

Be a Chesapeake Bay Retriever: Designing Effective Outreach Programs to Reduce Pet Waste

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Introduction

Stormwater runoff from urban and residential lands are a significant source of pollution to local streams and surface waters. According to most recent water quality data, nearly half of the monitored stream miles in the mid-Atlantic are impaired, with pathogens (38%) and nutrients (14%) serving as two of the leading contaminants¹.

To combat these impairments, many communities are now subject to MS4 permits. These permits establish six program elements, or, “minimum control measures”, that when implemented in concert, are expected to significantly reduce pollutants discharged into streams and other waterbodies².

The first minimum control measure, public education and outreach, requires municipalities to distribute educational materials to inform citizens about the impact that polluted stormwater runoff discharges can have on water quality. Local resources for outreach are often limited, so it is important to focus outreach efforts to make a real difference.

In this report, we focus on an education and outreach technique that can be a little “hairy”. Local efforts on pet waste pick-up can be one of the best opportunities to meet permit conditions for public education and outreach and improve the health and safety of their local waters. However, it is not without its complications and challenges.

Pet Waste in the Chesapeake Bay Watershed

The Straight Poop

Pet waste is a leading source of both nutrient and bacteria pollution to urban streams and waterways. According to recent research, pet waste can make up as much as 76% of the total phosphorus and 28% of the total nitrogen exports from households in high-density development areas³ while a single gram of dog waste contains 23 million fecal coliform bacteria⁴.

The human health implications of pet waste are significant. Dog waste contains many pathogens, including *Salmonella*, *E. Coli*, *Giardia*, and *Cryptosporidium* that can lead to severe intestinal diseases in humans and are frequently spread through drinking water or ingestion. More recently, researchers have also found that dog waste can also be a reservoir for antibiotic resistant bacteria⁵.

Because we walk and play in the same spaces as our pets, there is a direct pathway for these diseases to be spread if they are not properly contained and disposed of. Studies of pathogen transport have shown that surface water pollution from fecal sources spikes following storm events⁶. Pathogen contamination can be a problem for communities that rely on groundwater for their drinking water supply and has led to numerous disease outbreaks in the U.S.⁷.

Not picking-up and disposing of pet waste can expose our families to diseases when they play in the yard, or swim in a local stream. Pathogens from pet waste could also threaten the safety of food grown in our gardens or our drinking water supplies. Connecting pet waste to public health is an important part of any outreach and education strategy.

What Do We Do with Doo?

There are a lot of resources and contradictory information available on how to dispose of pet waste. Let's take a moment just to discuss best practices for pet waste disposal, since it will likely play a role in your outreach campaigns.

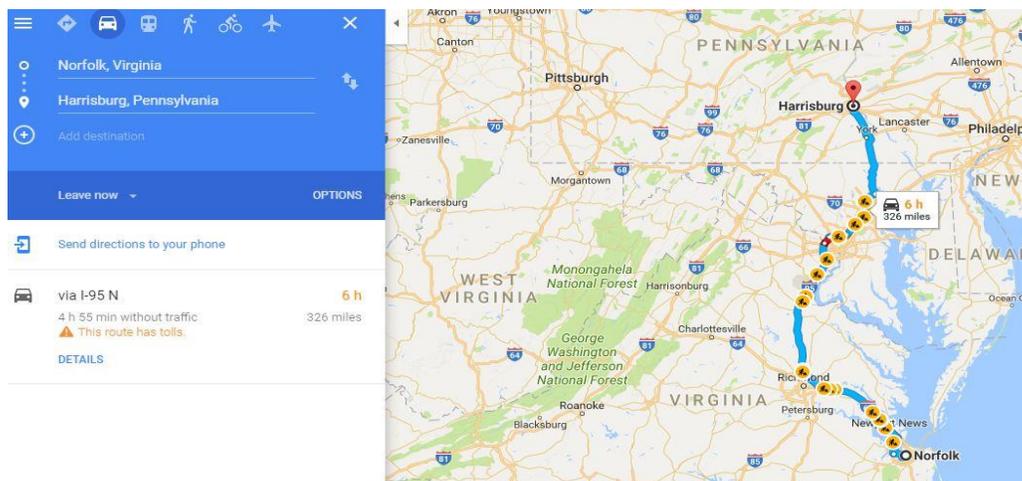
<p style="text-align: center;">Composting</p>  <p>It is possible to compost dog waste, but the pile must exceed 165 degrees Fahrenheit for over five days in order to safely sterilize the manure⁸. Unfortunately, most backyard compost systems rarely reach this temperature, and even if they did, it would still be inadvisable to use the waste as fertilizer.</p>	<p style="text-align: center;">Burying Waste</p>  <p>Burying waste is not recommended because it allows pathogens and parasites to establish themselves in the soil. Nutrients and bacteria will also leach through the soil and into the groundwater, where they will be transported to surface waters.</p>
<p style="text-align: center;">Flushing</p>  <p>Flushing pet waste can work if your home is connected to a sewer system that is treated by a wastewater treatment plant. However, many homes in the Chesapeake Bay watershed are on septic systems, which can be overwhelmed by the additional waste. Bags and cat litter cannot be flushed in any circumstance because they are likely to clog pipes and cause plumbing problems⁹.</p>	<p style="text-align: center;">Trash</p>  <p>This is probably the best recommendation for your outreach campaign. It is a simple solution and landfills are designed to handle pet waste. Using bags made out of recycled plastic is another good recommendation because once in a landfill, neither biodegradable nor regular plastic will break down¹⁰.</p>

How much is there?

When we apply what we know about dog waste to the entire Chesapeake Bay watershed, it is easy to see why this issue is so important to address. (To see the full assumptions and calculations behind the following estimates, see Appendix B).

According to the American Veterinary Medical Association¹¹, 36% of U.S. households own dogs, and with over 7 million households in the watershed¹², that adds up to over 4 million of our furry friends.

The USDA estimates that the average dog produces 0.75 lbs of waste per day¹³. Over the course of a year, that's 1.1 billion pounds of dog waste in the Chesapeake Bay watershed, enough to fill 14,600 tractor trailers to capacity. Lined up end-to-end, that many tractor trailers could stretch all the way from Baltimore, MD to Richmond, VA.



Assuming excretion of nitrogen and phosphorus is approximately equal to the amount of each nutrient in their food¹⁴, we can estimate that dogs excrete 50 million pounds of nitrogen and 11 million pounds of phosphorus each year in the Chesapeake Bay watershed. This exceeds the estimated nitrogen and phosphorus production of Canadian geese, a common nuisance species to water quality in the Bay region.

If we also assume that the majority of the pet waste is excreted on turf grass, we can spread it over the 3.8 million acres of turfgrass⁴¹ in the watershed to get an average of 13.15 lbs TN/ pervious acre and 2.9 lbs TP/ pervious acre. However, there are areas in the urban landscape where these loads are probably concentrated. Places like dog parks, hike and bike trails, and community open spaces in higher density development areas are potential “poop corridors” that could be pet waste hot spots.

Using the same assumptions, we can estimate the fecal coliform numbers in the watershed would be as high as 4.6×10^{18} . Looking at other pathogens, *Giardia* has been found in nearly 31% of dog waste left on urban streets and *enterococci* has been measured in 37% of dog samples, though specific numbers are more difficult to determine for these pathogens⁴².

Where is the poop?

While it is somewhat easy to calculate the total mass of dog waste being deposited within the Chesapeake Bay watershed boundaries, parsing out where that waste is actually left is a bit trickier. Among some of the

most commonly cited reasons for why they do not pick up after their dogs, are that the waste is “on the edge of my property” or “in my yard”¹⁵. Furthermore, another study found that the vast majority of their survey respondents (97%) strongly agreed that dog walkers should clean up after their dogs on street pavements, public parks and playing fields, while less than 12% strongly agreed in that they should pick up waste from open countryside or farmland¹⁶.

However, results from a recent survey of Chesapeake Bay residents found that the answer to where pet owners are more likely to pick-up and dispose of their dog waste might be even more complicated. While pet owners in rural areas were more likely than urban and suburban pet owners to say they never pick up and dispose of pet waste on their property, Chesapeake Bay residents also indicated that they more frequently pick up after their pets on their own property than they do off their property¹⁷.

With private lawns making up approximately 75% of all urban pervious lands across the watershed¹⁸, it is important for us to consider what is happening in our backyards as well as in public spaces. The conventional wisdom to this point has been that pet owners are much more likely to pick-up after their pets in public spaces than in their own yards, making it a common approach to target at-home behaviors. New data suggesting that this may not be the case in the Chesapeake Bay watershed should help shape new messaging strategies and outreach programs.

Who Scoops?

Just because dogs produce a lot of waste, doesn't mean it is all reaching local surface waters. Past surveys of Chesapeake Bay residents indicate that 60% of dog owners always or usually pick up their pet waste. These surveys rely on self-reported behavior, and are likely an over-estimate, but provide us with a good starting point. However, even if we take participants at their word, that still leaves 442 million pounds of dog waste (22 million pounds of N and 4.4 million pounds of P) left on the ground across the watershed each year.

The challenge is that picking up pet waste is an unpleasant task. Pet owners who don't pick up after their furry friends are not very likely to change their behavior¹⁷. Part of the reason for this is that past outreach efforts may have already convinced those who were most open to behavior change, leaving only the most stubborn pet owners for future programs.

To reach these audiences, communities need to think about improved targeting, messaging and program implementation. When done well, pet waste outreach may do more than just put a dent in the amount of waste left on the streets in your community. Pet waste programs can also be a great way to get a foot in the door with neighbors and may lead to more dialogue on controlling stormwater pollution in your community.

Why don't we have a pet waste BMP credit?

At this point in time, there is no Chesapeake Bay Program credit for adopting a pet waste outreach program. The challenge with defining pet waste nutrient reductions that could be used to meet numeric TMDL and MS4 permit goals lies in our difficulty measuring change in behavior from the baseline. While we have better data on how much pet waste is deposited across the entire Chesapeake Bay watershed, several key data gaps remain to be solved in order to support a numeric load reduction for pet waste outreach programs.

1. Where exactly in the landscape is the pet waste deposited? – How much pet waste is deposited on each urban land use (pervious lands, impervious lands, forests or meadows).

2. How much collected pet waste would have been picked up if there were no outreach program – Even if we directly measure the pounds of pet waste collected by a pet waste station, we would need to define a way to discount that mass of pet waste that would have just been placed in a different trash can and never measured.
3. Behavior change is tough to measure – If we try to measure load reductions based on anticipated behavior change, we need more studies on how effective outreach programs are at changing behavior. We currently rely on surveys of self-reported behaviors, which are inexact and may not lead to quantifiable changes to pet waste. The results that we do have on behavior change have also shown varying degrees of success, with some studies even finding worse pet waste pickup behaviors after the outreach program.

These challenges do not preclude developing a credit for pet waste outreach programs in the future, but may require an expert panel to develop recommendations.

What Does a Pet Waste Outreach Campaign Look Like?

Pet waste is an issue for many communities, and each program needs to be tweaked slightly to fit their unique needs and circumstances. The three most common elements are a pet waste ordinance, installation of pet waste disposal stations, and distribution of educational materials.

Pet Waste Ordinances

Of the 68 Maryland communities participating in the Maryland Sustainable Certified program, 24 of them have adopted a pet waste ordinance that requires residents to pick up after their pets¹⁹. In Centreville, Maryland, the ordinance requires that “all persons owning or in charge of a dog, cat, or other domesticated household pet shall immediately and properly dispose of their pet's solid waste deposited on any property, public or private, not owned or possessed by that person” punishable by a fine up to \$500²⁰. A similar approach is taken in the town of Bowie, MD, but with fines increasing with each offence from \$50 for a first offence, up to \$200²¹.

Pet waste stations

Installing signs and pet waste disposal stations in the community is another effective approach. These stations help to remove one of the most frequently cited barriers to picking up pet waste: not having a bag or trash can^{15,22}. Numerous studies have demonstrated the benefits of installing these stations, and they are relatively cost effective. For example, Montgomery County, MD installed seven stations across three sites in 2013, collecting 1,826 lbs of waste in just one year for a total cost of \$10,000 including materials, installation and weekly servicing²³. If we applied our earlier assumptions about nutrient content, the pet waste stations removed about 91 lbs TN or \$109 per pound for the first year.

The Hampton Roads Planning District Commission uses a grant program that awards free pet waste stations to neighborhood associations, community groups and property managers who agree to stock and maintain the station. To date, they have awarded 258 pet waste stations to groups throughout Hampton Roads²⁴.



Courtesy: Vienna, WV

Distributing educational materials

There has been a lot of discussion over the best ways to conduct the educational component of pet waste programs. With the way people consume information constantly changing, finding an effective vehicle for your message can be a moving target. For example, a 1999 survey of MS4 program managers found that local newspaper ads received the highest average effectiveness rating¹⁵. Another survey from the same report found that the preferred method for residents to receive outreach was via ads on public television. However, with newspaper readership numbers down by 20-30% across all age groups since 1999²⁵ and traditional television viewership showing similar declines, especially among younger audiences²⁶ it is important to think about other opportunities that may now be more effective.

With the rise of digital media, outreach campaigns can also be conducted online. A study on how homeowners would prefer to learn about more environmentally friendly lawn care practices found that they would most often prefer to visit a website and have the information presented either in the form of reading material, or a 3-5 minute video²⁷.

There is also the need to balance effectiveness with cost. In the Center for Watershed Protection survey, brochures/flyers were used by almost all the MS4 programs, but program managers ranked them rather low as an effective outreach technique. Training workshops were widely regarded by program managers as highly effective^{15,27} but they have a number of limitations including poor attendance rates and the inability of workshops to reach large segments of the general watershed population.

No outreach method is perfect, so it is helpful to combine several approaches to increase your chances of success. For example, a series of short videos posted to your social media site may reach a younger demographic, while brochures or flyers distributed to local pet stores may reach another audience.

Implementing a Program

Getting Started

The first, and often the most overlooked, step in developing any outreach campaign is to clearly identify a goal and desired outcome. If the goal is to improve water quality by crafting a pet waste outreach program, think about defining outcomes that are specific and measurable²⁸. Maybe you can monitor the mass of waste deposited in waste collection stations in the community. Or, think about administering a survey before and after your program to try and measure the number of residents who change their behaviors. Having specific goals in mind and a process for tracking progress towards them will allow you to learn what works and make future outreach efforts more efficient and effective.

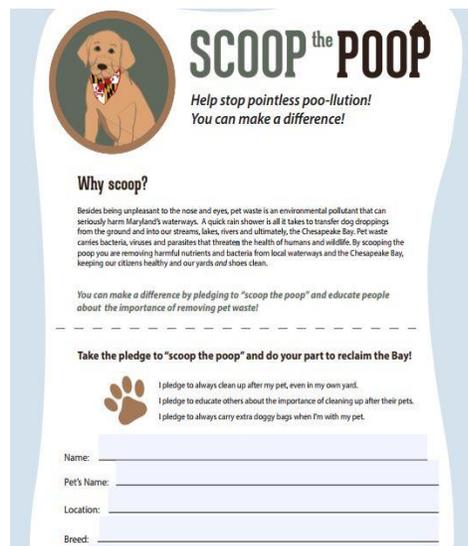
The next step is to identify the target audience for your outreach campaign. Targeting helps 1) identify the particular benefits of and barriers to pet waste pick-up for your specific audience; and 2) optimize the message and method to best accomplish the educational objective²⁹. While there is not a lot of good demographic data on who might be most easily swayed to pick up after their pets, it never hurts to get out and talk to residents. For a pet waste program, go to a dog park, open space or popular trail and ask dog walkers about their opinions on pet waste. It doesn't need to be a scientific survey if you can't spare the time

or resources. Sometimes an anecdotal understanding of common concerns and barriers can help you more effectively message to the people you specifically want to reach with your campaign.

The other factor to consider when targeting your audience is available staff resources to install, monitor and maintain pet waste stations. Depending on the type of program you are interested in, identifying a leader in the community who is willing to be a champion for the program may be invaluable. These community coordinators could be identified during your early conversations with residents, and could be the point person on the ground who stores refill bags, serves as the first contact for other community members, and makes sure that any hired contractors are removing full bags. In some cases, they may even be relied upon to obtain county permits for sign installation and order station parts³⁰.

Once you have defined your goals and identified your target audience, you need to figure out what you want your program to actually look like. There are many options available, which are not mutually exclusive, including adopting a pet waste ordinance, installing pet waste stations and conducting an educational campaign to teach residents about the impacts that pet waste can have on local water quality.

Research suggests that combining these options can help to maximize the success of your program. This comprehensive approach, called “outcomes based education” uses the following four steps: 1) asking for a commitment from the audience, 2) placing specific behavior prompts near the behavior, 3) communicating the norm, and 4) removing barriers to desired behavior²⁹.



Courtesy: Maryland Department of the Environment

Asking for a Commitment

Having an accountability system is important for the success of any program. For you, that means having the specific, measurable outcomes in place to ensure you follow through with your program. But the need for accountability also applies to your target audience. To improve the odds that residents will change their pet waste pick-up behaviors, you can have them sign a pledge.

One program, developed by Los Angeles County Department of Public Works, created a partnership with three local Petco pet supply stores where dogs pledge that they will not pollute by having the owner pick up after them¹⁵. Another program, in Alachua County, FL had 10% of respondents report a change in their behaviors because of a campaign that included a pledge to pick up after their pets³¹.

Part of the reason why a sense of accountability is so important for pet waste programs is that perceived social pressure is often a major motivating factor in this behavior. A study of dog owners in the United Kingdom found that visibility and a positive perception of the dog walking area impacted the likelihood that owners would bag and discard their pet's waste. In many instances, the dog owners would scoop the poop while in highly public areas, but then would leave the bags along the path once out of sight of others¹⁶.

A pledge is a gentle but effective way to establish a commitment from the audience that can serve as a motivator and lead to lasting changes in behavior.

Behavior Prompts

The next step is to make sure that you place specific behavior prompts in locations that can trigger the desired behavior. Signs are an easy and effective way to remind people of the importance of picking up after their pet, and can be strategically located to reach the greatest audience. When selecting your sites, remember your early conversations with residents about their walking patterns. Also think about dog park locations, visibility and accessibility. It is usually best to avoid private property, but keep in mind that any signs placed in the road right-of-way will make permitting much more difficult³⁰. Land owned by a homeowner's association might be the best place to start. We will spend more time talking about the specific messaging that can be used for signs in the next section.

The other consideration with behavior prompts is to distribute your outreach materials in the best places to make sure they reach your desired audience. Think about pet service providers as both potential audiences, as well as messengers. In Snohomish County, Washington, county staff visited dog kennels, pet stores, pet shelters, and veterinary offices to learn about their pet waste management practices, interests, and challenges. About 25 percent of all businesses visited had problems with poor pet waste disposal, and education alone resulted in improvements at 75 percent of those facilities. County staff also quickly discovered that veterinary offices are great places to get the message out and help teach pet owners about the importance of managing pet waste. Veterinary staffs' enthusiasm and professional expertise are important factors that will help local education campaigns to be as effective as possible³². Similarly, a program in Austin, Texas mailed outreach brochures distributed to city vet clinics, animal shelters, libraries, and recreation centers and found that after the campaign, 96% of pet owners reported picking up their dog's waste compared to 87% prior to the campaign.

Communicating the Norm

The third component to the outcomes based education approach is "communicating the norm". This means crafting a message that is most likely to result in the desired behavior change. What that message looks like will depend upon who your target audience is and what you found in early discussions with community members. Because of the subject matter, many outreach programs like to use humor as part of their messaging strategy. While humor can certainly be incorporated to enhance your message, many studies have shown that one of the greatest motivations for people to clean up after their pets, is the desire to be a good neighbor^{15,22,23}. Therefore, crafting a message that appeals to a sense of community and responsibility can really resonate with a lot of audiences.

That said, there are many different barriers that people cite that may be stopping them from picking up after their pets. If there is a knowledge barrier, focus your outreach efforts on educating residents about the high levels of bacteria in dog waste and how it can affect water quality and human health. If convenience is a barrier, target outreach on making sure residents are aware of pet waste collection stations, or other services that can even pick up their pet waste for them³³.

When it comes to signs around the community, a study that measured Raleigh residents' preferences towards pet waste pick-up signs found that personal responsibility and community integration were consistently the most salient motivators. While humor was presented on various signs, it did not play a compelling role overall. Guilt-inducing messages consistently performed poorly²². When assessing the design of each sign, simplicity and a straightforward message were often cited as preferable features.

Simplicity and message clarity are important to emphasize because many outreach materials tend to pack too many messages into one publication. This dilutes the key message and can overload packets with information, overwhelming the intended audience¹⁵. The “Scoop it. Bag it. Trash it.” campaign slogan has been used in many communities around the country³¹ and is effective because its simple message not only conveys the need to pick-up waste but also to dispose of the waste properly. It is straightforward and leads the audience directly to a desired action.



Dog Park Signs: Raleigh, NC



Sign in Anne Arundel County, MD



Sign in Austin, TX



Pet Waste Message: Prince George's County, MD



Pet Waste Message: Clemson University Extension

Removing Barriers

We have already talked a little bit about the final step in the process, “removing barriers”. Education and outreach alone may not be able to affect behavior change if there are other perceived barriers that influence the actions of community members²⁷. That is why the installation of pet waste stations with trash receptacles and “mutt mitts” can help translate pet owners’ new knowledge into tangible behavior change.

San Bernardino County, CA gave away free doggie bag canisters with their outreach materials and saw a 5% increase in positive behavior practices³⁴. Meanwhile, Austin, TX has installed over 100 “mutt mitt” stations and have reported an 11% increase in pet waste pick-up behaviors³⁵. While there are many factors that may have contributed to these results, the combination of simple messaging with the removal of barriers seems to be an effective approach.

Another opportunity to improve your program is by putting together a map of the pet waste stations in your community. This can be done quickly and simply using pins on Google Maps and can help to prevent pet owners from abandoning bags or not picking up waste because they think there are no receptacles nearby.

CSN Recommendations

Pet waste is a great opportunity to develop an effective outreach program because people are passionate about their pets and their communities. While targeting pet waste pick-up behaviors has the potential to make a positive difference for local water quality, it is also a great way to get to know your residents and start a larger conversation about stormwater management.

Education and outreach focused on behavior change can be a very inexact science. However, by establishing clear goals, being precise about who your audience is, crafting a simple and actionable message and removing key barriers, you can achieve lasting behavior change that improves the health and safety of your local waters.

Now that we have discussed what the literature has to say about the impact of pet waste on water quality and the effectiveness of various types of outreach campaigns, we would like to present two options for how to execute a simple and effective pet waste program. The first option is designed for a Phase I MS4 community with full time staff and a budget that can be dedicated to the outreach program. The second option is geared towards smaller Phase II MS4s or unregulated communities who want to tackle the issue of pet waste but are operating on a shoestring.



Pet Waste Outreach Guidance for Phase I MS4s



1 Develop a Pre-program Behavior Survey



This is a great first step in helping you to find out more about your target audience. Ask questions not only about whether they pick up after their dog and why, but also try to gain a little information about where your residents get their information. Do they read community newsletters or attend local community events? All this information will help you design an outreach program that addresses the largest barriers for your audience in a medium that is most convenient for them.

Also be sure to attend community events or visit local dog parks to talk to pet owners about their habits. See if they know of particularly problematic areas or common walking routes that could be targeted by a program.

Avoid the one-size fits all approach to outreach. Evaluate your pre-survey findings and decide what messages will be most important for your community members and design and outreach strategy that is suitable for those messages. Anne Arundel County, Maryland has developed a list of commonly cited barriers to pet waste pick-up and linked them to suggested tools and approaches for tackling them³³.



2 Select Appropriate Outreach Tools



Because you have already administered a pre-program survey, having a post-program survey is a great way to get a sense of behavior change that may have resulted in your outreach program. If part of your program involves the installation of pet waste stations, think about measuring the amount of waste collected. Maybe you even want to try surface water monitoring. Know ahead of time how you want to measure and define success.



3 Decide How to Measure Success



Regardless of which tool you choose for outreach or barrier you decide to tackle, make sure you have a clear and concise message. Remember to keep it simple and actionable. Keep the "Scoop it. Bag it. Trash it." slogan in mind as a good example.



4 Lock in Your Message



One of the advantages of being a larger MS4 is that you may have the staff resources to get out into the community more frequently. Just like smaller MS4s, you can visit vet clinics, shelters and pet stores and see if any of them will take your materials and distribute them to their customers. This might be particularly effective for both establishing social norms, and increasing residents' knowledge about pet waste. You can also attend more community events if social diffusion is called for based on your pre-program survey. One on one interactions are still one of the most effective ways to create lasting behavior change, so the more you can get out into the community, the more successful your program is likely to be.



5 Go Out into the Community



You may also be in a position to create a more advanced media outreach effort. Social media is one way to promote your message and catch people's attention, using short videos and articles. Beyond that, hiring a marketing specialist to develop a few short ads that could run on local television or in nearby movie theaters is also an option that is likely to reach a much larger audience than most other outreach efforts.



6 Consider Media Outreach



7 Evaluate Your Program



After about a year of outreach, it's time to evaluate your program. Administer your post-program survey and ask again about behaviors, as well as whether participants had seen any of your educational materials or interacted with staff at a community event. Compare waste collected to any goals you established at the outset of the program. Then, begin to look at making tweaks to your program. Maybe you see in the post-program survey that knowledge is no longer a behavior barrier, and now it is all about convenience. Over the next year, start to shift your messaging and outreach methods to address that barrier more directly.



Pet Waste Outreach Guidance for Phase II MS4s



1 Get to Know Your Target Audience



Send a staff member to a community event or local dog park to talk to pet owners about their habits. See if they know of particularly problematic areas or common walking routes that could be targeted by a program.

If you can find a resident who is willing to champion the effort, sign them up! Ideally, they could be the point contact for other community members and take the lead on ordering parts for pet waste stations.

Using information gathered during your discussions with community members, come up with a short, simple pledge that residents can sign, promising to pick up and dispose of their pet waste. Take it to community events, post it to your social media sites and MS4 program website. A good example is the one used by the City of Frederick:

<https://www.cityoffrederick.com/DocumentCenter/View/2811>



2 Develop a Pledge



Based on your discussions with community members, order pet waste stations that can be placed in highly trafficked dog walking areas. They can be ordered from sites like this one:

<http://www.belson.com/Steel-DOGIPOT-Pet-Station>.

Make sure that you obtain all the proper permits for your stations and signs. Check with the zoning and permits authority in your location for more information.



3 Craft a Message



Remember to keep it simple and actionable. Keep the "Scoop it. Bag it. Trash it." slogan in mind as a good example. For signs and other outreach materials, think about the barriers that were most commonly mentioned by your audience.



4 Install Pet Waste Stations



This is done in two parts. If you have a social media presence, use it as a way to promote your program. Use the same messages over and over again on each platform to drive the point home. If you have more detailed information that might overcrowd a brochure or flyer, create a few short videos (3-4 minutes) and post them to your website along with any other facts and information you would like to include. While your website should lead with your simple message, it is also a place where people who want more information should be able to find it.



5 Distribute Outreach Materials



For your print materials, whether you prefer flyers, brochures or door hangers, take them to local businesses that support the pet industry. Spend a day visiting a few vet clinics, shelters and pet stores and see if any of them will take your materials and distribute them to their customers. Forming these relationships can help you target your desired audience more efficiently. Shelters and pet stores can also be effective messengers for behavior change because you may reach some new dog owners before they have formed bad pet waste habits.

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Appendix A: Links to Other Resources

The following resources are available for additional guidance:

Type of Resource	Title of Resource	Web link
Local Program Example	Anne Arundel County Watershed Stewards Academy Pet Waste Outreach Resources	All Resources: http://aawsa.org/new-page-60/ One Pager: https://static1.squarespace.com/static/544916c3e4b09edc336b555e/t/568408fd4bf1188b5be35cba/1451493629877/pet_waste_one_page_r_v2.pdf
Local Program Example	How-To Guide: Pet Waste Station Community Program	http://arundelonthebay.org/pdf/How-to-Guide~Pet_Waste_Station_Community_Program_2010Final.pdf
Local Program Example	Snohomish County Pet Waste Outreach Program Resources	Program Summary: https://fortress.wa.gov/ecy/publications/documents/0910042.pdf Presentation: https://snohomishcountywa.gov/DocumentCenter/View/17601
Local Program Example	Hampton Roads Planning District Commission: Pet Waste Station Grant Program	http://askhrgreen.org/pet-waste-station-grant/
Community Certification Program	Sustainable Maryland Certified	http://sustainablemaryland.com/
EPA Guidance	Getting in Step: A Guide to Conducting Watershed Outreach Programs	https://cfpub.epa.gov/npstbx/files/getnstepguide.pdf
EPA Guidance	The Inside Scoop: How to Conduct a Pet Waste Outreach Campaign	https://cfpub.epa.gov/npstbx/files/NHDES%20Pet%20Waste%20Campaign2.pdf
Past Reports	A Survey of Residential Nutrient Behavior in the Chesapeake Bay	https://cfpub.epa.gov/npstbx/files/unep_all.pdf
Past Reports	Technical Memo on the Feasibility of an Expert Panel on MS4 Outreach as an Urban BMP	http://www.chesapeakebay.net/channel_files/22420/draft_tech_memo_on_outreach_lit_review_5_6_15.pdf
CSN Webcast	Conducting Effective Pet Waste Outreach Campaigns	http://chesapeakestormwater.net/events/webcast-conducting-effective-pet-waste-outreach-programs/

Appendix B: Pet Waste Calculation Assumptions

Chesapeake Bay Watershed Population = 18.1 million people¹²

Average Household Size: 2.58 people per household³⁶

18.1 million people / 2.58 people per household = 7.02 million households

Dog Ownership = 36% of households own dogs, with 1.6 dogs per household¹¹

7.02 million households x 0.36 x 1.6 dogs per households = 4.04 million dogs

Waste Production = 0.75 lbs of waste per dog, based on average dog weight of 20kg¹³

4.04 million dogs x 0.75 lbs x 365 days = 1.1 billion pounds dog waste per year

Tractor trailer capacity = 34,000 lbs on dual axel trailer³⁷

1.1 Billion lbs dog waste / 34,000 lbs per trailer = 32,535 trailers

Tractor trailer length = 53 foot max³⁸

32,535 trailers x 53 ft / 5280 ft per mile = 327 miles

Distance from Norfolk, VA to Harrisburg, PA = 326 miles via Richmond, DC, and Baltimore

Nutrient Content = 12.3 lbs TN per year and 2.65 lbs TP per year; excretion of nitrogen and phosphorus is approximately equal to the amount of each nutrient in their food¹⁴

12.3 lb TN/yr x 4.04 million dogs = 49.7 million lbs TN

2.65 lb TP/yr x 4.04 million dogs = 10.7 million lbs TP

Canada Goose Population = 1 million in the Atlantic flyway³⁹

Canada Goose Nutrient Excretion = 3.11 lbs TKN and 1.41 lbs TP per goose per year⁴⁰

1.41 lb TP/yr x 1 million geese = 1.41 million lbs TP

3.11 lb TKN/yr x 1 million geese = 3.11 million lbs TKN