LITTER GITTER
FEASIBILITY IN URBAN WATERS

A Report By CHATTAHOOCHEE RIVERKEEPER®

September 2020

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EXECUTIVE SUMMARY

The following report discusses the use of floating in-stream litter collection devices, known as “Litter Gitters,” to reduce litter pollution from urban stormwater runoff in Atlanta, Georgia. This report was produced as part of a program administrated by Chattahoochee Riverkeeper and funded through a grant from the Coca-Cola Foundation. Using the Litter Gitter Pilot Program installations in Proctor Creek as an example, this report will discuss the strengths and weaknesses of the trash trap and recommendations for organizations interested in implementing similar programs. The objective of this publication is to provide government agencies, non-profit organizations, private businesses, watershed and community groups, and other interested parties actionable information regarding the potential for these devices to assist in achieving trash-free waterways.

ABOUT

Chattahoochee Riverkeeper is a 501(c)(3) organization whose mission is to educate, advocate and secure the protection and stewardship of the Chattahoochee River, including its lakes, tributaries and watershed, in order to restore and conserve their ecological health for the people and wildlife that depend on the river system and in recognition of the important ecosystem functions provided throughout the region and planet. Since 1994, CRK has worked with our members, donors, partners, and other stakeholders to protect the river’s health and promote an ethic of river stewardship from the north Georgia mountains to the Florida border. Riverkeeper Jason Ulseth and Watershed Protection Specialist Jordan Yu manage CRK’s In-stream Trash Removal Program and the Litter Gitter Pilot Program.

ACKNOWLEDGEMENTS

We would like to thank the Coca-Cola Company and the Coca-Cola Foundation for supporting this project. The City of Atlanta and Atlanta Department of Watershed Management provided invaluable assistance. We would like to thank Osprey Initiative LLC, without whom the Litter Gitters would not exist. We would also like to thank the Georgia TRADE-UP crewmembers who, through our collaboration with Groundwork Atlanta, helped clean out the trash traps. We thank the West Atlanta Watershed Alliance and the National Recreation and Parks Association for bringing national attention the Proctor Creek watershed. Lastly, we are grateful to the parks officials and property owners who shared invaluable information and allowed us to use their land for this project.

INTRODUCTION

PLASTIC CRISIS

All humans rely on clean water. From electrical production and agriculture to bathing and recreation, we depend on safe access to unpolluted waterways. However, collective access to this crucial resource is being threatened. The volume of litter and garbage in our rivers, lakes, and oceans has become a global crisis and plastic waste is fast becoming a dominant form of pollution in urban waterways. From microplastics bioaccumulating in fish to vast garbage patches expanding in our oceans, plastics and other aquatic trash have begun to have ripple effects throughout the world's ecosystems that will last for centuries. Water-borne refuse can endanger the health of people and wildlife as well as prevent waterways from being used for beneficial purposes (Environmental Protection Agency, 2020). Floating litter reduces the aesthetic, recreational, and commercial value of urban waterways and it is imperative that immediate action is taken to alleviate this problem.

Much of the litter found in our waterways is composed of single-use plastic products carried through urban stormwater systems from impervious surfaces – like parking lots and roads – into creeks and lakes (State Water Resources Control Board, 2020). Litter in urban waterways impedes normal stream flow, decreases visibility, and decomposes due to sun exposure and weathering. These small decomposed plastic fragments, called microplastics, can act as sponges for other water-borne pollutants and can accumulate in the bodies of fish and birds. Municipal water treatment facilities do not generally remove microplastics and microplastics have been found in both bottled water and municipal tap water (WHO, 2019). To address microplastic pollution specifically, steps must be taken to remove litter from waterways before it degrades.

Solving the floating litter and microplastic problem will require multifaceted strategies including the use of inexpensive and easy-to-deploy litter-collection technology. Studies show that approximately 80% of the trash found in waterways originates on land (Environmental Protection Agency, 2020). Thus, there is an immense need for interventions that both prevent trash from accumulating in urban ecosystems and remove floating litter once it enters urban waterways. Given the costs involved in removing litter from oceans, the need to extricate litter before it degrades, and the ability of urban waterways to collect and concentrate trash, in-stream litter-collection devices intended for small "feeder" tributaries have emerged as a promising solution.

PROCTOR CREEK PILOT PROGRAM

Originating near downtown Atlanta, the Proctor Creek watershed is heavily urbanized resulting in large swaths of impervious groundcover. The watershed is subject to significant impacts related to stormwater, illegal trash dumping, aging sewer infrastructure, industrial pollution, and eroded stream banks. Urban stormwater flowing down Proctor Creek deposits large volumes of litter on the creek's banks and transports more as it empties into the Chattahoochee River. The Proctor Creek watershed is home to some of Atlanta's most historically disadvantaged communities, who have been organizing and working to improve their neighborhoods and environment.

In recent years, the Proctor Creek watershed has seen a surge in investment from both public and private sector organizations, with commercial development, infrastructure investment, and environmental restoration efforts changing the neighborhood dramatically. Development of the Westside Reservoir Park, Westside Beltline, and Proctor Creek Greenway have only furthered outside interest in the creek's ecological health. These factors combined with the proximity to Chattahoochee Riverkeeper and Coca-Cola world headquarters made Proctor Creek an ideal testing ground for small, in-stream litter collection devices through the collaborative Litter Gitter Pilot Program. Funded through a grant from Coca-Cola and involving a variety of partner organizations, the pilot program operated from June 2019 to June 2020.

Figure 1: Installation of first Litter Gitter in Proctor Creek, June 2019

TECHNICAL CONSIDERATIONS

TRAP DESIGNS

The litter-collection devices used in the pilot program were developed by the Alabama-based environmental contractor Osprey Initiative LLC. At the outset of the program in June 2019 Osprey staff installed a prototype trash trap called the "Litter Gitter." The Litter Gitter is a small-stream litter collection device designed to catch floating trash from stormwater runoff. It uses floating booms to guide floating trash into a wire-mesh container, which can be emptied after a rainstorm. The whole device floats on the water allowing heavy objects and wildlife to pass underneath. This initial version of the Litter Gitter design used a collection basket constructed from PVC pipe with a thin wire mesh forming the basket walls. The floating booms were made from rope and foam tubes. This design was quick to manufacture, ultra-lightweight, and inexpensive. However, these prototypes were not intended to be a permanent solution for urban streams and were replaced with updated designs during the pilot program.

Figure 2: Prototype "Litter Gitter" trash trap along Proctor Creek at Maddox Park, June 2019

Figure 3: Aluminum "Litter Gitter" at Maddox Park, December 2019

Although inexpensive, the ultra-lightweight prototype Litter Gitter devices were not durable enough for the flashy flows in Proctor Creek. Buoyancy issues caused the trap's front end to dip below the waterline, reducing the litter-collecting capability. A small basket size also hampered litter collection.

A subsequent design, made from heavy-duty aluminum pipe, fixed many of its predecessor's issues. Also dubbed the "Litter Gitter", the new trap body was made from welded aluminum and featured a 3-inch metal basket mesh. The collection booms were upgraded to larger and more durable fishing floats instead of foam tubes. CRK employed the aluminum designs for most of the project duration. As such, unless specifically mentioned, the term "Litter Gitter" refers to the updated aluminum design and not the initial PVC prototype.

SITE SELECTION

For this pilot program, dozens of potential Litter Gitter installation sites were investigated, both in Proctor Creek and around the Chattahoochee basin. In general, potential sites were assessed using the criteria of streamflow, pollution level, and property access. Throughout the process, it became apparent that jurisdictional concerns often limited potential trash trap installations.

Ideally, Litter Gitters should be placed in canals, ponds, or stream sections where the energy from fast-moving stormwater quickly dissipates. Steady, non-turbulent flows increase the trap efficiency. Situating the traps in a straight stream channel or river section ensures that prevailing currents will guide litter toward the central collection basket. The traps are best suited to relatively shallow, consistent streams that are much wider than the collection basket. Turbulent flow, rocky riverbeds, and dramatic variation in stream width all present potential hazards or efficiency concerns for the device. The traps require less than a foot of water to remain buoyant and placement in shallow streams eases cleanout efforts. Although Litter Gitters can and have operated in ditches and in seasonal or intermittent waterways, these sites should be avoided due to their reduced litter-collection potential.

Assessing the litter-collecting potential of a site is critical. Although simple to transport and install, improperly assessing litter pollution in a site decreases project efficiency. Most urban litter originates not from direct dumping into water bodies, but from stormwater runoff. According to our findings, littered single-use products on sidewalks, parking lots, and other impermeable surfaces are the largest contributors to urban floating trash. Therefore, sites downstream of densely developed residential, industrial, retail, and park districts should be prioritized over less densely developed residential or rural areas. Before installing a Litter Gitter, or any trash trap, visual site inspections should assess the amount of litter near a given stream and the potential for litter-laden stormwater to pass through the stream section.

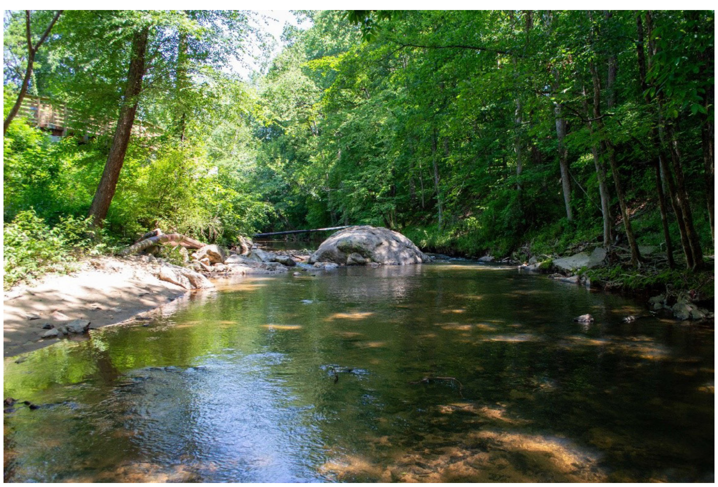

Figure 4: Unobstructed creek beds (shallow enough for wading) ease installation and cleanout

The level of trash-impairment is one of the most important factors when choosing an appropriate site. The State of Georgia's 303(d) impaired streams list provides a comprehensive list of water bodies with specific pollution concerns. Unlike other pollutants such as fecal coliform or mercury, water-borne litter is not a category of stream impairment in Georgia. However, it is worth noting that other categories of impairment, like the inability to support aquatic life, can be affected by the presence of trash.

Assessing streamflow before installation can avoid potential damage during large rain events. United States Geological Survey Streamflow Stations measure hydrological parameters in waterways throughout Georgia. Useful metrics to consider are flow rate (ft^3/s) and gage height (ft). Station data is typically updated on an hourly basis and records from the past 120 days are easily retrievable. A Google Earth layer, as well as the USGS's own website maps the locations of each rain gauge to give a clearer understanding of the station distribution. By using these tools, researchers can avoid placing Litter Gitters in streams with extreme currents or depth changes.

Permission to install the traps on private property proves one of the greatest barriers to Litter Gitter installation. When scouting for potential trash trap locations Chattahoochee Riverkeeper used county-provided tax assessor information to determine the owner of each parcel on which we desired to place a Litter Gitter. Private landowners were often unresponsive to requests to install the untested trash traps on their property. Other landowners were skeptical of the devices and the maintenance commitments and refused permission. For this reason, publicly owned land was prioritized when choosing suitable trap sites. Tracts owned by the City of Atlanta and Fulton County, power and conservation easements, and highway rights-of-way proved most convenient.

Miscellaneous other factors affected site selection. Proximity to schools factored into site assessment as did visibility from pedestrian walkways and roads. Driving and walking access was also critical. Sites must be easily and safely accessible on foot with enough parking and open space in which to stage materials and conduct Escaped Trash Assessment Protocols (ETAPs). Although metal posts can be driven into the stream bank to provide anchor points to the traps, in practice trees proved the most convenient anchors. Sites with mild tree cover allowed for the greatest visibility and access while still providing ample anchor points.

SITE PREPARATION AND INSTALLATION

Preparing a site for a Litter Gitter installation is simple. A site visit to confirm the presence of litter, safety concerns, and to photograph the location can be completed in a matter of minutes. Once a site is chosen, a trap can be installed in a matter of hours. On location, the stream width is measured and boom lengths are calculated. Special attention is given to the presence of underwater hazards, boulders, hanging branches, and any other features that could impact streamflow or trap performance. The Litter Gitters are relatively lightweight but bulky to hold and require a minimum of three people to carry. Boom cables are tied around anchor points (either to metal posts or trees) and buoys are slid down the length. If necessary, placement of the trap within the stream and boom length can be adjusted later.

Figure 5: Aluminum Litter Gitter installation at Maddox Park

STORMWATER DAMAGE

Although the traps functioned well under normal operating conditions, the Litter Gitters were eventually pushed to their breaking point. On January 3, 2020, Atlanta experienced a massive rain event flooding Proctor Creek in a matter of hours. Not since the start of the pilot program had the watershed seen such rainfall in such a short period of time. The USGS Streamflow Gage recorded a rapid 7ft increase in water depth, from 3.5ft to more than 10.5ft – with a discharge rate greater than 2,000 cubic feet per second. For comparison, the discharge rate during dry weather is typically below 30 cubic feet per second.

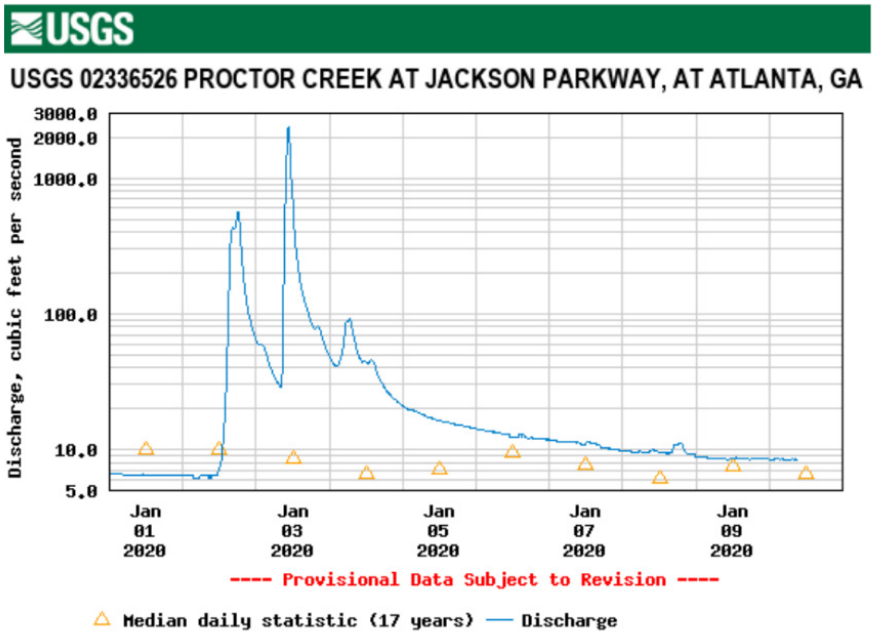

Figure 6: USGS Streamflow Gage in Proctor Creek, January 2020

Below is a photo of the Litter Gitter at Northwest Drive. Laden with trash and overwhelmed by the fast current a linkage connecting the boom to the collection basket broke at the weld point. No longer attached to both anchors, the current pushed the trap to the right creek bank.

Figure 7: Litter Gitter at Northwest Drive, Jan. 8, 2020

Upstream, the Litter Gitter outside of Boyd Elementary failed in a similar way, breaking free from its boom and swinging to the right creek bank. Both traps were replaced in the weeks following the January 3 rainstorm.

Figure 8: PVC Litter Gitter prototype at Boyd Elementary, Jan. 13, 2020

In future projects, assuming flow data are available, care should be taken when placing trash traps in streams where the gage height is expected to exceed 10 feet above normal level or the flow rate exceed 2,500 cubic feet per second. When traps are laden with debris, heavy flows can put unbearable strain on boom connection points. If large storms are predicted, CRK recommends temporarily removing the traps from the water. Where no flow data are available visual observations of the site during large rain events should be conducted. Videos, photographs, and descriptions of the site geography and trap performance during rain events help maintenance crews to diagnose and solve problems. In high flow events, floating trash has been observed slipping underneath boom sections instead of being directed toward the basket. To alleviate this, the trap manufacturer – Osprey Initiative has recommended lengthening the booms to decrease the angle at which the litter contacts the boom.

EDUCATIONAL AND OUTREACH CONSIDERATIONS

EDUCATIONAL OPPORTUNITIES

The Litter Gitters have shown to be a highly popular tool for drawing attention to the plastic crisis. Through CRK's outreach and education program, Riverkeeper staff have presented at two schools in the metro Atlanta area reaching more than 80 students from grades 1-5. After each event, students and teachers were given informational pamphlets, stickers, and "Protect Your Watershed" magnets to distribute. Through multimedia presentations and live ETAP demonstrations, students learned about the water cycle, trash trap operation, forensic trash analysis, and the ways individuals can reduce their ecological footprint.

The trap design is simple enough that student groups are developing their own versions. Students from Mt. Bethel Christian Academy used the Litter Gitters as inspiration for their First Lego League robot design competition. Their after-school robotics club used Osprey's prototype as inspiration for their own remote-controlled litter collection device designed to scoop up floating litter in lakes and ponds.

Figure 9: Osprey Initiative founder Don Bates demonstrates ETAPs to students at Boyd Elementary

Through joint CRK and Osprey presentations, students at Atlanta's Boyd Elementary were introduced to watershed geography concepts, the microplastics crisis, and analyzed the trash collected from around their school. These outreach and education initiatives, especially those aimed at younger generations, are imperative for discouraging littering behavior and building long-term support for in-stream litter collection interventions. There is widespread confusion about sources of urban pollution and apathy toward participating in solutions and these types of educational events counterbalance those forces.

More broadly, by providing the background knowledge and opportunities for young people to become better stewards, the Litter Gitter Pilot Program sought to inspire the kind of long-term change in plastic consumption and disposal habits that might eventually negate the need for trash traps entirely. Seeing the local effects of trash pollution and the people and technologies involved in its removal will make tangible often nebulous ideas about "environmentalism," "recycling," "conservation," etc. As a bonus, meeting the professionals involved in environmental non-profit and resource conservation work introduce students to exploring those fields as viable vocational opportunities.

PUBLIC RELATIONS OPPORTUNITIES

From a communications standpoint, the Litter Gitters have generated a large amount of positive publicity. Chattahoochee Riverkeeper's most well-received social media post of all time concerned the Maddox Park Litter Gitter. The traps are highly visible, physical manifestations of Chattahoochee Riverkeeper's presence in the watershed and have potential to act as focal points and conversation-starters in the public waterways in which they are placed. The program has attracted attention from local and national media outlets. The design and implementation of the Litter Gitter is fairly simple to summarize, which proves useful when explaining the program in layman's terms. Trash traps can serve as a jumping-off point for community cleanup events and will diversify an organization's trash-reduction portfolio. Lastly, depending on the goals of the organization installing the trap, data generated from ETAP analyses could prove useful in developing campaigns to target polluters – this is discussed in more detail later in this report.

Figure 10: CRK staff giving Litter Gitter lessons to Girl Scout Troop 19132

LABOR CONSIDERATIONS

TRAP CLEANOUT

Georgia TRADE-UP, a Groundwork Atlanta sub-contractor, was responsible for scheduled cleanouts with Osprey Initiative staff acting in an oversight role. During the pilot, the Litter Gitters were checked on a weekly basis unless a major rain event occurred. In those cases, cleanup crews were dispatched after it was safe to enter the water. This schedule worked well, though there is room for improvement. Instead of a full crew checking each site on a weekly basis, a single project manager could attend to each site more regularly and deploy an "on-call" crew as needed. Occassionally during the pilot program, cleanup crews attended to mostly empty traps or were unable, due to other commitments, to service full traps. Another cleanout scheduling system could avoid these issues.

Figure 11: Litter Gitter cleanout

Figure 12: Typical litter and debris at Northwest Drive

For cleanouts, a three to four-person crew was typically present. One crew manager would oversee the process from the shore while two to three workers would clean the device. The cleanouts typically took 30-45 minutes, depending on trash level. Crewmembers would use rakes and trash pickers to remove litter and buckets to transport trash to the shoreline.

Not only is the cleanup crew manager an OSHA-trained safety professional, but they also led site-specific safety meetings before each cleanup event. CRK recommends continuing these meetings for all future trash trap implementations. When West Atlanta received more than a couple inches of rain over the course of a day, high waters often clogged the traps with organic matter and large manmade debris increasing cleanout times and safety concerns. The cleanout crew manager should exercise great caution when dealing with potentially hazardous materials and underwater obstacles.

STAFFING CONSIDERATIONS

One of the difficulties for this program was sourcing labor for the cleanout operations and data collection. Regular cleanouts require a minimum of two crewmembers while more staff speed up the process. Volunteer groups may not have the availability or equipment to carry out the necessary upkeep. Litter Gitter cleanouts may require lifting heavy loads, driving long distances, and donning waders and boots. For maximum effectiveness, cleanout crews need to be "on-call" and available to empty the traps on irregular schedules and in a variety of weather conditions (safety permitting).

Without regular cleanouts the traps become clogged with debris reducing their efficiency and increasing the likelihood of equipment failure. Local workforce development programs present a potential source of labor for trash trap cleanouts; however, careful worker selection is necessary to ensure crews can fulfill all cleanout, maintenance, and data collection requirements to exacting standards. Programs with strong communication, clearly defined roles and responsibilities, and close program manager oversight are more likely to succeed.

SAFETY CONSIDERATIONS

Safety concerns mostly involved drowning or biological hazards. Best management practices and personal protective equipment protocols must apply. Heavy-duty boots and gloves should always be worn, and cleanout crews should be watchful for glass shards, twisted metal, hypodermic needles, and other sharp objects. Collected needles were placed inside plastic bottles for safe transport then properly disposed of after cataloguing. Biohazardous materials such as bottles of urine and medical supplies were a frequent occurrence in and around the traps. CRK recommends that crewmembers wear sturdy gloves and wash or sanitize their hands immediately after trash cleanouts and litter analysis.

Falling and drowning presents a real and present danger during trap maintenance. Crewmembers should use their best judgement when cleaning out the Litter Gitters and consult weather reports to determine if lightning or large rain events are predicted. Areas with eroded stream banks, algae-covered rocks, and fallen trees should be navigated with care. For safety reasons, Chattahoochee Riverkeeper recommends sending at least two crewmembers to clean out the devices. Project or crew managers should prioritize safety and err on the side of caution when servicing the traps.

LIABILITY

Legal liability and insurance factor into the feasibility of implementing these programs. Although unlikely, it is possible, in theory, that the traps could completely break away from their anchors and float downstream, becoming additional floating refuse. Rogue traps could present a hazard to recreationalists or damage downstream property. During the pilot program, the insurance and legal burdens fell upon the trash trap manufacturer and each individual organization. Implications for future installations must be considered on a case-by-case basis.

CRK worked closely with the City of Atlanta and Fulton County throughout the pilot program, resulting in few roadblocks to trash trap installation. Since no streamflow alterations were involved in the installation, CRK and Osprey did not need to request permission from the Army Corp of Engineers. No stream buffer or other variances were needed, making the installation agreement often as simple as verbal confirmation of the trap location after a site visit with interested stakeholders and property owners.

DATA

The following section is not intended to be a full breakdown of the data collected from the pilot program, but an exploration of the data as it pertains to trap effectiveness in capturing floating litter and the potential value the data provides to researchers, companies, and other stakeholders interested in employing the Litter Gitter.

Certain confounding factors affect the representativeness of the dataset. The cleanout crews have observed decreased volumes of trash after the City of Atlanta's Shelter-in-place policies went into effect in March 2020. With school closures, public event cancellations, and reduced economic activity, littering has decreased. Because of this, the litter output in Proctor Creek in 2020 was subject to abnormal factors and may not represent the litter output of Proctor Creek during previous years.

E.T.A.P. DATA AND ANALYSIS

The U.S. Environmental Protection Agency's Escaped Trash Assessment Protocol, or ETAP, is a method for cataloging litter from a plethora of sources that has found its way into a variety of environments. It is meant to be used by a broad range of stakeholders to fill incomplete data sets and systematize and standardize data collection for the benefit of analysts. According to the EPA's Draft Escaped Trash Assessment Protocol from 2018, ETAPs can help users identify:

1. Dry and wet weather trash distribution
2. Longitudinal variability within watersheds
3. Variability across watersheds, including marine areas, by comparing various site assessments within a region

Figure 13: Plastic types being separated for cataloging and recycling

ETAPs are straightforward and inexpensive to conduct and are designed to be used by community groups, schools, non-profits, and citizen science groups. Following the ETAP procedure, littered items are categorized by various characteristics including:

1. Material composition of the litter (plastic, paper, metal, glass. etc.)
2. Item conditions ("Intact, Partially Intact, Fouled")
3. Item notes (product, brands, language, event)

During Litter Gitter cleanouts, trash was removed from the trash trap then bagged and stored to analyze at a later date. The practice of conducting ETAPs en masse instead of after each individual cleanup saves time and should be implemented in future projects. ETAPs were typically conducted every two weeks by Osprey and TRADE-UP staff.

There is considerable subjectivity involved in performing ETAPs. What constitutes a noteworthy trash fragment can vary from person-to-person, project-to-project. For this project, Osprey and TRADE-UP staff focused on "fist-sized" pieces of trash during ETAP assessments. Multiple small pieces of trash would be combined to form a single large piece if no intact specimens were available. For example, if fragments from multiple brands of Styrofoam cups could be combined into three total cups-worth, then they would be recorded on the ETAP datacard as three cups.

Additionally, certain types of litter pose challenges when classifying and cataloguing. When a "Styrofoam Cup" fragment becomes an unrecognizable "Styrofoam Piece" is subjective, a single piece of trash may fall into multiple listed categories or "other." Item condition assessments "Intact, Partially Intact, Fouled" are also subject to interpretation. The ability to recognize product branding and exterior discoloration factored into this assessment. Styrofoam degrades quickly and was therefore one of the most difficult pollutants to quantify. Nearly weightless and often of negligible volume, collecting every single piece of foam in a given area is often impossible. For these reasons, consistency is key when conducting ETAPs. If possible, have the same crewmembers conduct the ETAPs every time.

COLLECTED TRASH

From late-June 2019 to mid-May 2020, the total amount of trash collected through normal Litter Gitter operation was 903.25 pounds. Of that, 146.63 pounds, mostly consisting of plastic bottles and metal cans, was sent to recycling facilities.

Recycle (Lbs.)	Recycle (ft^3)	Dispose (Lbs.)	Total (Lbs.)	Total (ft^3)
146.63	125.25	756.62	305.00	430.25

Table 1: Litter collection, all traps, June 2019 – May 2020

By volume, 29% of the litter collected by the traps was recycled. By weight, 16% was recycled. The most easily recycled products were plastic bottles, which being relatively large and lightweight, skewed the "volume recycled" metric higher. Due to safety and handling concerns, glass products were not recycled. Due to various other economic and logistical concerns, the only materials recycled in this program were #1 plastic and aluminum products. Municipalities with other materials recovery facilities may be able to recycle greater or lesser amounts of collected litter.

	Amount - Recycle		Amount - Dispose		Amount - Total	
Boyd Elementary	Lbs.	ft^3	Lbs.	ft^3	Lbs.	ft^3
2019/Q2	0	0	21.25	6	21.25	6
2019/Q3	12.43	8.5	83.5	32.5	95.93	41
2019/Q4	10.35	7.75	35.75	23.5	46.1	31.25
2020/Q1	22.71	19.5	136.85	56.5	159.56	76
2020/Q2	4.47	5.25	36.24	17.75	40.71	23
Site Total	49.96	41	313.59	136.25	363.55	177.25
Northwest Drive						
2019/Q4	10.24	7.5	17.84	10	28.08	17.5
2020/Q1	16.17	22.5	69.61	33	85.78	55.5
2020/Q2	10.12	11.5	24.14	14.25	34.26	25.75
Site Total	36.53	41.5	111.59	57.25	148.12	98.75
Maddox Park						
2019/Q2	1.5	1	84.5	18	86	19
2019/Q3	19.51	16	130.5	55	150.01	71
2019/Q4	39.13	25.75	116.44	38.5	155.57	64.25
Site Total	60.14	42.75	331.44	111.5	391.58	154.25

Table 2: Litter collection by site, June 2019 - May 2020

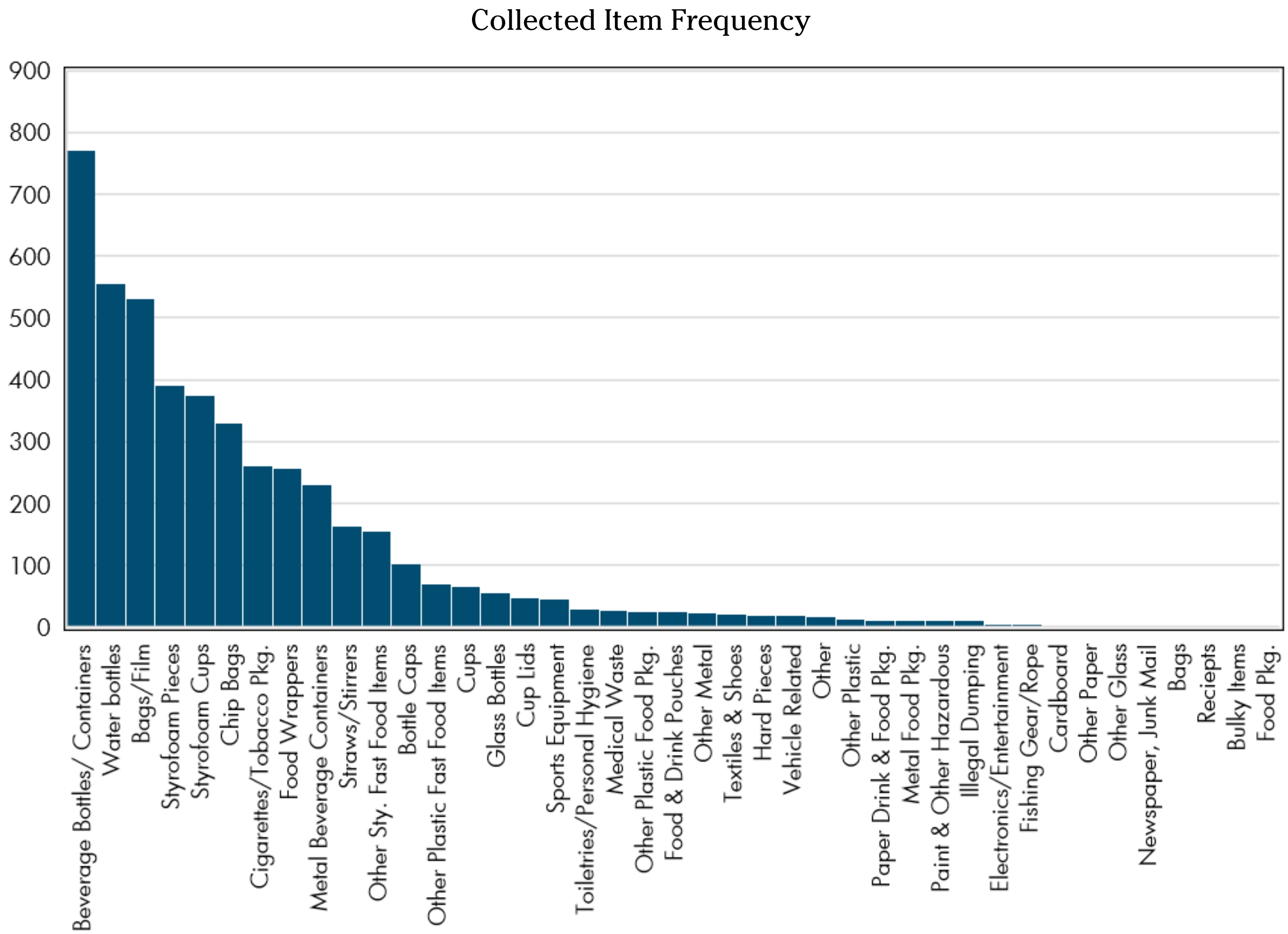

Figure 14: Collected item frequency, categorized by their ETAP item designation

The five most frequently found items in descending order were: plastic beverage bottles, water bottles, plastic bags, Styrofoam Pieces, and Styrofoam cups. Most of the collected litter consisted of just a handful of popular plastic items which is consistent with what other non-profits have observed during beach cleanups. Single-use food packaging, tobacco products, and Styrofoam containers are a common sight in trash traps throughout the region.

ETAP assessments give us insight into the age and extent of litter decomposition. As the following graph shows, most of the trash was either “Unfouled” or “Partially Fouled”:

Collected Item Composition

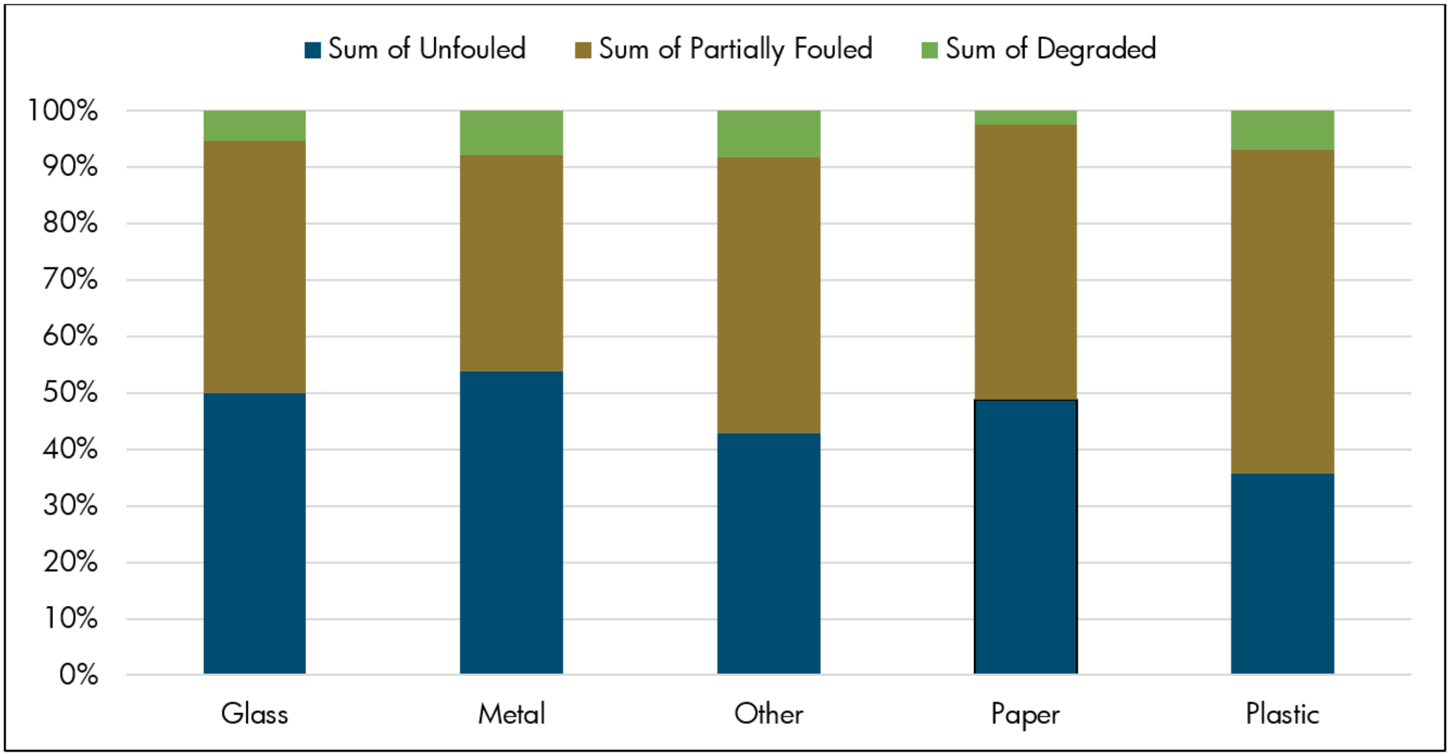

Figure 15: Item degradation level by material type (sum of all traps)

As the Litter Gitter only collects floating litter, this makes sense. The longer that litter remains in the aquatic environment, the more it is broken down by sunlight and wave action. Over time, Styrofoam containers break apart, water bottles discolor, and beverage cans become weighed-down by sediment. This result highlights the potential for these devices to be used as tools to reduce microplastic pollution, thought quantitative microplastic analysis of Proctor Creek has yet to be conducted. Targeted cleanups of the riverbed and surrounding area are necessary to remove older, more fouled litter as well as debris embedded in riverbanks, heavy metal litter, and bottles filled with sediment.

Collected Item Composition

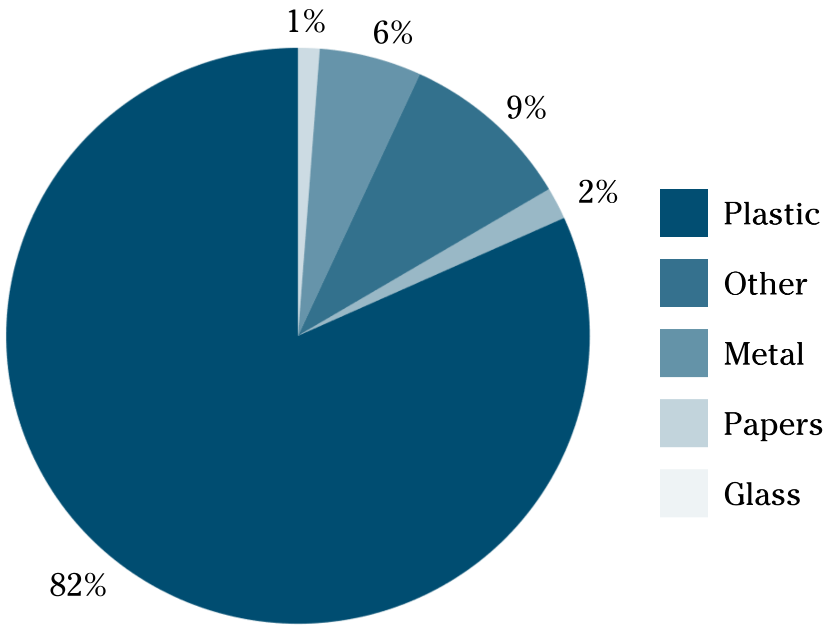

Figure 16: Composition of litter by ETAP material category

Consistent with findings from other studies, most of the items collected were plastic products. Plastic made up 82% of found trash, glass 1%, metal 6%, paper 2%, and 9% are categorized as "Other." The "Other" category includes bulky and/or hard-to-categorize items such as automotive parts, sports equipment, and tobacco products.

The brands most associated with the collected litter are popular local food and drink suppliers namely, Coca-Cola, Pepsi, McDonalds, Popeye's, American Deli, and Chick-fil-A. Brand identification could prove a useful tool in developing strategies to reduce litter pollution at its source. For example, if a large amount of litter were collected in the weeks following a music festival, trash trap operators could pressure festival planners to add additional litter receptacles. A restaurant whose takeout containers end up in a nearby waterway could be persuaded to switch to biodegradable containers. These avenues were not explored during the pilot program but are areas of interest for future trash trap programs.

Figure 17: Osprey Initiative and Georgia TRADE-UP staff prepare collected plastic for recycling.

COMPARISON TO OTHER IN-STREAM LITTER COLLECTION DEVICES

There is fierce competition both domestically and internationally to produce devices intended to intercept floating litter. From Storm Water System's "Bandalong" and "Storm-X" system to Clear Rivers' "Litter Trap" and Watergoat USA's "Watergoat," there is no shortage of in-stream litter collection devices. The following are selected assessments of the Litter Gitter device alongside comparable products. CRK does not have firsthand experience operating all the listed products, and therefore, the following comparisons are not intended to be either definitive or exhaustive.

EASE OF INSTALLATION

The Litter Gitters are easily transported in the bed of a truck or trailer and require little equipment to install. Two Litter Gitters can easily fit on the bed of an 18ft trailer. The trap can be installed in a matter of hours and with minimal disturbance to the riparian buffer. Compared to the larger Bandalong-style device or Storm-X net systems, Litter Gitter installation involves no construction, digging, or heavy installation equipment. For example, concrete anchoring equipment, construction supplies, and cranes were required to install the Bandalong trash trap at Maddox Park. By comparison, the aluminum-bodied Litter Gitter devices are lightweight to hold and require only a small crew to install.

Litter Gitters can be placed further away from access roads or staging areas increasing the number of locations where they can be installed. A "boom-style" trash trap design, such as the varieties offered the non-profit Watergoat U.S.A., are easier to install than either the Bandalong or the Litter Gitter. With a Litter Gitter or trash boom design, lengthening the boom system and adjusting trap alignment are trivial. Generally, larger and more invasive devices require expanded permissions from various governmental bodies, including the Army Corp of Engineers, which adds to the complexity and cost.

COST

Installation, maintenance, and cleanout costs vary by program and the cost of maintaining the traps varies by manufacturer. Some trash trap manufacturers prefer to sell the traps outright while others lease their products. The Litter Gitter designs and physical devices used in this pilot program are owned by Osprey Initiative LLC. Osprey holds the patents for the "Litter Gitters," including the prototype PVC model as well as the more expensive and heavy-duty device. It should be noted that Storm Water Systems is in the early stages of developing a smaller Bandalong device called the "Bandit". Although only prototypes exist, the Bandit trash traps are intended to compete directly with Osprey Initiative's in terms of functionality and price.

Manufacturers offer broad selection of services, making comparison difficult. For this program, Osprey's expenses included ETAP analysis, data handling, and other services aside from trap repair. For $50,000, CRK was able to maintain two trash collection locations on Proctor Creek, with between 1-4 traps installed at any given time. This price included cleanups of the area directly upstream of the traps.

Long-term operations and maintenance challenges must be considered. For this pilot program, the Litter Gitters were repaired, upgraded, and re-installed at no additional cost. Apart from Osprey Initiative, CRK has not encountered trash trap manufacturers that offer formal maintenance regimes after product delivery. The potential for multiple traps to fail simultaneously during an extreme weather event raises other budgetary concerns. Organizations interested in these devices should expect the risk associated with replacing multiple devices to be reflected in pricing. Product selection should ultimately be determined by environmental needs such as streamflow and trash level, as well as long-term funding availability. All mentioned products see widespread use in the United States.

MAINTENANCE AND EFFICIENCY

In addition to cost and design, trash traps vary in their maintenance needs and litter-catching ability. Tests conducted by Osprey indicate an 80% reduction in floating litter downstream of the devices. However, during heavy rain events, CRK staff occasionally observed trash slipping beneath the floating booms. With extreme rain events and turbulent flows, the main concern was not just trash collection but the safety and security of the trap itself. The Litter Gitters are less effective at intercepting litter during these large storms, but the effectiveness cannot be quantified without constant monitoring. Overall, except for the January 3 storm, the non-cleanout maintenance burden was small.

For comparison, crews reported greater litter-catching ability for the Bandalong device. The Bandalong trap is larger with heavy-duty booms constructed from high-density polyethylene. The collection area is larger, and therefore, can collect more trash before needing to be cleaned. For this and other reasons, since the relocation of the Litter Gitter from Maddox Park to Northwest Drive, the Maddox Park Bandalong site has become the most productive trash trap site in the Proctor Creek watershed. These efficiency concerns must be weighed against cost differences on a case-by-case basis depending on the watershed and program budget.

Figure18: Left - Bandalong in Proctor Creek   *Figure 19: Right - "boom style" trash trap in Anneewakee Creek*

RECOMMENDATIONS

Ultimately, the feasibility of the Litter Gitters as a tool for litter reduction depends on many factors including site selection, maintenance, and program goals. Forensic trash analysis, such as the EPA's Escaped Trash Assessment Protocol, increases the training and labor requirements, but provide data not easily obtained through other methods. Data from ETAP analyses can prove useful to a variety of organizations and offers insight into the Litter Gitter's effectiveness. Most of the recyclable litter is in pristine or undamaged condition, which depending on location, eases recycling efforts.

The traps are less effective at catching non-buoyant and degraded refuse. To remove smaller plastic fragments, legacy litter, tires, etc. targeted cleanups utilizing volunteer or hired labor are necessary. Forensic trash assessments may be unnecessary depending on the program goals of the organization operating the trap. While consistent ETAPs can be a powerful educational, outreach, and scientific tool, organizations concerned with minimizing labor costs may opt to conduct more targeted ETAPs or skip them altogether.

The Litter Gitters can serve as a powerful educational tool and a venue for workforce development and community participation. The devices are simple to understand, popular in media, and can be imitated and expanded upon by student groups. More generally, the issue of plastic pollution can be used to draw attention to broader water quality issues. Trash traps offer environmental organizations the opportunity to raise awareness for less visible forms of pollution like sedimentation and industrial runoff (Jambeck, et al., 2020). As a tool for direct job creation, between Osprey Initiative, Georgia TRADE-UP, and Chattahoochee Riverkeeper, the year-long Litter Gitter Pilot Program has sustained a half-dozen jobs. For organizations that prioritize both environmental and economic justice, contracting local workforce development programs like Georgia TRADE-UP present advantages over volunteer cleanouts.

Although pushed to their breaking point in this pilot program, the Litter Gitter design proved highly effective during normal use. With the deployment of Osprey Initiative's updated aluminum Litter Gitter design, longevity and robustness improved. Given proper site selection, maintenance, and monitoring, the traps effectively caught floating trash in all but the largest rain events. Due to their small formfactor and price, the Litter Gitters offer a reasonable option for non-profit organizations and municipalities considering in-stream trash removal.

Ultimately, the feasibility of employing the Litter Gitters as a tool for improving urban waterways depends on the values, goals, staffing abilities, and funding limitations of the organization. The field of floating litter collection is diverse, with non-profit and business entities around the world offering a variety of solutions for every conceivable body of water, trash load, and budgetary restriction. It is imperative that a diverse group of local stakeholders explore the full spectrum of options before implementing an initiative like Chattahoochee Riverkeeper's Litter Gitter Pilot Program in their own watershed.

APPENDIX

MAP

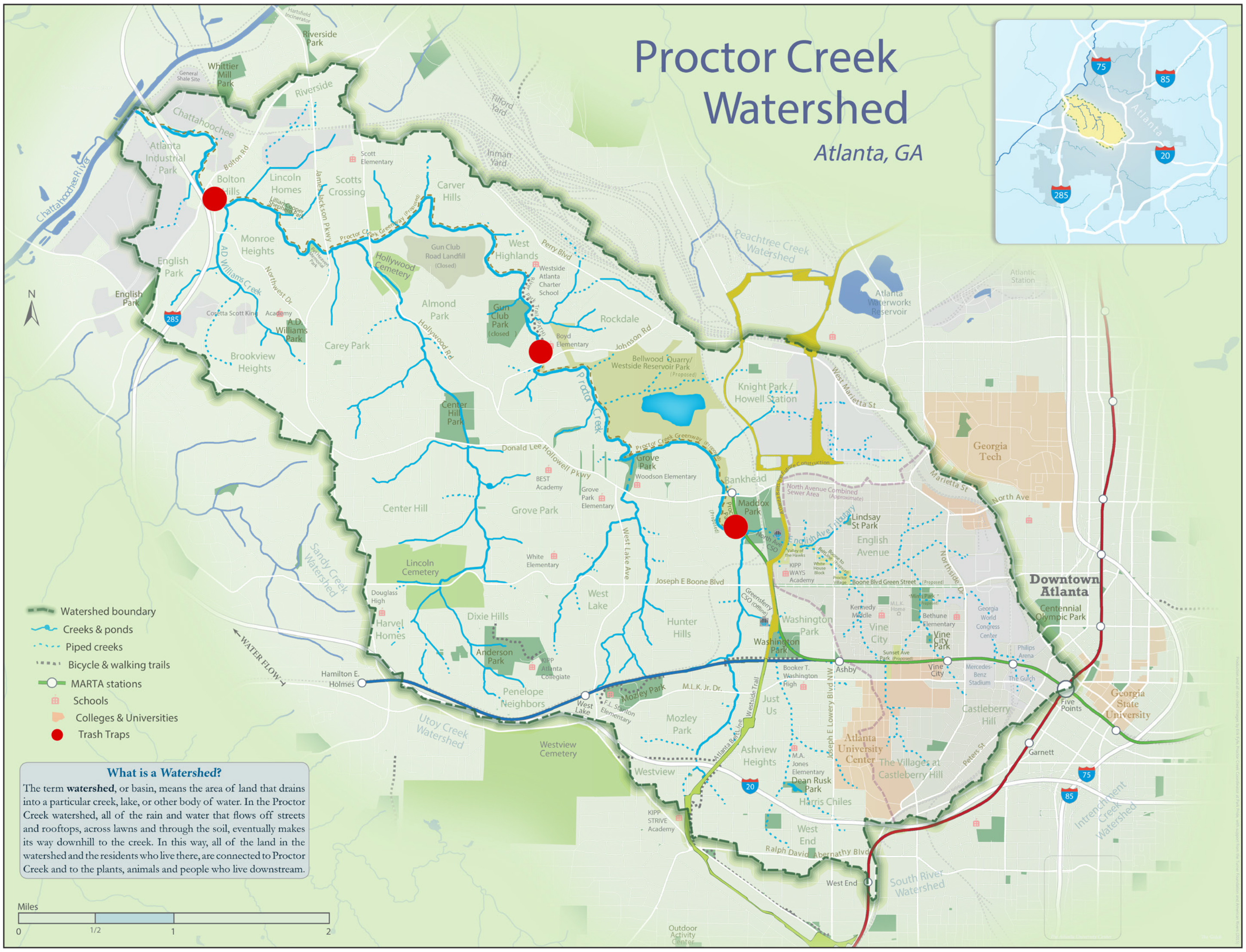

Figure 20: West Atlanta's Proctor Creek Watershed with Litter Gitter locations marked in red

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