absecon Inlet behind Golden Nugget Casino	Creek
S-33	Ocean View	Cedar Swamp Creek under Tuckahoe Road in Woodbine	Creek
S-34	Mays Landing	040W50.11: Corner of Rt 40 West/Harding Hwy.	Basin

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#	City/Twp.	Site Description	Type
S-35	Newfield	Willow Grove Lake under County Hwy 639	Lake
S-36	Millville	055S24.68: Rt 55 @ Rt. 49	Basin
S-37	Glassboro	055S48.90: Rt 55 S @ Ellis Mill Rd.	Basin
S-38	Woolwich	Oldmans Creek under 16 Main St./Auburn Rd.	Creek
S-39	Monroe Twp.	322E26.70: US-322 E @ West Malaga Rd.	Basin
S-40	Upper Twp.	050S4.45: Rt 50 S @ Sunset Dr.	Basin
S-41	Upper Twp.	Great Egg Harbor Bay near Beesley's Point Beach	Bay

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Appendix D - Sites Map

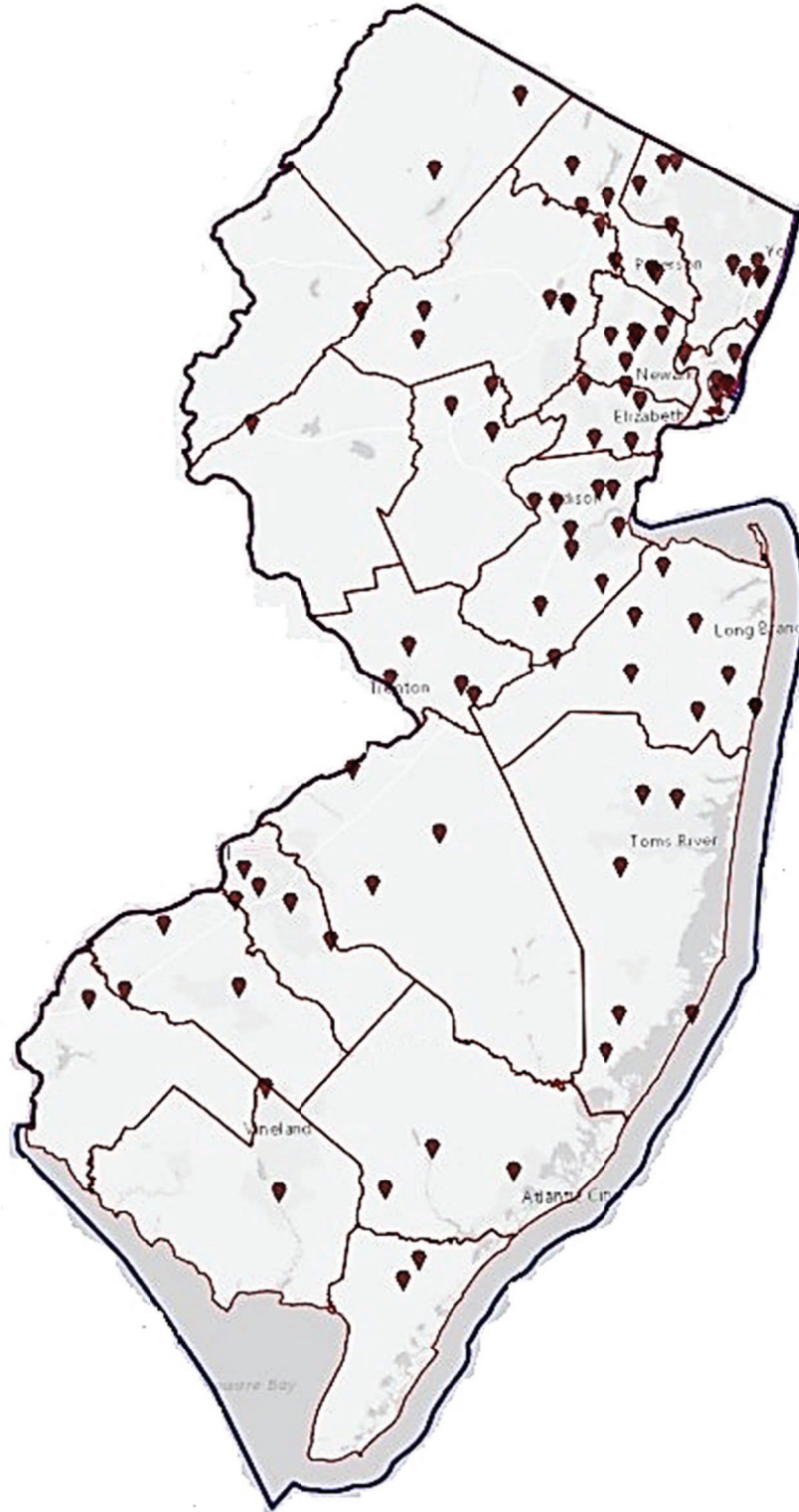


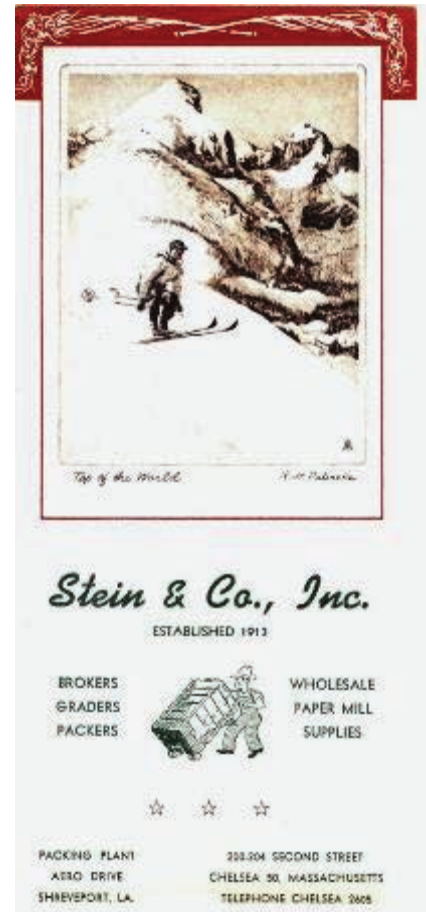
Figure 8 - Map of Sites Surveyed

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Appendix E - Firm Qualifications

Environmental Resources Planning, LLC (ERP) is an analytics firm focusing exclusively on litter surveys and litter-related research. Field crews under our supervision have surveyed more than 40 million square feet of roadways and recreational areas in a number of states and cities throughout North America. Our litter survey work and support include:

- New Jersey Waterways Litter Survey (2019)
- Texas Statewide Litter Survey (2019)
- Ohio Statewide Litter Survey (2019)
- Stump Sound, NC Litter Survey (2019)
- Fairfax County, VA Litter Sources Survey (2019)
- New Jersey Litter Survey (2017)
- Los Angeles Area Litter Surveys (2017-2019)
- Honolulu Litter Index Surveys (2016-2019)
- Honolulu Litter Study (2016)
- Anacostia Statewide Litter Survey (2015)
- Rhode Island Litter Survey (2014)
- Texas Statewide Litter Survey (2013)
- Toronto, ON Citywide Litter Survey (2012)
- Oakland, CA Citywide Bag Litter Survey (2012)
- San Francisco, CA Citywide Bag Litter Survey (2012)
- Washington, DC Citywide Bag Litter Survey (2012)
- Maine Statewide Litter Survey (2010)
- New Hampshire Statewide Litter Survey (2010)
- Vermont Statewide Litter Survey (2010)
- KAB National Litter Survey and Cost Study (2009)
- KAB Community Appearance Index (2008)
- KAB Litter - Literature Review (2007)
- Georgia Statewide Litter Survey (2006)
- Tennessee Statewide Litter Survey (2006)
- Santa Monica, CA Citywide Beach Litter Surveys (2005)
- Malibu, CA Citywide Beach Litter Surveys (2005)
- New Jersey Statewide Litter Survey (2004)



The firm's roots date back more than 100 years when Mr. Stein's family opened their first recycling facility. His litter-related work began with a KAB affiliate project in 1986.

Mr. Stein's litter studies and research have been featured in *National Geographic* magazine, the *New York Times* and *Time* magazine as well as on *ABC's Good Morning America* and *NPR*.

He was invited, as a subject-matter expert, to participate in a study on community resilience and resource optimization conducted for the President in 2010.

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Mr. Stein earned his B.Sc. Cum Laude in *Environmental Studies* from *Syracuse University* and *SUNY College of Environmental Science and Forestry* studying *Waste Management* and *Environmental Law* while interning with the NYS Department of Environmental Conservation. He also earned his M.Sc. in *Natural Resource Policy and Management* there.

He was awarded a scholarship by New York SWANA for his Master's thesis research, examining the impacts of public policy intervention on sustainable recycling markets. He also began a doctorate program that focused on identifying underlying cultural influences on littering rates.

In addition, Mr. Stein has been active in numerous activities and writing related to litter and marine debris including, most recently:

- Litter Prevention White Paper (2019)
- California State Water Board - Technical Assessment of Statewide Water Quality Plans to Control Storm Water Trash (2014)
- Florida Litter Prevention Program - Advisor (2014)
- San Francisco Water Board - Presentation on Measuring Trash TMDL Compliance and Load Reductions (2013)
- Ocean Conservancy - Beach Litter Survey Methodology Enhancements (2011)
- National Litter Forum - Restoring Our Communities, Organizer (2011)
- Keep America Beautiful - International Litter Research Forum (2007)
- Keep America Beautiful - Litter: Literature Review, Lead author (2007)
- Potomac Watershed Initiative Trash Monitoring Protocol Subcommittee - Survey design advisor, pro bono (2006-2007)
- Ocean Conservancy's National Marine Debris Monitoring Program - Survey director for Chincoteague Island Site, pro bono (2006-2007)

Other senior staff on this project:

Kristian Ferguson, Senior Consultant, has managed field surveys and assisted with analysis and cost studies for litter projects throughout the U.S. and Canada. He received his B.Sc. in Geography and, while receiving his Master's Degree, he presented a capstone seminar focusing on the relationship between litter and solid waste management.

Emilie Knapp, Assistant Project Manager, has helped plan all aspects of field survey work, supervised field crews, conducted data management and coordinated the site selection process for 10 litter surveys nationwide. In this role, she has surveyed more than 10 million square feet of roadways. She earned an A.A. in Business Management and subsequently a B.A.

Ron Visco, Project Statistician, holds a Ph.D. in Research Design and Statistics from Princeton University. Dr. Visco conducted the statistical analysis for the firm's litter-related projects in Anacostia, Maine, New Hampshire, New Jersey, North Carolina, Oakland, Ohio, Rhode Island, San Francisco, Texas, Toronto, Vermont and Washington, DC.

2019 New Jersey Litter Survey

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