Trash Traps: A Guide to Implementing In-stream Litter Pollution Control

CHATTAHOOCHEE RIVERKEEPER®

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Trash Traps: A Guide to Implementing In-stream Litter Pollution Control

The following guide discusses the use of floating in-stream litter collection devices, known as "Trash Traps," to reduce litter pollution from urban stormwater. This document was produced as part of a program administered by Chattahoochee Riverkeeper and funded through grants from Arcadis and COX. The objective of this publication is to provide government agencies, non-profit organizations, private businesses, watershed community groups, and other interested parties with actionable information regarding the use of trash traps to control litter pollution in waterways.

Acknowledgements

We would like to thank Arcadis and COX for generously supporting this project. Without the dedicated and experienced staff at Arcadis, developing this guidebook's companion publication on geospatial analysis would not have been possible. This document drew much of its content from CRK's previous report: "Litter Gitter Feasibility in Urban Waters." The West Atlanta Watershed Alliance has partnered with CRK for years and has helped to educate thousands on water conservation. The expertise of trash trap manufacturers such as Storm Water Systems, Osprey Initiatives, and Watergoat INC. proved invaluable to our maintenance program. Don Bates and Gary Hopkins provided key guidance and resources during the early stages of CRK's trash trap program. CRK thanks the Jackson Lake Association for their partnership as well as the city and county governments who share their knowledge and allow CRK access to these important waterways. Lastly, we thank the foundations, corporate sponsors, and more than 10,000 members who support our mission to preserve and protect the Chattahoochee watershed.

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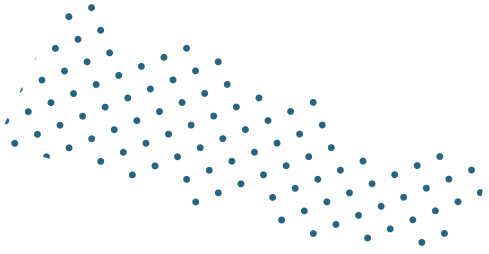
Introduction

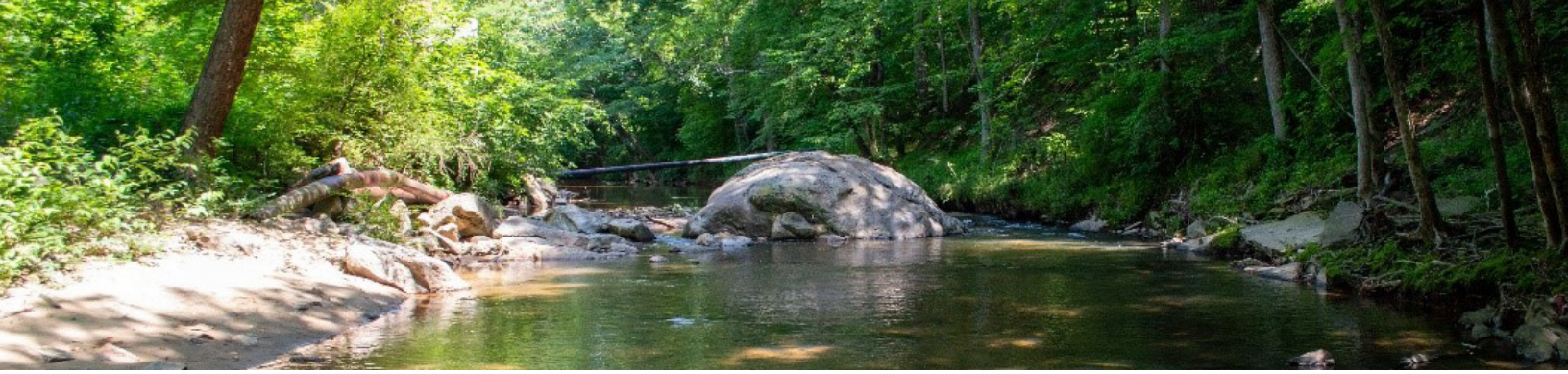
All humans rely on clean water. From electrical production and agriculture to bathing and recreation, we all depend on safe access to unpolluted waterways. However, collective access to this crucial resource is being threatened. The volume of litter and garbage in our rivers, lakes, and oceans has become a global crisis and plastic waste is fast becoming a dominant form of pollution in 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, 2023). 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 drinking water treatment facilities generally remove only some microplastics and microplastics have been found in both bottled water and municipal tap water (Shen et al). 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 from land-based activities (Environmental Protection Agency, 2023). 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 (1) the costs involved in removing litter from oceans, (2) the need to extricate litter before it degrades, and (3) 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.

In 2019, Atlanta-based environmental non-profit Chattahoochee Riverkeeper (CRK) launched a pilot project deploying two trash traps to remove floating litter from Proctor Creek, an urban tributary of the Chattahoochee River. While CRK had a robust volunteer clean-up program, volunteer events were not capable of continuously collecting litter moving downstream after rain events. Known as the Trash Trap Program, CRK's trash traps continue to collect thousands of pounds of trash each year. Since its inception, the trash traps deployed by CRK have collected more than 10,000 pounds of floating trash; nearly 30% of that trash volume has been recycled. CRK now operates 14 traps in five Georgia counties, with plans to expand into more impaired waterways throughout the region. Today, CRK's trash trap program serves as a model so that other organizations may adopt initiatives to safeguard their local waterways, fostering healthier ecosystems and cleaner communities for generations to come.





Are Trash Traps Right for You?

Trash traps are not a one-size-fits-all solution for water-borne litter pollution. The value of these devices depends on characteristics of the watershed in which they are installed as well as the objectives and resources of the organizations operating them. Trash traps are one litter-capture method in a constellation of interventions including, but not limited to: curbside-pickup, public trash cans, stormwater inlet filters, volunteer cleanups, and ocean litter capture. For the purposes of this guide, trash traps are defined as in-stream litter collection devices that capture floating litter from stormwater runoff. Powered primarily by a waterway's natural current, these devices occupy a portion or entirety of a waterway's span and use floating booms to guide refuse towards a central "collection area." This collection area is typically a bin, a cage, or a string of floating buoys that concentrates litter to ease cleanout efforts. Once the device has filled with litter, the refuse is removed using human or mechanical labor. While a plethora of manufacturers produce traps of varying designs and costs, the considerations in this guide will apply to any group interested in implementing similar litter-reduction technology.

Trash traps fill a specific niche within the litter-abatement environment. If the total amount of litter collected is the only metric by which a trash trap program is evaluated, then the trash traps may well fall short of other options. For organizations for whom volunteers are more accessible than funding, targeted volunteer cleanups will likely achieve greater trash collection than a trash trap. A single 10-person cleanup lasting three hours can collect more trash than some trash traps will in a month. In areas suffering from systemic waste mismanagement, programs aiming to increase public sanitation infrastructure and regulate landfills may be more effective at curtailing trash pollution. For other litter solutions, The United States Environmental Protection Agency's Trash-Free Waters campaign offers extensive documentation of all manner of litter-reduction policies, technologies, and practices.

In general, trash traps are best suited to fill gaps in existing litter-reduction measures. Trash traps succeed in densely populated and urbanized watersheds, particularly those impacted by stormwater pollution. They are most effective when paired with multi-year funding for maintenance and a dedicated staff or volunteer group to perform "cleanouts." Trash traps are not a solution to temporary litter influx as the result of, for instance, a new construction project. Finally, trash traps should ideally be paired with other proactive litter-reduction efforts including outreach, education, and political advocacy.

If a trash trap is the right choice in your watershed, the project's success will be largely dictated by three categories of concern: Location, Financing, and Labor. In the following sections we will explore these aspects of trash trap implementation as well as general guidelines to nourish a sustainable and effective litter capture program.

Location

As the old saying goes: "Geography is destiny." This holds true in environmental conservation in general and litter reduction is no exception. A given region's terrain, climate, demographics, infrastructure, and political landscape all shape the amounts and types of pollution harming local water bodies. For trash traps, a waterway's physical character, trash load, and access are crucial factors impacting program success. These and other factors can be mapped using analysis tools like Geographic Information Systems (GIS) to better assess waterways for their potential as trash trap sites.

Waterway Characteristics

Ideally, trash traps should be placed in rivers, canals, 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 area. Trash traps are best suited to relatively shallow, consistent streams that are much wider than the collection area. Turbulent flow, rocky riverbeds, and dramatic variation in stream width all may reduce device efficacy. Trash Traps typically require less than a foot of water to remain buoyant and placement in shallow streams eases cleanout efforts.

Assessing streamflow before trap installation can avoid potential damage during large storm events. United States Geological Survey Streamflow Stations measure hydrological parameters in waterways throughout the nation. Useful metrics to consider are flow rate (ft^3/s), gage height (ft), and precipitation (in). Station data is typically updated on an hourly basis and records from past years are easily retrievable. Utilizing this tool, program managers can steer clear of situating traps in water bodies with excessive currents, ensuring the traps remain within their designated operating parameters.

Trash Load

Assessing the amount of litter flowing through a creek, otherwise called the trash load, is crucial to placing an effective trash trap. Improperly assessing litter pollution in a site decreases project efficiency and can lead to labor-intensive trap relocation. Most litter found in waterways originates from stormwater runoff. According to CRK's findings, littered single-use products on roads, sidewalks, parking lots, and other impermeable surfaces are the largest contributors to urban floating trash. Therefore, sites downstream of densely developed residential, industrial, and retail districts should be prioritized over less densely developed or rural areas. Although trash traps can operate in ephemeral or intermittent waterways, these sites should typically be avoided due to their reduced litter-collection potential. Before installing 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 that stream section.

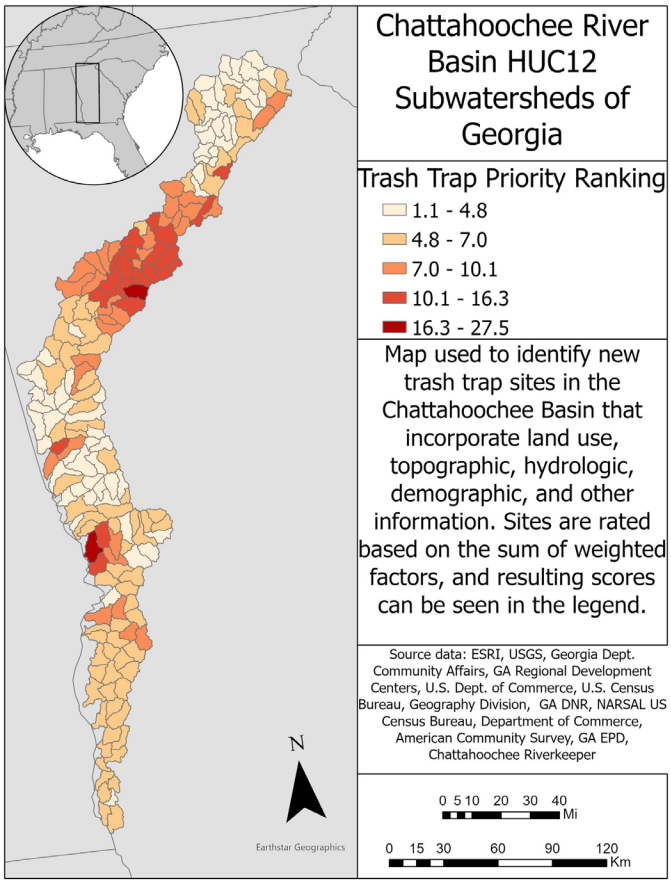
Site Access

Access can make or break a trash trap installation site. Put simply: can you place a trash trap at this site? Permission to install trash traps on private property proves one of the greatest barriers to installation. When scouting for potential locations, CRK used publicly available parcel data on potential trap locations. Private landowners were often unresponsive to requests to install the devices on their property. Other landowners were skeptical of the maintenance commitments or personnel traffic and refused permission. For this reason, publicly owned land was prioritized when choosing suitable trap sites. Tracts of city and county property, power and conservation easements, and highway right-of-way proved convenient installation sites. The particularities of securing permission to install a trash trap are described in detail in the section "Permitting."

Driving and walking access is also critical for trash trap sites. The devices must be easily and safely accessible on foot with enough parking and open space in which to conduct litter assessments and stage equipment. Sites with mild tree cover offer great visibility and access while still providing ample anchor points for traps. Google Maps, municipal parcel maps, and GIS are all useful tools for quickly assessing the basic viability of a trash trap site.

Mapping

Mapping is a crucial tool in determining suitable trash trap locations. Although often difficult to use, Geospatial analysis using tools such as GIS can be a powerful means to gain knowledge about a watershed and can be invaluable in the early stages of selecting a trash trap site. Trap placement determines cleanout logistics, equipment, labor needs, and most importantly, the amount of collected trash. Depeinding on an organization's goals, proximity to important landmarks, visibility from pedestrian areas, and



Results from Chattahoochee Riverkeeper's Trash Trap Prioritization Model using a custom ArcGIS Pro Model

demographic information may also factor into site selection. For CRK's trash trap program, the devices need to be placed in water bodies that:

- Are readily accessible by foot and vehicles
- Experience substantial litter pollution
- Require minimal permitting
- Align with grant requirements
- Aid CRK's environmental justice goals

Given these often-conflicting variables, narrowing down promising trash trap sites can be difficult. Many of these factors are subjective, hard to quantify, or difficult to control for. For organizations with sufficient resources and time, developing a model to automate finding trash trap locations could reap huge benefits.

To this end, CRK has developed a GIS tool to identify trash trap sites throughout the Chattahoochee watershed. It incorporates land use, hydrologic, and demographic data to rate potential trash trap sites on a scale from 1 to 10. Tailored to CRK's organizational priorities, this tool can be updated as new data becomes available. This "Trash Trap Location Prioritization Model" gives a high rating to tributaries which contain high levels of impervious land cover, that are near schools and other public areas, and are in low-income and majority-minority communities. The GIS model itself, as well as the manual for recreating a similar model in your own watershed is described in detail in this guide's companion publication: *Trash Trap Location Prioritizaion Manual*.

Financial Concerns

Trap Selection

There is fierce competition both domestically and internationally to produce devices intended to intercept floating litter. From Storm Water Systems' "Bandalong" system to Clear Rivers' "Litter Trap,", Osprey Initiatives' "Litter Gitter," and Watergoat INC's "Watergoat," there is no shortage of in-stream litter collection devices. Manufacturers produce trash traps of varying size, quality, cost, and intended operating conditions. Purchase prices range from $2,500 to $250,000. There is no exhaustive list of trap manufacturers, though one resource comes close: *"Waste in our Waters: A Community Toolkit for Aquatic Litter Removal."* Published by River Network in 2020, the toolkit "is a step-by-step guide for addressing litter in your community, both before and after it reaches your local waterway." It includes a detailed roundup of trash capture devices, their costs, designs, and capacity.

The most appropriate trap design will be determined through collaboration between the manufacturer and the organization operating the trap. Typically, manufacturers will need to know a prospective trap's location, desired capacity, waterway size, and potential anchoring system to provide an accurate price quote. Although metal or concrete posts can be driven in the stream bank to provide anchor points for trash traps, trees can also act as cheap and convenient anchors for small traps. Devices anchored to trees have another advantage over larger traps: they do not require the permitting or expense to clear riparian vegetation before installation. Installation prices can vary greatly depending on the region, though some manufacturers offer the option to ship trash traps for customer assembly.

Large Storm Water Systems "Bandalong" trash trap in north Georgia

Funding Opportunities

Chattahoochee Riverkeeper has employed several strategies to fund our trash trap program throughout its lifespan. Funding from local governments, EPA grants, utility companies, private foundations, and small business sponsorships have all played their role in supporting the installation, operation, and maintenance of CRK's trash traps. Even after installation, trash traps require continual investment in equipment and labor to operate. When multi-year grant funding is not available, year-long corporate "trash trap sponsorships" can be a useful tool to finance cleanouts. As part

of a typical corporate sponsorship opportunity, CRK agrees to clean and maintain a trap, install signage displaying the sponsor's logo, post on social media, and give recognition to the sponsor on our website. CRK typically charges $4,000 - $12,000 per trap annually to cover the labor cost of cleanout, transportation, consumable equipment (i.e. trash bags), and disposal fees.

Funding from private foundations has been the most stable source of trash trap revenue. Private grant application and reporting requirements are typically less onerous than EPA or NOAA grants and are often more worthwhile for smaller organizations to pursue. Prospective trap operators should be cautious of grants with specific geographic restrictions unless they are confident the grant area contains an effective and accessible trash trap site.

Liability

Legal liability and insurance are major factors when implementing trash trap programs. During extreme weather events, traps can completely break away from their anchors and float downstream, becoming additional floating refuse. "Rogue" traps could present a hazard to recreationists or damage downstream property. Even during normal operation, trash traps themselves could qualify as an attractive nuisance and be a tripping or drowning hazard. To mitigate these possibilities, trap placement should avoid impeding the movement of boaters and other water recreationalists. Signage should clearly describe the device and provide contact information for the program operator. Trap designs should be fail-safe and able to withstand 50-year flood events in the areas in which they are installed. Lastly, trap installers and operators should maintain general liability insurance in the unlikely event a trash trap causes harm to property or life.

Storm Water Systems "Bandit" trap after anchor failure

Permitting

Permitting can prove one of the most time-consuming and difficult aspects of initiating a trash trap program. As described in River Network's *Waste in our Waters: A Community Toolkit for Aquatic Litter Removal*:

> Depending on your location and the size and permanency of your litter capture device, permitting could be as simple as a check-in with your local stormwater agency or as complicated as securing a variety of different county, state, and federal permits.

Prior to installing a trap onsite, it's crucial to assess whether permission has been granted by the property owners. Public property, land trusts, utility easements, and residential backyards may all require varying levels of permission for an organization to feel confident in its ability to access a site long-term. Acquiring buffer variances, tree clearing, and the use of heavy machinery will likely increase permitting requirements. In general, project planners should consider potential stakeholders including local:

- Stormwater (MS4 Permit) administrators
- U.S. Army Corps of Engineers offices

- EPA or related offices
- U.S. Geological Survey (USGS) offices
- Water and sewer utilities
- U.S. Fish and Wildlife Service offices

Although not strictly necessary, in-house general legal counsel can prove invaluable when navigating the permitting process. Trash trap project managers may be required to submit project plans, Memoranda or Agreement/ Understanding, and Certificates of Insurance to receive approval.

Labor

Over the years, Chattahoochee Riverkeeper has tried several schemes to staff trash trap cleanouts. Full-time staff members, independent contractors, and volunteers have all been employed to clean out trash traps. In CRK's experience, only the most committed volunteers can manage cleanout and data collection of the traps without staff supervision. However, the safety and maintenance considerations in the following section hold true regardless of who operates the traps.

Personnel

The most important characteristics of a cleanout operator are attention to detail, safety, and availability. Physical fitness and the ability to complete fieldwork are crucial traits for trap operators as well. Trap maintenance (in particular removing large logs and fallen trees) as well as relocating and replacing damaged traps requires the ability to lift heavy objects. Trash traps can weigh hundreds or thousands of pounds, and experience in the construction industry can come in handy when repairing or transporting large traps.

Personnel must be available for cleanout within a few days of each major rain event. While traps may be left uncleaned for weeks at a time, partially filled traps will have reduced capacity. In those situations, unexpected weather events may result in significant amounts of litter escaping from the trap. Without regular cleanouts the traps become clogged with debris reducing their efficiency, increasing strain, and escalating the odds of equipment failure. Due to the unpredictability of extreme weather events, flexibility in scheduling should be prioritized when selecting trap operators. Local workforce development programs present a potential source of labor; however, careful worker selection is necessary to ensure crews fulfill all cleanout, maintenance, and data collection requirements to exacting standards. Programs with strong culture of communication, clearly defined roles, and appropriate program manager oversight are more likely to succeed.

Intern cleans out trash trap after rainfall

CRK has had mixed success using volunteers to operate trash traps. For a resource-limited organization, volunteers can provide much needed flexibility at low or no cost. However, reliability and logistical concerns can negate the benefits of free labor. Proper training is needed to accurately sort items heading for the landfill or recycling. Cleaning out several traps in a timely manner and disposing of refuse can be difficult to schedule between multiple volunteers. Inconsistency in data collection and reporting can result from insufficiently trained personnel. Cleanout tools, personal protective equipment,

and transportation must be provided to, or by, trash trap volunteers. Of course, these issues should be considered on a case-by-case basis and weighed against potential benefits.

Operation & Maintenance

On most small and medium capacity trash traps, cleanouts are performed "by hand." While some large traps like Storm Water Systems' "Bandalong" or Baltimore's "Mr. Trash Wheel" are cleaned out by cranes or automatic conveyors, most trash traps in operation are serviced manually. Because of the hazards associated with cleanouts and trap placement in remote areas, at least two personnel are recommended for each cleanout. Labor requirements for trash cleanouts depend on the size of the trap. Although additional personnel will increase cleanout speed, given typical trap sizes and trash loads no more than four workers in total are necessary. Increasing the number of cleanout personnel beyond five typically does not lead to a proportional increase in efficiency. For the majority of CRK's trash trap program, cleanouts have been completed using groups of 2-4 personnel. With a two-person team, a large Bandalong trash trap can be cleaned in less than 1.5 hours. Smaller, boom-style devices can usually be serviced in 30 minutes or less.

Watergoat INC "Watergoat" trash trap during cleanout in north Georgia

Trash traps are only useful if they are cleaned out and maintained on a regular basis. In addition to collecting floating litter, the trash traps catch all manner of debris floating through streams. Furniture, appliances, tires, branches, and large-diameter logs have all made appearances in the trash traps. After a heavy rain, logs, sticks, and leaves can coalesce into a heavy sludge mat in front of or behind the trap's catchment area (sometimes both). If not removed, this buildup reduces capacity and hampers the trap's ability adjust to changing currents.

General Tips when cleaning out a trash trap by hand include:

- Move slowly and steadily to avoid flooding waders or gloves
- Look carefully for hazards before reaching into a trash pile
- Consistency is key when completing litter analysis
- "When in doubt, throw it out." If it looks hazardous or questionable, don't recycle it
- Transport time and litter disposal often take longer than cleanouts themselves
- Trash can "hide" in or underneath the body of the trash trap

A complete Standard Operating Procedure as well as an equipment list for cleanout operations can be found in the Appendix.

Safety

For a trash trap operator, the greatest safety concerns are drowning and biological hazards. Best management practices and personal protective equipment protocols always 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. Waders are made of thin material so care should be taken to avoid thorns, broken bottles, and sharp trap parts. 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.

Additionally, trash traps can attract and provide habitat for snakes, biting insects, and small mammals. Large organic buildup mixed with refuse provides a comfortable habitat for fire ants, snapping turtles, and small snakes. Trapped logs and sticks also represent a tripping hazard if not removed in a timely manner. Finally, CRK recommends that crew members wash or sanitize their hands immediately after performing cleanouts or litter assessments. A full list of recommended safety equipment is available in the Appendix.

Data Collection & Reporting

Data collection and recording are fundamental facets of any sustainable trash trap program. How program data are collected and relayed to stakeholders is not only crucial to the financial feasibility of a trash trap program, but to its scientific, educational, and advocacy value as well. Data collection goals and methodologies will vary according to the resources and missions of the organizations managing the traps. Chattahoochee Riverkeeper's reporting methods including internal forms and procedures are described in the following section and in the Appendix.

Basic Data Collection

For both private and governmental grants, the most requested program metrics are volume

Plastic litter being sorted prior to weighing

and weight of collected trash. For every trash trap, CRK records the mass and volume of collected litter for both the disposed and recycled items. A decision was made early in the program not to consider naturally occurring debris in reports. Logs, sticks, leaves, and other organic matter often comprise the bulk of a trash trap's catch and if not separated from litter, their inclusion will lead to inflated trash-capture metrics. Removing organic debris also disrupts the natural carbon cycle of the environment and deprives downstream wildlife of potential habitat. Some organizations choose not to separate organic matter from the man-made trash on large traps and traps serviced mechanically. While this process greatly simplifies cleanouts and reduces labor costs, the inclusion of non-trash organic matter must be noted in grant reports and public communication.

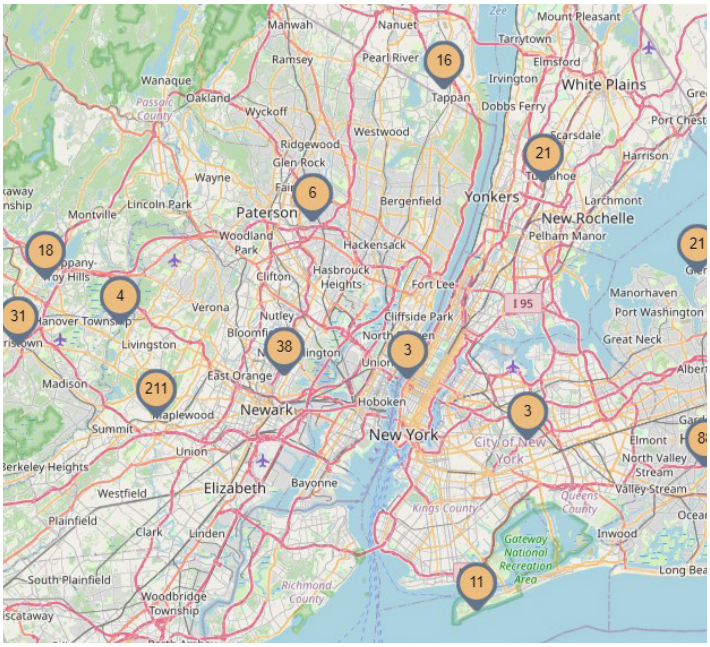
For our grant reports, CRK provides both weight and volume measurements for captured litter destined for both the landfill and recycling center. We use fishing scales and containers of known volume to measure litter to the nearest tenth of a pound and volume to the nearest quarter of a cubic foot. Because littered items like Styrofoam are easily compressed, weight is generally a more accurate measure of trash collection. To increase accuracy, litter can be

weighed after drying – although simply draining trash containers of excess water before weighing is often sufficient. Data are entered into spreadsheets for analysis. Example cleanout forms and analysis worksheets can be found in the Appendix.

Litter Analysis & Publishing

There are many methods of analyzing and publishing trash trap program data. Data handling will depend on the program's goals. Fortunately, there are a plethora of free tools available to track, analyze, and disseminate trash trap program information. A list of free data collection, reporting, and citizen science tools are outlined in the following paragraphs.

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. Chattahoochee Riverkeeper has used the protocol since the program's inception to gain unparalleled insight into local litter pollution. The ETAP 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. Performing the ETAP can greatly slow down the cleanout process. The procedure involves organizing and counting each item of captured litter: every plastic bottle, foam cup, and cigarette butt included. While performing the ETAP requires training and a significant labor investment, over time they produce a comprehensive picture of what trash traps capture. Example ETAP results can be found in the Appendix.



Map of cleanup events in New York City by National Georaphic's Marine Debris Tracker

National Geographic's Marine Debris Tracker is a free application for uploading ETAP and other trash cleanup data for public use. Designed for both desktops and mobile devices, the application allows users to submit cleanup information, including the location, time, and amount of litter collected according to the ETAP and other taxonomies. Additionally, the tracker has tools to graph collected trash by organization, region, and date. An open data platform, the public can download raw data from the tracker's entire database to examine themselves.

Other platforms include Litterati, a mobile application for crowd-sourced litter tracking around the world. Users can take geo-tagged photos of illegal dumping and litter hotspots to help researchers and policymakers curb trash pollution. The free-to-use TACO dataset is an open-source project to improve machine-assisted litter identification. Users upload photos of refuse to TACO and trace the litter's outline with the provided tools. These datasets are then used to train artificial intelligences to identify and categorize littered items by sight alone.

Lastly, geographic information systems (GIS) and map visualization can greatly expand an organization's ability to communicate the results of a trash trap program. ESRI's ArcGIS Online mapping software can provide in-depth analysis tools for internal use while ArcGIS StoryMaps can provide interactive experiences for sponsors and the public.

You Have a Trash Trap Program, Now What?

Beyond simply collecting litter, trash traps convey numerous qualitative benefits to their watersheds and the groups that operate them. In addition to the water quality benefits, trash trap programs can aid an organization's education and outreach efforts.

Education

Trash traps provide a powerful platform for learning about water conservation and pollution mitigation. Chattahoochee Riverkeeper regularly features images and video of trash trap cleanouts in print marketing materials, at tabling events, and on social media.

In hands-on learning activities, CRK conducts simulated ETAP events showing students how to sort and categorize capture litter. These "ETAP Demonstrations" have been presented to students from 6 to 18 years of age. Through multimedia presentations, students learned about the water cycle, trash trap operation, forensic trash analysis, and the ways individuals can reduce their ecological footprint. Trash trap discussions are a common feature of stakeholder meetings with municipalities, non-governmental organizations, faith-based groups, universities, and more.

Trash trap design and operation is intuitive enough that student groups can develop their own versions. Student clubs have approached CRK to use trash traps as inspiration for robot design competition and science fair projects. Trash traps have often been the subject of after-school club activities and Eagle-Scout projects. By providing the background knowledge and opportunities for young people to become better stewards, trash trap programs can 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

Demonstration of Escaped Trash Assessment Protocol (ETAP) litter analysis

Students perform simulated ETAP during a visit to a trash trap

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 introduces students to exploring those fields as viable vocational opportunities.

Outreach

Trash traps can generate large amounts of positive publicity and aid an organization's advocacy goals. The traps are highly visible, physical manifestations of an organization's presence in a watershed and have potential to act as focal points and conversation-starters in the waterways in which they are placed. Trash trap devices like Baltimore's "Mr. Trash Wheel" and The Ocean Cleanup's "Interceptor" attracted attention from national and international media outlets. The design and implementation of the trash traps is simple to summarize, which proves useful when explaining the program to a wide audience.

Trash traps can also serve as a jumping-off point for community cleanup events and can diversify an organization's trash-reduction portfolio. While river and roadside litter cleanups are a traditional choice for volunteer events, a one-off trash trap cleanup can prove an exciting twist for more dedicated volunteers. For non-profits, volunteer trash trap cleanups can serve as a donor reward for program sponsors.

Lastly, depending on the goals of the organization installing the trap, data generated from litter analyses could prove useful in developing campaigns to reduce litter pollution at its source. Through the ETAP and other litter assessment tools, organizations can use data to focus litter reduction efforts on hot spots. Littered items can often be traced to specific businesses, events, or brands, which can help identify commercial illegal dumping. Trash capture data can bring much-needed specificity to local anti-littering campaigns. Ultimately, the specific strategies used for outreach will depend on the organization's mission, available resources, and target audience.

Conclusion

Ultimately, the feasibility of employing trash traps to combat litter pollution depends on the values, goals, and resource limitations of the organization. The field of litter abatement is diverse, with businesses around the world offering a variety of solutions for every conceivable waterway, pollution level, and budget. Although initially daunting, collaborative efforts between watershed organizations and local stakeholders, armed with the most pertinent information, can yield efficient trash trap programs that can endure for years and even decades.

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Appendix: Trash Trap Maintenance SOP

General Notes

- Trash Traps will be cleaned out at a minimum of two times per month
- They will be inspected weekly. Additional cleanouts may be warranted based on inspection.
- "Cleaning out a Trash Trap" - removing all trash items from the trap, around the trap (including the trash items caught by the booms). This includes clearing debris caught by the trap.
- ETAP on all materials if less than one 40-gallon trash bags. ETAP 1 bag + 10% of each additional bag when multiple bags of litter are removed from a Trap.

Equipment

- Trash Pickers
- Gloves and PPE
- Tubs
- Waders
- Hanging Scale
- Trash bags
- Clipboard
- ETAP and Cleanout Forms
- Pen
- Insect repellant
- Sanitation Gear
- Knife or multi-tool

Process

1. When first arriving at the site, take a safety moment. Examine the site for changes and potential hazards. Discuss with team.

2. Clean out the trap - remove all trash items from the trap, around the trap (including the trash items caught by the booms). Use the tubs and pickers to collect all materials.

3. After all trash is removed, check condition of trap, ensure trap is operational for next rain event. Make note of any repairs.

4. Once out of the water, perform ETAP and then separate recyclables.

   a. If ETAP is to be performed later, proceed with separating recyclables for weighing and volume determination. After needed data is acquired, re-bag all materials and label with

site name and date. Materials should be stored in a secure place.

b. "Recyclables" are determined based on local recycling rules. Sort the recyclables - dump all trash out of tubs, sort with pickers putting the designated recyclable items into tubs to be weighed.

5. Once all materials have been separated, weight and volume need to be documented.

   a. Every attempt should be made to drain materials of water or fluid to avoid skewing weight. Only drain materials if it is safe and environmentally sound.

   b. No vegetation should be weighed.

   c. Large items such as furniture should be noted in the debris section of the "Cleanout" form and weighed separately.

   d. Two methods for weighing material:By bag (bag weight is considered negligible), or by tub (tare scale using empty tub)

   e. Volume - Tubs have a known volume of 3 cubic feet (per 21gal Plastic tub)

6. Once all items have been weighed, field leads will fill out the "Cleanout" form in its entirety.

7. Materials will be hauled away and taken to approved storage or disposal site.

8. Once quality check on field forms has been completed, recyclables can be sorted, and trash can be properly disposed of.

ETAP Tips

- "When in doubt, throw it out." If it looks hazardwous or questionable, don't recycle.
- The majority of plastic, ~90%, is in a recyclable condition.
- Labels help differentiate fouled from unfouled plastic bottles.
- Focus ETAPs on pieces of trash fist-sized or larger.
- Combine small trash fragments to form fist-sized pieces.
- During ETAPs 1st sort by item, 2nd sort by labeling, 3rd sort by condition.
- Vast majority of "Bags and Film" items are partially intact.

Appendix: Example Trap Cleanout Form

Name:	
Date:	

Site:
Creek:
City:

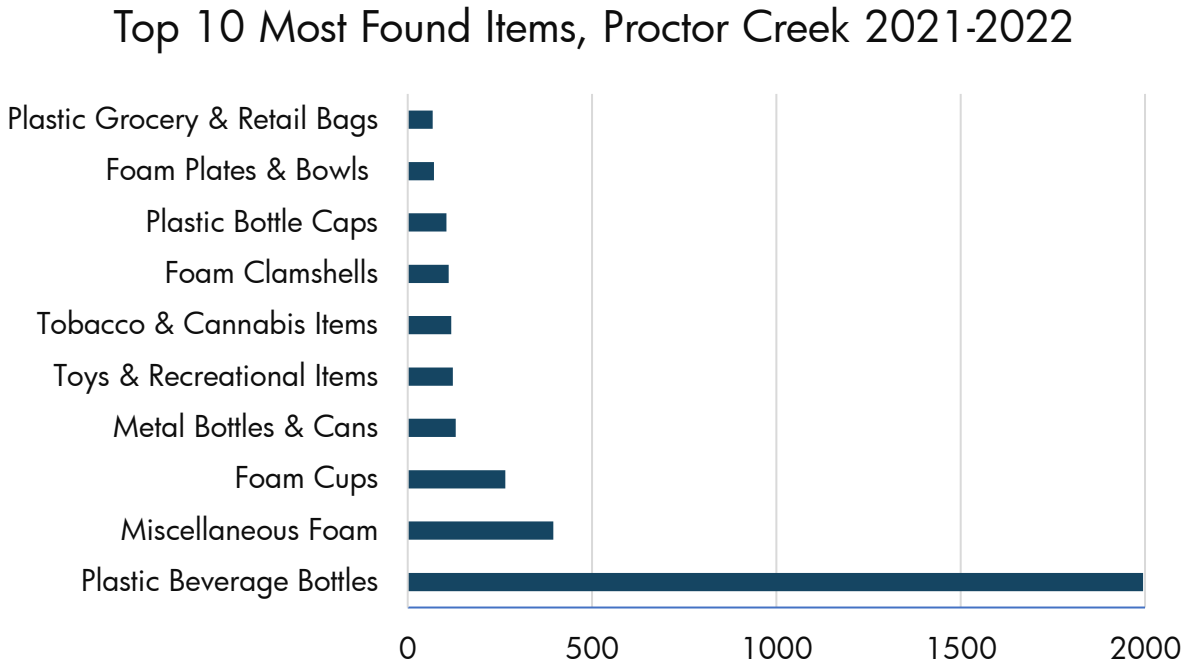
Time In:	**Time Out:**

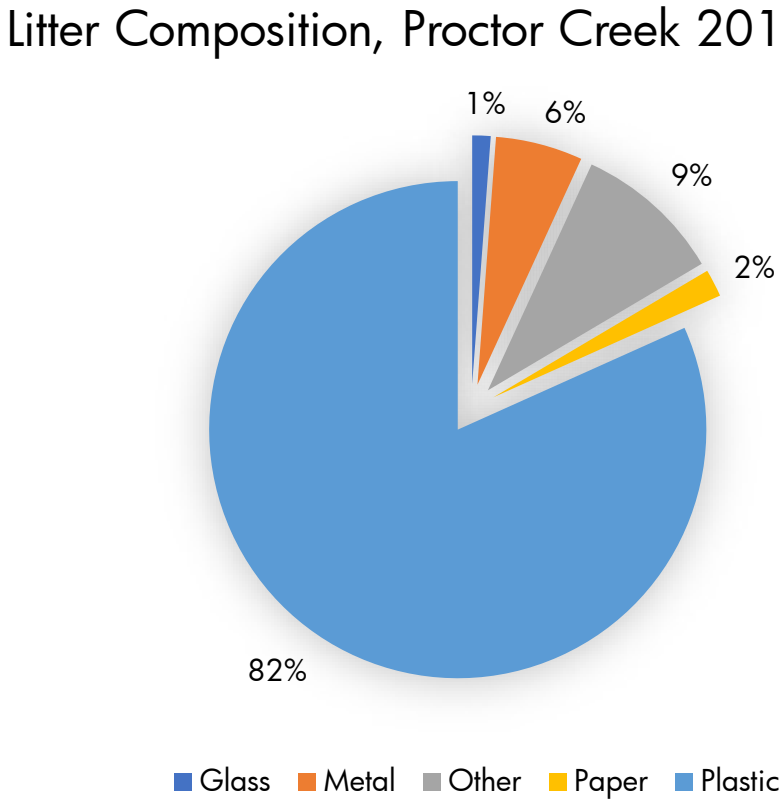
	Trash Trap		Surroundings	
Recycle	**lbs**	**ft^3**	**lbs**	**ft^3**
Dispose	**lbs**	**ft^3**	**lbs**	**ft^3**
Total	**lbs**	**ft^3**	**lbs**	**ft^3**

Site Observations:	**ETAP?:**

Comments:

Appendix: Example ETAP Results





All documents needed to complete EPA's Escaped Trash Assessment Protocol (ETAP) can be found here: www.epa.gov/trash-free-waters/gulf-mexico-partnership-etap-materials