Stormwater Pollution Prevention Behavior of Corvallis Residents

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Final Report Presented by

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EXECUTIVE SUMMARY

As a component of the NPDES permit, Corvallis has an education and outreach program designed to help residents learn how to reduce and prevent stormwater pollution. Members of Sociology 519 (Applied Research Methods) undertook a study to gather information from Corvallis residents about what they know (1) about stormwater pollution prevention and (2) what kinds of potentially stormwater polluting behaviors they participate in. To do this, a 31-question survey instrument was created and then administered to almost 600 Corvallis households through face-to-face interviews. In addition, a focus group with individuals who live near a stream was also conducted to gather more in-depth information about their choices. Data from the survey was entered into an Excel database for analysis while the focus group interview was transcribed for analysis.

We found that about two-thirds (68%) of respondents knew that stormwater ran directly into waterways with respondents in some City Wards much more knowledgeable than those in others; three-quarters of respondents report that they "live near a stream" although the way they measured nearness varies from minutes to miles; for the most part respondents had strong environmental values as expressed through an index although these values weren't usually used to describe why they chose certain practices. Motivations for what appear to be pro-environmental behaviors are likely to be described as social pressure, economic reasons, and convenience. Barriers tend to be related to lack of knowledge about specific kinds of behavior related to somewhat complicated practices like the use of chemicals and native landscaping, although some respondents view cost as a barrier to using a car wash or immediate repair of leaking cars. About two-thirds of respondents report that they take direct action when they see someone polluting (62%), although none said they use the City hotline. The *City* newsletter, websites, and the Gazette-Times were all identified as sources of information to which they turn for information about stormwater pollution prevention. They are less likely to participate in activities like stream clean-up, booths at community activities,

Based on these findings we recommend that the Corvallis Education and Outreach program continue to provide information about stormwater pollution prevention through a wide array of venues, although more attention should be paid to providing explicit instructions and examples about specific practices that may be confusing to residents. The program should also provide details about City practices related to stormwater pollution prevention, especially if it can relate these efforts to individual practices. Finally, because most respondents (and likely Corvallis residents) perceive themselves as living near a stream, we recommend that this perception be used as the foundation for explicit requests for behavioral change – capitalize on this connection to waterways in Corvallis to show people how to improve their day-to-day practices that impact those streams and rivers.

I. INTRODUCTION

The Clean Water Act and the NPDES require Corvallis to implement certain stormwater management best practices including public education and involvement to increase citizen knowledge about residential storm water pollution prevention and encourage citizen implementation of best practices while developing a stream stewardship ethic. In particular, the residential program addresses the following practices likely to affect stream quality: riparian planting, erosion prevention, sediment control, pet waste disposal, landscaping with native plants, reducing chemical and fertilizer use, choosing better household products and their disposal, and car care including repairs and washing. The City of Corvallis has implemented several programs to target these behaviors such as distributing informative door hangers and magnets to encourage reporting negative water practices, pet waste bag dispensers, labeling storm drains, creek tours, stream restoration projects, community presentations, and outreach at public events. The program has not conducted a comprehensive evaluation of these efforts.

In order to effectively use finite resources in current programs as well as plan for the 2012 NPDES permit renewal, the City requires information about what Corvallis residents know about stormwater management, current outreach and education programs, and individual practices that affect water quality in the stormwater system. To that end, SOC 519 class members developed and implemented a survey and focus group to explore the following themes with Corvallis residents:

- What do citizens currently know about stormwater management? Do they understand what happens to water that runs off their driveway, lawn, or other public spaces?
- Do they understand the impact of various practices like leaving pet waste behind, disposing of chemicals and oils in storm drains, and increasing impervious surfaces on their property, etc.?
- What values do citizens hold regarding clean streams and do citizens perceive clean streams as a critical component of a healthy community? Do citizens believe that the actions they take have an effect on the water quality of streams?
- What do people do if they see storm drain pollution or a water quality issue? Do they know about the hotline? What would be other ways to direct people to report issues?
- What barriers do people perceive or experience to changing behaviors that affect stormwater quality? Are behavioral changes perceived as difficult, expensive, or ineffective?
- What are best methods and venues to provide information about stormwater management? How do Corvallis citizens learn about City programs to increase water quality and how do they access new/needed information?

After a review of relevant literature, we describe the approach and methods we used to collect and analyze data, discuss the findings for each of the questions, and conclude with recommendations based on the findings. A copy of the survey with frequencies is also included as Appendix A.

II. LITERATURE REVIEW

A. Environmental Knowledge

In evaluating educational programs' capacity to produce stormwater protection behaviors, it should be noted that models of pro-environmental behavior have disproven the common assumption that knowledge translates into desired behavioral change (Kollmuss and Agyeman 2002). Research tends to indicate that measures of specific attitudes rather than general measures of environmental concern are better predictors of pro-environmental behavior (Tanner and Wo¨lfing Kast 2003), and it is now generally accepted that values (Ajzen and Fishbein 1980), attitudes, and intentions are important determinants of behavior (Kotchen and Reiling 2000). Individuals who have strong post-materialist values (e.g., values and practices less focused on material consumption) tend to support environmental protection and engage in pro-environmental behavior (Lee and Kidd 1997), as evidenced by a study in which "riparian landowners who responded best to civic engagement efforts had a strong personal stewardship ethic" (Ryan, 2009: 1,122). Fischer and Bliss (2007) found that when individuals' embraced the beliefs and values of conservation efforts, they became more vested in protection efforts and behaviors and less concerned with constraints. In the context of changing behaviors this means that simply educating citizens about environmental issues is not enough to evoke action: the values and beliefs of community members need to be targeted as well (Pooley and O'Connor, 2000). This is not to say that knowledge is unimportant, but rather, knowledge alone is unlikely to change behavior without the appropriate set of values and conversely, that values will dictate desirable behaviors only with relevant knowledge (Inglehart 1995). In addition to knowledge and values, behavior change is also influenced by demographic variables and perceived constraints (Kollmuss and Agyeman 2002).

B. Demographics

Generally, it is difficult to use any single socio-demographic characteristic to target education and outreach efforts as studies linking demographics to certain behaviors and values are inconsistent and suggest that "people's beliefs and past behavior are better explanatory variables than socio-demographic characteristics" (Connelly, Knuth, and Kay 2002: 474). For example, in one study, participants in a landscaping and stormwater prevention program were more likely to be homeowners, well-educated, older, female, and newer residents (Israel and Hague 2002) while another study revealed no difference between these groups (Lofland 1999). As Vaske et al. (2001) concluded, taken together, demographic characteristics can provide some indication of pro-environmental attitudes and, consequently, of areas where education and outreach efforts would be most valuable, but they do not provide a complete picture.

Despite these difficulties, there has been extensive research on demographics including gender, age, income, education, occupation, as well as length of residency and proximity to resources. Most research has found that females are more likely to have pro-environmental values and beliefs (Vaske et al. 2001; Zelezny, Chua, and Aldrich 2000; Ewert and Baker 2001), and are more willing and likely to engage in pro-environmental activities even though they tend to have less extensive knowledge of environmental issues than men (Kollmuss and Agyeman 2002). Zelezny et al. (2000), however, cautioned that gender explains only a small percentage of pro-environment behavior and, as a consequence, gender's role in predicting stormwater behaviors appears limited. Age is a poor indicator of environmental values with some studies suggesting no correlation, others finding a negative correlation, and still others finding a positive correlation (Finisterre do Paco, Raposol & Filho 2009). Identifying the role income plays as a

predictor of environmental attitudes is difficult given the positive relationship income has with education; in some instances increased income is associated with more anthropocentric beliefs (Vaske et al. 2001). As a consequence, the role income plays is highly dependent on other factors such as education and occupation. Higher education is associated with greater bio-centric environmental values, more environmental knowledge (Kollmuss and Agyeman 2002; Vaske et al. 2001; Ewert and Baker 2001), and a greater level of responsibility for stormwater issues (Syme, Nancarrow, and Jorgenson 2002). In addition to education, an individual's academic major and professional background is strong indicators of environmental values (Ewert and Baker 2001).

Length of residence in a community may also be an important indicator of knowledge and pro-environment behavior, as those who have lived in a community longer, typically have greater knowledge of the region (Vaske et al. 2001; Syme et al. 2002). Additionally, it could be argued that the longer an individual lives in a community, the greater their attachment to and investment in the community. However, while Vaske et al. (2001) found that the length of time an individual lived in a state increased their anthropocentric views on forest practices, Syme et al. (2002) found that longevity at a given location positively influenced an individual's sense of responsibility for the area and implementation of responsible stormwater practices. Research on place-based theory, which examines both distance and place context such as social and cultural factors has found that communities place different kinds of values on resources that are close to them, and resources that are far away (Brown, Tucker, and Harris 2002). Similarly, when controlling for other variables, the residential distance from a waterway was a significant factor in explaining familiarity with creeks and views about the level of pollution in them (Brody 2004). Based on these theories, there has been a recent emphasis on connecting community members to their natural resources so that they will care more about the fate of those resources (Middleton, 2001). Instead of simply educating community members about scientific facts, research indicates that it is more effective to get them to spend time in proximity to the resources that need protection (Brody 2004; Cantrill 1998).

C. Barriers

Knowledge about perceived and actual barriers is crucial to developing an effective strategy to promote desirable behaviors; once managers know what the barriers are, they can develop a way to remove them (Kollmuss and Agyeman 2002). Behavior can be blocked by the lack of real or unreal opportunities that are imposed by internal or external forces (Tanner 1999), and many barriers may exist and be specific to a single behavior (McKenzie-Mohr et al. 1995; Oskamp 1995). Kollmuss and Agyeman (2002) distinguish individuality, responsibility, and practicality as the three types of barriers to action.

Individuality involves personal attitudes that conflict with and cancel out environmental concern (Kollmuss and Agyeman 2002). Many of society's problems are social dilemmas, where there is a conflict between immediate personal needs and long-term collective interest in which an individual's environmentally irresponsible behavior leads to better personal outcomes (Pieters et al. 1998; Kerr and Kaufman-Gilliland 1997).

Responsibility acts as a constraint to pro-environmental behavior and an obstacle to improving water quality when people feel they cannot influence the situation, or that it is not their responsibility (Kollmuss and Agyeman 2002). Kerr and Kaufman-Gilliland (1997) concluded that many people believe their actions have little impact on pollution. According to the U.S. EPA (2009), "Seventy-eight percent of the American public does not understand that runoff…is now the most common source of water pollution; and nearly half of Americans" believe industry is the problem. Similarly, Stave (2003) found

that participants blamed businesses for water waste, while Jorgensen and Syme (2000) noted that many respondents felt they were entitled to pollute stormwater. To overcome these barriers, individuals must be assured that the rest of the public will also partake in similar positive actions (Runge 1984), and they must believe their environmental actions do make a difference in reducing pollution; otherwise, they have no motivation to engage in behavior that benefits the collective interests of society (Tanner and Wo¨lfing Kast 2003; Brucks and Van Lange 2008; Kerr et al. 1997).

Practicality, the third barrier, refers to the social and institutional constraints that hinder people from pro-environmental behavior regardless of attitudes or intentions. These constraints are usually lack of time, money or information (Kollmuss and Agyeman 2002). Research has consistently found that cost and inconvenience are often barriers to changing physical structures to support environmental practices such as reducing impervious surfaces (Roy et al. 2008), and implementing water conserving landscapes and devices (Stave 2003). Similarly, in another study, lower income populations were less willing to pay for pollution abatement and willingness to pay decreased across all income levels as costs increased (Jorgensen and Syme 2000). Jorgensen and Syme (2000), however, found that attitudes were a much stronger predictor of willingness to pay, suggesting that financial barriers to some extent can be overcome by changing attitudes, whereas Stave (2003) suggested incentives are the solution.

D. Changing Behavior

According to Browne et al. (2007), other variables such as social and cultural conditioning, or social norms, are likely to influence behavior and may be barriers that prevent people from acting on their attitudes. Nielson and Smith (2005) found that "neighborhood appearance," followed by cost, aesthetics, property values, and finally environmental impact influenced landscaping choices. Miller and Buys (2008) found that residents of neighborhoods in which social capital was high, responded to community norms of yard care regardless of environmental impact. Therefore, social norms could increase water conservation behaviors or increase overwatering depending on the neighborhood norms. Other studies have confirmed that the use of native plants and lawns (Browne, et al. 2007), the amount of water and fertilizer application, and overall yard appearance and maintenance is primarily influenced by perceived neighbor opinions of one's yard and not on professional advice or literature (Browne, et al. 2007; Nielson and Smith 2005; Miller and Buys 2008).

Pro-environmental models, in conjunction with the studies on stormwater pollution, suggest that education that strictly targets knowledge will not necessarily produce the desired results of reducing stormwater pollution. Programs must overcome barriers that prevent knowledge from translating into pollution prevention practices (Taylor and Wong 2002). Social learning in water resource management contexts has been shown to lead to attitudinal and behavioral changes by individuals in social settings through interactions and deliberation (Pahl-Wostl et al. 2008), which increased public and stakeholder knowledge surrounding water resource management (Blackmore 2007; Steyaert and Jiggins 2007). Ryan (2009) argues that personal interaction with stakeholders is the most important variable in changing behaviors, whereas Bruce (2009), in direct contrast with Ryan, concluded that media campaigns when designed correctly, will lead to effective outreach and educational outcomes. Dietz, Clausen and Filchak (2004) determined a combination of media campaigns and participatory training sessions were most effective. A review of the stormwater literature generally supports the conclusion that intensive, participatory educational programs – that engage participants and require a higher level of involvement – are more effective in overcoming barriers and producing adoption of desired residential stormwater best management practices than passive educational campaigns such as newsletters, demonstration projects, and the Internet (Taylor and Wong 2002; Dietz et al. 2004; Ryan 2009; Lofland 1999).

Kaplan (2000) suggests that ideas that engage motivations for competence, describe recipients as needed because they make a difference, and propose ways to forge a better life should be included in all education programs. A study by Batson, Ahmad, and Tsang (2002) identified four motivations for community involvement (egoism, altruism, collectivism, and principlism) and found that the best programs were able to appeal to multiple motivations. Community based participation (CBP) programs have been found to be an effective way of increasing stewardship, public awareness and knowledge of water quality issues by involving citizen volunteers in the collection of water pollution samples, stream restoration, and policy development and implementation (Conrad 2007; Sharpe 2006; Litke 1998; Fleming 2003). In addition, in college communities such as Corvallis, garnering student investment in water quality can be done by partnering with the university to provide technical support, resources and volunteer time from faculty and students to monitor streams (Savan 2003).

III. APPROACH AND METHODS

Two different methods were used to collect data including a face-to-face survey conducted with a sample of Corvallis residents and a focus group with five residents who live near a stream. Each approach is discussed in some detail below.

A. Survey

i. ***Survey sampling strategy:*** GIS data for the City of Corvallis was obtained including information from tax records containing addresses and the geographic layout of the nine wards in the City. Using ArcGIS, a list of addresses contained within each ward was compiled into separate records. There were a total of ~22,000 total addresses within the Corvallis City limits and ~2,220 addresses in each ward record. For each of these individual ward records a random number generator (www.random.org) was used to generate six addresses. Each student from the class was assigned one of these addresses as a designated starting point to initiate the survey process.

ii. ***Survey development:*** Developing the survey was a complex and iterative process to create questions that helped answer the broader questions of the project. We began the work of creating the survey instrument by analyzing the nature of these broad questions, which generally related to knowledge about and values toward stormwater management and related outreach and education programs, as well as perceived and actual barriers to a range of targeted behaviors. The final survey consists of 31 questions, roughly broken into sections correlating to the broad topics of interest (knowledge, attitudes, values, and practices); see Appendix A for the final survey.

One difficult aspect of survey development was determining an answer method for each question; our objective was to obtain answers that could be analyzed mainly through quantitative measures. Ultimately, we left certain questions open-ended, to be assessed and coded after the survey was conducted. For the remaining questions we created response values that included scales (e.g., strongly agree to strongly disagree) as well as discrete categories (e.g., *City* newsletter, website, etc., for questions about where people get information). As this survey was to be administered face-to-face, it was a practical necessity to have simple and easy-to-understand response categories.

Because we were interested in more than just whether or not a respondent participated in a specific practices (e.g., car washing in driveway), we also asked them why or why not they participate. This was done with the purpose of gaining a greater understanding of the intentions behind that certain practice, such as whether they were value based or knowledge based. With the inclusion of these questions our survey ended up with 31 questions, beginning with simple demographic questions followed roughly by a knowledge section, a practices section, a values section, and an attitudes section.

The survey was pilot tested with 25 respondents, each of whom also provided comments about the design of the survey, order of questions, and understandability of language. Based on these comments, revisions were made to the initial survey before implementation.

iii. ***Survey implementation:*** The survey was conducted between May 1st and May 11th, 2010 mostly on weekend days and weekday evenings. As described above, each surveyor was randomly assigned a randomly-selected address as their starting location for conducting the door-to-door survey. The surveyors assigned to each ward divided up the area to be sure they would not double-sample any residents. Each surveyor was responsible for completing 20 surveys, for a total of 592 completed surveys (some completed 21 surveys as a back-up). To spread out the sample within the ward, surveyors knocked on every fifth door and developed a strategy for covering both sides of the street. If an apartment complex was encountered, it was treated as a single residence. The surveyor knocked on the first door they came to; if nobody answered they moved on to the next residence. This was to prevent completing all 20 surveys at one apartment complex, and thus over-sampling renters within any given ward.

If a "no solicitors" sign was observed at a residence the surveyor would not knock on the door. Otherwise, the surveyor would knock on the door of the selected residence and wait for a response. If it was not obvious that the person answering the door was over 18, the surveyor would ask. Once it was established that the respondent was a legal adult, the surveyor would introduce the survey using the following script (or an appropriate summary):

> "Hi, my name is _____ and I'm a graduate student at OSU working on a project for class. We're trying to learn more about what Corvallis residents know and think about existing City programs related to ***stormwater pollution prevention***. We will be sharing our findings with the City of Corvallis Stormwater Program (Public Works Department). [If not apparent] Are you at least 18 years old? [If no, can I talk to someone in your household who is at least 18 years old?] All information we collect will be anonymous – we don't need your name or address – and be helpful to improving existing and planned City services. You don't have to answer any question that makes you uncomfortable – just let me know you'd rather not answer. Do you have a few minutes to answer a few questions?"

If the resident agreed to participate, the surveyor would begin asking the questions on the survey. Upon completion, the surveyor would ask if they had any questions about the survey. If respondents were interested in more information about the stormwater program, they were provided with brochures and/or magnets from the City of Corvallis about stormwater pollution prevention.

iv. ***Data management:*** The database for this survey was designed and coded in Microsoft Excel so that a person with basic knowledge can enter data as easily and accurately as possible. A first level codebook was created for all survey questions including four fields (survey number, coder, ward, and date survey data entered) and 58 variables with both close and open ended responses. In order to avoid the risk of incorrect data entry, the property called data validation was used in creating the database so the person entering the data could select the appropriate response from a pull-down menu. This reduced the need for the coder to refer to the codebook while entering data. If data were entered that did not meet the criteria for the response, a warning message was displayed letting the coder know that the entered data was not correct.

The codebook for open ended questions related to why or why not someone participated in a specific practice (e.g., carwash, native planting) was designed after the first level of data entry so that all the responses could be captured for data analysis. After review of the open-ended questions, a series of response categories unique to each question was created. The data were then re-coded to match the new response categories. An additional 27 variables were added to the database through this process, for a total of 85 coded variables. The final database contains responses from 592 different surveys collected during the two week period.

v. Data analysis: For the data analysis, separate groups representing the major research questions of this project examined the data. Each group used Microsoft Excel for analysis of the data, using frequencies, cross-tabulations, and in some cases regressions to address the research questions.

vi. Limitations: The survey responses are not a strictly random selection, although we used multiple ways to ensure that we got a representative sample of Corvallis residents: we recruited participants in all wards, started at random addresses in each ward, had a consistent protocol for selecting households, and recruited at different times of the day and week. We also collected enough completed surveys that if this had been a random sample, we could report there was a 95% confidence interval with a +/- 4% confidence interval. We also completed enough surveys in each ward to ensure that socio-economic or other demographic variables were represented by respondents. Because this project was designed, implemented, and analyzed in about nine weeks, there was little time to explore the data in great detail, although class members provided a diverse range of ideas, expertise, and interpretation of results that cannot be provided by smaller research team. We believe there is much more information in the data that should be explored in more detail at a later date (survey data are provided in an Excel format for further analysis).

B. Focus Group

The purpose of a focus group is to generate interaction among participants, in this case, people who live along streams in Corvallis. Participants were encouraged to speak and give their opinion and also to comment on what others had to say. The focus was to explore and understand the participants' knowledge and values regarding issues related to storm water pollution in Corvallis.

i. ***Recruiting participants:*** We sought six to eight participants so that the group would be small enough to give everyone the opportunity to express an opinion and large enough to provide a diversity of experience and opinions. We recruited purposively for citizens of Corvallis that live on property that abuts an urban waterway. We attempted to recruit at least one participant from each stream in Corvallis. Some contacts were referred by Gwenn Kubeck (City of Corvallis, Public Works

Department), and some were acquaintances of Focus Group Team members. Concerted efforts were made to recruit other riparian landowners directly, but these efforts did not generate participants. Ultimately, we recruited two participants who live along the Willamette River, one from the Mill Race, and two from Dixon creek. Notably absent are representatives from the Marys River, Oak Creek, and Dunawi Creek.

ii. ***Questions:*** Given our schedule of an hour and thirty minutes, the number of questions was limited in order to achieve the depth of inquiry we wanted. The questions addressed included:

- What stream do you live near?
- What activities can affect stormwater pollution?
- Why do people do/not do these things?
- Are these factors that affect you as well?
- What is the best way for the City to reach you with information regarding stormwater issues?

iii. ***Focus group session:*** Of the seven people recruited, five participants attended the focus group. A facilitator guided the discussion, and a co-facilitator was present to keep the discussion on topic and keep track of the time. Also present was a note taker with the responsibility of taking notes on nonverbal interactions. We used an audio tape recorder to facilitate transcription. After introductions, we asked participants to derive a list of things that might affect stormwater pollution. Very little prompting was necessary to come up with a complete list that echoed main concerns raised by the City. Participants discussed barriers and incentives regarding these behaviors and how they perceive their own and others' values about stormwater management and property stewardship. Additionally, participants were very forthcoming about services and incentives that they would find helpful in augmenting their current stewardship practices. A qualitative analysis of the focus group discussion is included in the Results section below.

iv. ***Transcription and coding:*** With the help of transcription software, we compiled the transcription into a document for analysis. We used six primary codes: knowledge, values, behavior, barriers, information, and runoff concerns. Each primary code was broken down into secondary and tertiary codes for analysis. Quantitative results have been compiled for the purpose of tracking certain metrics, but given the small size of the group and the broad range of experiences and knowledge represented, the most interesting information came from the qualitative analysis. This analysis is found in the Results section.

v. ***Limitations:*** Our sample is not representative of the Corvallis population at large. Neither is it representative of riparian landowners since three of the five participants were targeted for recruitment due to previous involvement with stormwater pollution prevention programs. We can expect these participants to have more knowledge, express a greater interest in environmental conservation, and exhibit a more emotional attachment to waterways than average for Corvallis residents. Also, due to time and personnel constraints, we did not make a complete measurement of inter-coder reliability although we worked together to create and test the code book on small sections of the transcription.

IV. FINDINGS

A. Who took the survey?

As described above, almost 600 surveys were completed (N=592). More women (56%) than men (44%) completed the survey (see Table 1), and owners (57%) were more likely than renters to be survey respondents (42%). Most respondents were long-time residents of Corvallis, with a range of residency from less than one year to almost 70 years. Not surprisingly, most respondents were well educated (50% with at least a Bachelor's degree). Finally, 74% of respondents described living "near a stream or river," although when asked how far from the stream we received answers in both time (how long it took to walk, bike, or drive to the stream) and distance (how far in feet, blocks, and parts of miles). For the most part, Corvallis residents who answered this survey consider themselves as living near some waterway.

Gender	44% Men 56% Women
Home ownership	57% Own 42% Rent
Length of time in Corvallis	11% 0-1 year 18% 2-4 years 18% 5-10 years 16% 11-15 years 37% 16+ years Mean: 14.2 years Range: 0-68 years
Level of education	2% less than HS 4% HS/GED 8% 2-year degree 24% some college 32% BA/BS 28% Post graduate 1% Other
Live near stream	74% Yes 20% No 6% Don't know

Table 1: Characteristics of survey respondents

B. What do citizens currently know about stormwater management? Do they understand what happens to water that runs off their driveway, lawn or other public spaces?

To meet the goal of reducing water pollution in rivers and streams, the City of Corvallis has been promoting awareness of the fact that most stormwater in Corvallis flows directly into rivers and streams. Part of the purpose of this survey was to see what proportion of the population sampled was aware that stormwater flows into rivers and streams. We asked the question "When water runs into storm drains—the grates in the streets—where do you think most of it ends up?"

As described in Figure 1, about two-thirds (68%) of survey respondents identified rivers and streams. Fifteen percent of respondents believe storm water ends up in the wastewater treatment plant. Some respondents offered other answers to the question, including oceans, sewers, and stormwater treatment plant. One respondent said he believed stormwater ends up "down some pipe and out somewhere." Eight percent of respondents said they did not know where water from storm drains ends

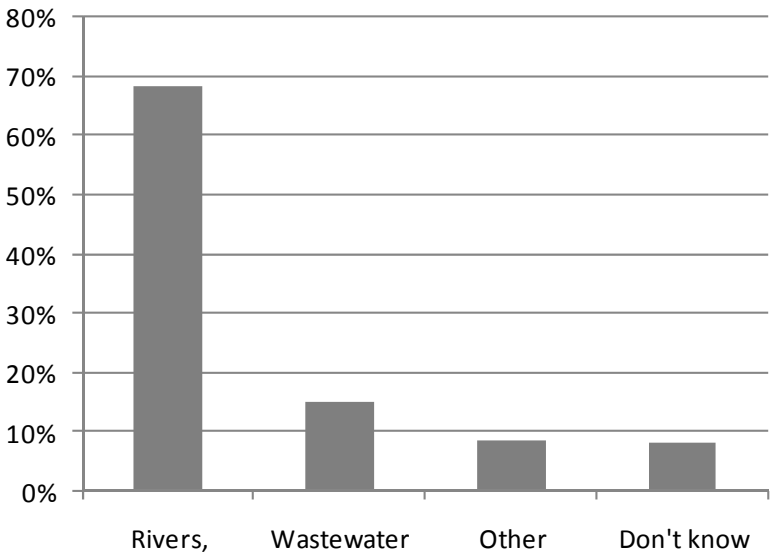


Figure 1: Knowledge of where stormwater ends up

up. We are confident that a majority of Corvallis residents knows that stormwater ends up in rivers or streams.

We explored various demographics to determine if certain groups were more or less likely to know where stormwater ends up (Table 2). We found that certain wards, perception of a stream nearby, and receiving information from the City were correlated with knowledge of where stormwater goes. For example, Ward 5 had the highest percentage of respondents (80%) with correct knowledge of where stormwater ends up while only about one-half of respondents in Ward 9 were able to correctly identify where stormwater goes. It also appears as if people who don't know if they live near a stream are less likely to understand where stormwater goes when compared to respondents who do know if they live near a stream; even those who report that they don't live near a stream are mostly able to correctly identify where stormwater goes (66%). This finding is supported by research that shows people who live closer to streams generally have higher environmental values, which also appears to be connected to environmental knowledge (Brody, 2004).

Respondents who reported they had seen or heard information from the City of Corvallis about stormwater pollution prevention were significantly more likely to choose "river and streams" than those who reported not seeing or hearing information. This implies that City outreach efforts are effectively educating people about how stormwater impacts rivers and streams.

		Rivers & Streams	Other	Total
Ward				
	1	62%	38%	n= 61
	2	70%	31%	n= 82
	3	76%	24%	n= 63
	4	71%	30%	n= 61
	5	80%	20%	n= 60
	6	65%	35%	n= 60
	7	78%	22%	n= 59
	8	69%	31%	n= 62
	9	51%	49%	n= 83
Stream Nearby				
	Yes	71%	30%	n= 441
	No	66%	34%	n= 116
	Don't Know	47%	53%	n= 34
Seen/Heard City Stormwater Information				
	Yes	77%	23%	n= 228
	No	61%	39%	n= 272
	Don't Know	43%	57%	n= 30

Table 2: Variables affecting knowledge of stormwater

C. Do survey respondents know the impact of their various practices such as cleaning up pet waste, repairing car leaks, dumping substances into storm drains, etc?"

We aggregated ward responses to residential activity practices, reasons for activity practices, and if exposure to City stormwater information correlates with different activity practice frequencies. Table 3 describes the response rates of the various activities. For the most part, dog owners are pretty commonly picking up after their dog (89%) , almost all respondents report they never put anything down the storm drain (96%), and more than three-quarters (82%) report they repair leaks from their cars quickly. However, other practices including car washing in the driveway, covering standing piles, and landscaping with native plants do not appear to be as wide spread among our respondents and are discussed in some detail below.

	Yes	No	Don't Know	N/A/
Pick up pet waste (dog owners only)?	89%	11%		
Put substances down storm drains?	3%	96%	1%	
Cover standing piles of dirt, compost, bark, etc?	25%	37%	39%	
Landscape with native plants?	43%	22%	22%	13%
Repair leaks from car?	82%	7%	11%	
Use a car wash instead of driveway or street?	52%	39%	9%	

Table 3: Level of participation in various practices that affect stormwater pollution

When we look at the reasons why people do or don't practice stormwater-friendly behavior, we often find that the reasons are less related to pro-environmental explanations than they are to other social, convenience, and cost explanations. For example, when asked why they picked up after their dogs, only about 14% of respondents identified the practice as "bad for the environment" (Table 4).

More commonly, respondents didn't want to step in their own or other dog's waste on the trail or sidewalk (24%), and also reported aesthetic (17%) and social norms (15%) driving their behavior.

Environmental concerns also rated as a relatively low concern for the other practices with personal preferences, convenience, and costs usually reported as more important than issues related to the environment (Table 4).

Two primary findings emerge from the data. First, respondents' practices are environmentally-friendly, although the

Pick up pet waste?		**Put substances in storm drains?**	
Not to step in it.	24%*	It's bad for the environment.	44%*
Looks and smells bad.	17%*	It's wrong to do.	35%*
Socially correct.	15%*		
Bad for environment.	14%*		
Cover standing piles of dirt…		**Landscape with native plants?**	
No perceived need	16%*	Personal preferences	25%*
Didn't know I should	10%*	Less care and water required	18%
Weather related	7%*	Convenience	10%
Environmental concerns	*7%**	*Better for environment*	8%*
Repair leaks from car?		**Use car wash?**	
Good car maintenance	57%*	Convenience	37%*
Dislike stains and messes	15%*	Cost	18%*
Environmental Concerns	12%*	Environment	11%*

Table 4: Stormwater Pollution Practices (Note: * values significant at p=.01)

reason why people practice the activities are not always environmentally motivated. In fact the only activity category whereby environmental concerns received the highest response rate was putting substances in storm drains. All other activity categories point to reasons that relate to personal preferences (pet waste, native plants, repair leaks, use car wash) or a lack of knowledge (covering piles). This is an interesting finding because 68% of respondents indicated that they know stormwater ultimately finds its way into Corvallis rivers, streams, and open ditches. Furthermore, as reflected in Figure 2, we find that 58% of respondents cite personal efforts as being important in protecting these waterways yet again the data tables inform us that environmental reasons are not the primary motivation for activity practices.

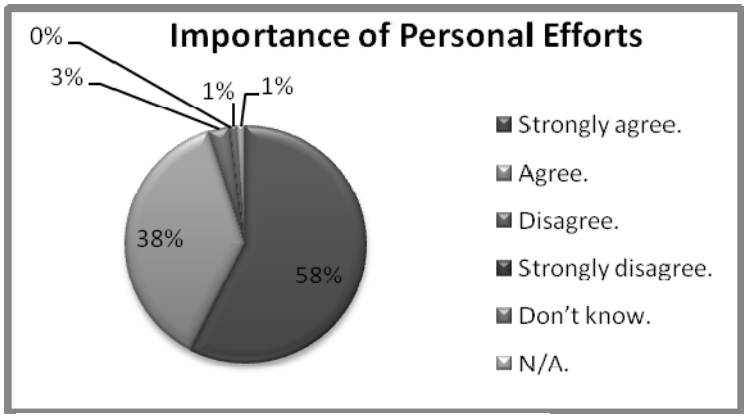


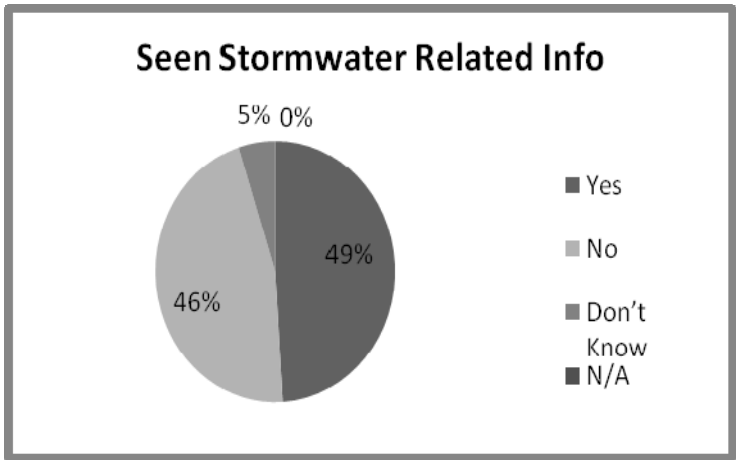
Figure 2: Importance of personal efforts

As described in Figure 3, almost half (49%) of respondents have seen or heard information from the City related to stormwater pollution prevention. When we compare those who have seen or heard information with those that haven't, the second primary finding emerges: exposure to information appears to be positively correlated with pro-environmental practices. Table 5 captures the comparison between those who have and haven't seen information from the City.

It appears that seeing or hearing information about stormwater pollution prevention is correlated with an increased level of pro-environmental practices. Even those respondents who haven't heard or seen information, are more likely than not to practice pro-environmental behaviors although not at a rate as high as those who had seen or heard information from the City. The one exception is the use of landscaping with native plants.

A majority of respondents practice most of the environmentally friendly activities with the most cited motivation being personal preferences rather than environmentally related concerns. This suggests a possible misalignment with the finding that personal effort is important to protecting rivers and streams although this finding is reinforced in the literature when personal attitudes conflict with and cancel out environmental concerns (Kollmuss and Agyeman 2002).

Figure 3: Percentage of respondents who have seen or heard information related to stormwater pollution prevention



	Response Rate to Practicing Specific Activities	
Seen/Heard Stormwater Info?	**Use Car Wash**	
	Yes	No
Seen or heard info.	28%	22%
Not seen or heard info.	25%	20%
Don't Know if Seen Info	4%	2%
Total Response Rates for Activity Participation	57%	43%
Seen/Heard Stormwater Info?	**Cover Piles of…**	
	Yes	No
Seen or heard info.	25%	31%
Not seen or heard Info.	13%	25%
Don't Know if Seen Info	2%	3%
Total Response Rates for Activity Participation	40%	60%
Seen/Heard Stormwater Info?	**Use Native Plants**	
	Yes	No
Seen or heard info.	42%	16%
Not seen or heard info.	23%	15%
Don't Know if Seen Info	2%	2%
Total Response Rates for Activity Participation	67%	33%
Seen/Heard Stormwater Info?	**Repair Car Leaks**	
	Yes	No
Seen or heard info.	47%	3%
Not seen or heard info.	41%	4%
Don't Know if Seen Info	4%	1%
Total Response Rates to Activity Participation	92%	8%
Seen/Heard Stormwater Info?	**Pick Up Pet Waste**	
	Yes	No
Seen or heard info.	49%	5%
Not seen or heard info.	35%	6%
Don't Know if Seen Info	5%	1%
Total Response Rates to Activity Participation	89%	11%
Seen/Heard Stormwater Info?	**Stuff in Storm Drains**	
	Yes	No
Seen or heard info.	1%	48%
Not seen or heard info.	2%	44%
Don't Know if Seen Info	0%	5%
Total Response Rates to Activity Participation	3%	97%

Table 5: Impact of information on environmental behavior (*Values significant at p = .01; **Values significant at p = .05)

Pro-environment activities are primarily being practiced by our respondents, but not because they believe in the importance of their personal stewardship efforts, understand that stormwater runoff ends up in waterways, or because it's the environmentally correct thing to do. But rather these activities are practiced for self-interest reasons including convenience, personal preference, costs, etc. We therefore infer from the data that respondents do not know or understand the *full* impact that their activities have on preventing stormwater pollution.

Since information appears to have a positive correlation with increasing the level of activity participation it's clear that information dissemination should therefore continue. However, the data suggest that it may be worthwhile to reinforce environmental reasons for engaging in these "best practices." This may eventually lead individuals to a deeper understanding of the environmental impact of their behavior. For example, Connelly, Knuth, and Kay (2002) concluded that active and consistent public outreach efforts aimed at reinforcing supportive beliefs and behavior will lead to more people engaging in BMPs for environmentally friendly reasons.

D. What values do citizens hold regarding clean streams and do citizens perceive clean streams as a critical component of a healthy community?

We asked respondents four questions to assess their overall values, two come from the New Ecological Paradigm (NEP) (Dunlap et al. 2000) and two others asked about the importance of individual and city efforts. Table 6 suggests that respondents have generally strong environmental values and belief in the efficacy of both institutional and individual efforts

	Balance of nature is very delicate and easily upset	**Humans must live in harmony with nature to survive**	**City efforts to protect streams are important**	**Personal efforts to protect streams are important**
Strongly agree	44%	51%	59%	58%
Agree	47%	43%	37%	38%
Strongly disagree	7%	3%	2%	3%
Disagree	1%	1%	0%	0%
N/A	1%	2%	1%	2%

Table 6: Responses to values questions

As suggested above, respondents to the survey overwhelmingly reported high environmental values. The two NEP questions show more than 90% of respondents agreeing or strongly agreeing with the pro-environmental statements. It does appear, however, that home owners are more likely than renters to consistently strongly agree on all four questions in the value index (Table 7), suggesting that home owners may be more sure of their values or that these questions captured their values more effectively than they captured renters' values.

	Nature is balanced		Humans in Harmony		City Efforts		Personal Efforts	
	O	**R**	**O**	**R**	**O**	**R**	**O**	**R**
Strongly agree	49%	38%	54%	47%	64%	53%	62%	53%
Agree	41%	55%	41%	46%	32%	43%	34%	41%
Other	10%	7%	5%	7%	4%	4%	4%	6%

Table 7: Level of agreement among homeowners and renters on values index questions

In a regression analysis we looked at how environmental values as measured on the index are related to willingness to participate as measured by participation in a City activity related to stormwater pollution prevention (Q26 in the survey) and the likelihood of taking action when seeing someone pollute stormwater (Q29). As described in Table 9, those with a higher environmental values index scores are both more likely than those with a low values index scores to participate in City stormwater activities and take some form of action when they see someone polluting.

In order to determine the connection between education and environmental values, we grouped respondents into two categories based on the highest level of education they reported. The first group is all those who have not received a Bachelor's degree including those who do not have high school diploma, those with a HS diploma or GED, and those with some college. The second group consists of those will a Bachelor's degree, some graduate work, or a graduate degree. We found very little difference among the two groups, suggesting that level of education does not have a large impact on environmental values, somewhat contradicting earlier findings (e.g., Syme, Nancarrow, and Jorgenson 2002). In another measure of education, we found no correlation in a regression analysis between respondents' values and whether or not they had seen or heard information from the City about stormwater pollution prevention.

E. What do people do if they see storm drain pollution or a water quality issue?

A key finding of the overall survey was that zero respondents noted the hotline as a possible course of action if they were to see someone pollute. The apparent lack of awareness regarding the City hotline could be explained simply by the respondent's failure to specifically mention the hotline when responding. As indicated in Table 8, 16% of respondents claimed they would report an act of stormwater pollution if they were to see someone polluting and when asked who they would report it to they suggested utilities, calling the cops, and more generically calling the City. It is possible that some respondents were referencing the hotline when claiming they would report the polluter. Regardless, the results indicate that if the hotline is to be useful, awareness of the hotline's existence must be increased.

Answer Categories	Percent of respondents *(N=592)*	Type of answers included in category
Take direct action	**46%**	*Approach the person, talk to the person, tell them not to*
Take no action	**25%**	*Don't do anything*
Report it	**16%**	*Report it to the police, report it to the City (does not include the hotline)*
Don't know	**5%**	*I'm not sure*
Call pollution hotline	**0%**	*Specifically mentioned the hotline*
Other	**9%**	*Includes "I've never seen someone polluting"*

Table 8: What do respondents do when they see someone polluting a waterway in Corvallis?

Analysis of the type of action an individual would take was examined in conjunction with several demographic and behavioral characteristics. The analysis indicated no significant difference in key variables such as gender or education. However, the analysis did yield an interesting difference between people who owned their house and those who rent (Table 9). Those who owned their house were 27% more likely to take direct action than those who rent and 26% more likely to report the pollution than those who rent. This may suggest that homeowners have a stronger sense of responsibility to prevent stormwater pollution. However, we also observed that owners and renters reported at almost equal rates that they really "didn't know" what to do when observing polluting behavior.

	Own	**Rent**	**Other**	**N/A**
Report it	68%	32%	0%	0%
Take direct action	63%	36%	1%	0%
Other	60%	40%	0%	0%
No action	44%	55%	1%	0%
Don't know	47%	49%	3%	0%

Table 9: Differences between owners and renters on taking action when observing stormwater pollution activities

This sense of responsibility among homeowners may be supplemented by a difference in years lived in Corvallis and whether or not the person would take direct action (Table 10). Findings suggest that of the respondents who have lived in Corvallis for 0-1 year, 49% would take direct action or report the pollution and 31% would take no action. For the cross tabs run for any respondent who lived in Corvallis more than 2 years, there was an average of 57% of those who would take direct action or report the pollution and an average of 24% would take no action.

	Take direct action	Report it	Take no action	Don't know	Other	N/A
0-1 years in Corvallis	40%	9%	31%	10%	3%	7%
2-5 years in Corvallis	44%	10%	28%	11%	4%	4%
6-10 years in Corvallis	45%	13%	22%	7%	2%	10%
10-15 years in Corvallis	45%	11%	28%	8%	3%	5%
16+ years in Corvallis	47%	13%	17%	10%	8%	5%

Table 10: Differences in taking action when observing stormwater pollution among respondents with different lengths of residence in Corvallis

We also examined how living near a stream was connected to willingness to take direct action (Table 11). Our findings show that of those respondents who would take direct action, 77% report living near a stream or river (although most survey respondents do report living near a stream). Of those respondents who would report pollution, 79% report living near a stream or river. Similar to our findings that homeowners have a stronger sense of responsibility than renters to prevent stormwater pollution, respondents who reported living near streams are more likely than those who don't report living near a stream to have a sense of responsibility to report stormwater pollution.

	Live near stream	Don't live near stream	Don't know
Take direct action	77%	18%	5%
Take no action	65%	27%	9%
Report it	79%	12%	9%
Don't know	64%	31%	5%

Table 11: Differences in taking action when observing stormwater pollution among respondents who self-identify as living near (or not) a stream in Corvallis

The greatest opportunity for the City of Corvallis to successfully direct people to report issues could be realized in targeting those already taking direct action and/or reporting polluter behavior. Of survey respondents, some forms of media appear to be more effective outreach mechanisms than others (Table 12). The Corvallis *City* newsletter appears to be the most effective form of media to reach the desired population. Two outreach methods that closely follow the newsletter in terms of response rates are direct mail efforts and an article in the Gazette-Times.

	Info Source: Gazette Times	Info Source: Direct Mail	Info Source: *City* Newsletter
Take direct action	22%	18%	26%
Take no action	17%	21%	19%
Report it	15%	22%	31%
Don't know	1%	22%	24%
Other	13%	20%	30%

Table 12: Favored sources of information about what to do when seeing stormwater pollution

F. What barriers do people perceive or experience to changing behaviors that affect stormwater quality? Are behavioral changes perceived as difficult, expensive, or ineffective?

Of respondents who do not participate in City-sponsored stormwater pollution prevention and abatement activities, most (58%) say they don't participate because they are unaware of such programs (Table 13). Notably, only a few respondents indicated that they do not participate because they are not interested or otherwise feel their actions cannot make a difference. This implies that if outreach efforts can be made more effective, participation may increase. Respondents in both the survey and focus group mentioned water bills and the *City* newsletter as an effective method of communication. Our results suggest that ignorance of stormwater pollution prevention efforts and techniques, rather than lack of interest, is the main barrier to desirable behavior.

Reported barrier	
Not aware of programs	58%
No time	33%
Not interested	10%
Schedule conflict	8%
Doesn't apply to me	4%
Wouldn't make a difference	2%
Bad location	<1%
Lack of transportation	<1%

Table 13. Reasons for not participating in stormwater pollution prevention activities

When it comes to barriers to specific practices, we draw on results described above. For example, the overwhelming majority of respondents (96%) claim not to dump household waste such as oil or paint into the storm drain (Table 3). Of these, 48% cited environmental reasons, and 39% cited moral reasons (Table 4). This suggests that values are a significant motivator regarding improper disposal, and that most people already have a strong intuitive opposition to dumping. Only nineteen people indicated that they do dump into drains, and most reported that they were dumping material such as grass clippings, driveway duff, or other material not perceived as harmful. The results suggest that knowledge is the

main reason people dump material down drains, not values. If citizens learn about the harmful effects of dumping material even as common as grass clippings, they will likely stop doing it. One respondent reported that they regularly see neighbor dump oil in the stream behind their house but they were afraid to say anything to him. When the survey enumerator mentioned the anonymous hotline, the respondent said, "The hotline is anonymous eh? I didn't know that existed, I think I'll use it next time I see my neighbor doing this."

Of the 233 respondents who wash their cars at home, 40% indicated that it was to save money . Likewise, those who report allowing cars to leak (48%) cite the cost of repairs as the primary reason not fix their cars right away. If the resources exist, provision of vouchers or coupons for car care to citizens might eliminate this source of stormwater pollution. Most respondents leave standing piles of dirt, leaves, and compost uncovered (Table 3). Those who don't cover piles most commonly say there is no need to do so (43% of negative responses), compared to 33% who indicated that they didn't know they should cover piles (Table 4). Of people who do cover piles, 32% say it is for environmental reasons, and 16% say it is for aesthetic reasons. This suggests that the primary barrier regarding compost/gravel management is knowledge. This is an area that should be targeted for more education.

Overall, our results suggest that lack of knowledge continues to be a significant barrier to implementing stormwater BMPs in Corvallis. Few respondents know that the City has stormwater management programs or activities, that covering piles or using native plants, using a carwash, or repairing car leaks is good for the environment. And, very few respondents expressed anti-environmental values; most indicated a willingness to alter behavior for the benefit of the environment, although most did not realize the negative effects of their customary practices on water quality. With more information, it is likely that residents will change behaviors as the values appear to be in place and barriers rather limited.

There do appear to be practices, however, that are perceived by some respondents as costing too much including using a car wash or fixing leaky cars. Increased knowledge about the environmental impacts of these practices may only change these behaviors if the cost barriers are also addressed.

G. What are best methods and venues to provide information about stormwater management? How do Corvallis citizens learn about City programs to increase water quality and how do they access new/needed information?

The survey included several questions related to the respondent's awareness of City information on stormwater pollution. Results from these questions can be used to assess the effectiveness of current methods of informing the public and identify potential areas of improvement. Survey participants were asked if they had ever seen or heard information from the City regarding stormwater pollution. Forty nine percent said they had seen or heard information and of those that said they had seen information, the *City* newsletter was the most common source of information (Figure 4).

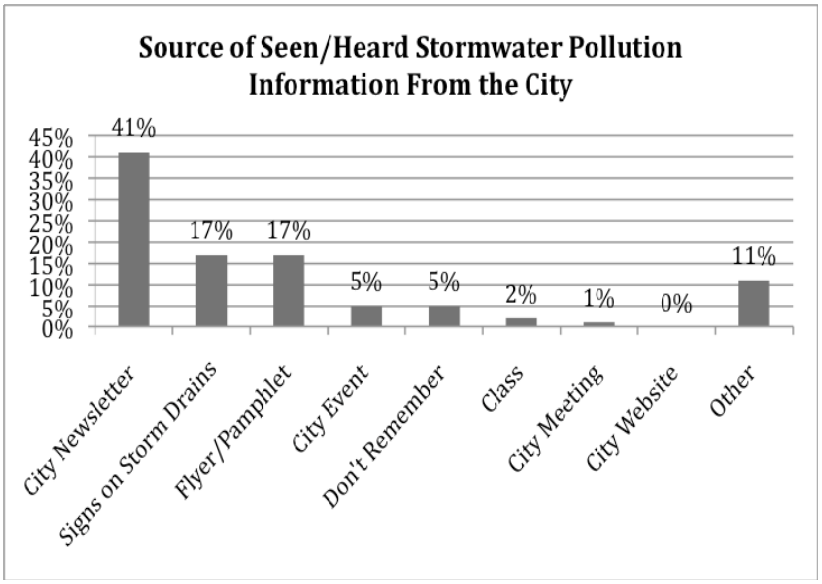


Figure 4: Source of information seen or heard from the City regarding stormwater pollution prevention

Respondents were asked what source they preferred when receiving information from the City on stormwater pollution prevention programs and activities (Table 14). Of all respondents, the most commonly preferred source was the *City* newsletter with 25% of responses followed by the City website and information mailed directly to the respondents, with 23% and 20% respectively. Labor-intensive methods such as setting up information booths at City events and posting information around Corvallis were some of the lowest preferred methods with 5% and 4% of responses. However, participants of the focus group noted the personal approach of outreach at events being more effective for some compared to the mass communications of the *City* newsletter.

Preferred Source	
City Newsletter	25%
City Website	23%
Info Mailed to Home	20%
Articles in Gazette Times	19%
E-Mail	16%
TV Commercial	10%
Brochures, Pamphlets	10%
Radio Announcements	7%
Info Booths at City Events	5%
Articles in Barometer	4%
Posters around Corvallis	4%
Announcements at Other City Programs	2%

Other	17%

Table 14: Preferred source of information on stormwater pollution prevention programs and activities

Developing an effective outreach campaign is predicated on programs being developed for specific audiences. Not all individuals or groups are receptive to the same outreach methodology and it is important to identify what has lead to respondent awareness of current City programs on stormwater pollution. In order to identify what variables led to respondents' awareness of City stormwater programs we developed several Logistic regression models that measured the marginal change in awareness of City programs.

We hypothesized that homeownership led to awareness of City programs on stormwater. In Table 15, we describe the results of an analysis where we first regressed awareness of City programs on homeownership (model 1) and the coefficient was significantly different from 0 at the .01 level. The dependent variable in the regression is the respondent's answer (yes or no) to the question "have you heard or seen information from the city related to stormwater pollution." The multiple regression has seven independent variables including home ownership, years in Corvallis, college graduate, gender, pro-environment, pro-water and if a stream was nearby. The independent variables of gender, homeowner, college graduate, and stream nearby by are dummy variables, or having a value of zero or one (ex: 0=male, 1-female). The variable of "pro-environment" was determined by summing respondent's scores on the two NEP questions. If the respondent had a cumulative score of six or higher they were considered "pro-environment." This variable was then coded as a dummy variable (0=not pro-environment, 1=pro-environment).

These results from the regression indicate that within our sample, homeownership leads to awareness of City programs on stormwater. In order to control for other variables we developed three additional logistic regression models which included years in Corvallis, college graduates, gender, pro-environmental values, pro-water values, and stream nearby. After controlling for all these variables (model 4) the only variables that had a significant effect on awareness of City programs was homeownership, years in Corvallis, and college graduates, which all had a positive correlation and were significant at the .01 level. These results are not surprising as we had expected home owners, long time residents, and higher educated residents to be more aware of the City programs; however these findings help to identify holes in the coverage of current programs. In order to inform a wider audience the City should diversify their current programs

and focus more of their attention on renters, new/ short term residents, and residents with less education.

To examine the best methods and venues to provide information about stormwater pollution prevention, analysis was done to compare demographic data against respondents' preferred methods of acquiring information around stormwater pollution prevention. Length of residency in Corvallis and status as an owner or renter were two of the biggest variables in influencing how respondents preferred to receive information. As frequency data indicated that the *City* Newsletter, website, information mailed to respondents' address, the Gazette Times, and email were the top five responses, these were analyzed. The other responses scored as 10% or below in frequency and thus were not included in crosstab data.

	Model 1		Model 2		Model 3		Model 4	
Home Owner	1.629	**	1.44	**	1.227	**	1.252	**
	(.195)		(.545)		(.222)		(.224)	
Years in Corvallis					.020	**	.020	**
					(.008)		(.008)	
College Graduates			.545	**	.552	**	.549	**
			(.210)		(.212)		(.213)	
Gender							-.117	
							(.201)	
Pro-Environment							.280	
							(.359)	
Pro-water							.124	
							(.688)	
Stream near							.262	
							(.246)	
R^ Squared	.139		.150		.162		.166	
N	504		504		504		504	

Table 15: Regression among demographics and seen or heard about city programs dealing with stormwater (Notes: *=significant at .05 level; **= significant at .01 level)

When asked what would be the best way to get information about stormwater pollution prevention programs and activities, the longer that a respondent lived in Corvallis, the more likely that they were to mention the *City* Newsletter. The responses showed that 37% of respondents who lived in Corvallis for 11 years or more preferred the *City* Newsletter, in comparison to 20% or below from more recent groups. In contrast, for those who lived in Corvallis less than a year at the time of the survey, 29% mentioned a website, 26% mentioned information mailed directly to their address, and 26% mentioned an email.

Respondents who own their residence indicate the *City* Newsletter and *Gazette Times* as the best ways for them to receive information. However, the newsletter and newspaper articles are not preferred methods for renters. Of renters, 31% prefer receiving information on the Internet, 24% prefer material mailed directly to their address, and 25% prefer email.

H. Focus Group

During the focus group session, we asked the following questions:

1) What are some activities that can affect stormwater pollution?
2) Why do people do or not do these things?
3) Are these factors that affect your behavior as well?
4) What is the best way to get you information about City programs and activities regarding stormwater pollution?

The group addressed each question, largely without being prompted by the facilitator. The facilitator probed responses to indentify clues about motivations, values, and barriers to action. One goal of the session was getting participants to address certain key behaviors emphasized by the client.

The group identified home car washing, vehicle oil leaks, errant pet waste, invasive species, and fertilizer/pesticide use as all contributing to stormwater pollution. In addition, they identified and discussed two practices that we did not cover in the survey: excessive watering practices – such as overwatering or watering on impermeable surfaces and agricultural practices that cause polluted runoff.

Participants exhibit broad general knowledge concerning the effects of these behaviors, although details were less well understood. For example, most participants express a blanket disdain for pesticides – even measured use for control of invasive species. Chemical runoff is generally recognized as detrimental to the creek system, but some participants are unsure as to whether fertilizers are also undesirable. One participant knew that riparian areas are important for "natural filterization," (sic) but most participants aren't sure which catchment basins drain to the river and which do not.

Chemical runoff including fertilizers and pesticides was mentioned eight distinct times as a problem, but as a problem to which others are contributing. In one case, a participant lamented the fact that there are few opportunities to learn about proper pesticide use – especially as it relates to invasive species control. Conflicting values also present a barrier to removing invasive species with measured pesticide use. One participant said "I need to try to get rid of it (blackberries) so it's not going to be a constant battle … (but) we don't really want to use pesticides." In another case, a participant expressed frustration at seeing what was assumed to be a City employee spraying weeds along Highways 20 and 34.

Pet waste runoff was also mentioned as a problem and led to a discussion about competing values and barriers to action. Specifically, some participants express conflict about using non-biodegradable plastic bags to pick up pet waste, such as those provided by the City along walking paths. When it was proposed that the City provide biodegradable plastic in these locations, one participant responded "I would pick it up all the time." Participants identified some opportunity barriers, such as a lack of trash cans along walkways for easy pet waste disposal, and a lack of educational opportunities in general.

Participants expressed concern over agricultural runoff – twice as a general water quality concern and once as a comparison while questioning the magnitude of the impact of urban stormwater runoff:

> "Let's look at big agriculture. Tell me they're not out there spraying. You're telling me that my little thing about not washing my car in the driveway is going to make a big deal? It's not really going to make a big deal in the scope of things."

Participants are generally aware that carwash runoff pollutes the stormwater system and home car washing was mentioned almost in passing as a source of pollution. Participants wanted to

ensure that car washes administered by groups as fundraisers take place at facilities with the ability to "recycle" the water. Oil leaks from cars were addressed as problems three separate times, but oil pollution was always mentioned as the responsibility of some unknown third party. For example, a participant noticed a garbage truck was leaking oil everywhere it went; this participant mentioned that the City or someone should be responsible for repairs. Specific behaviors such as quickly fixing leaks or cleaning up after leaks were not mentioned by group members.

Civic barriers to best management practices were mentioned six times during the focus group. Identified barriers included contractual obligations, such as tenant/landlord agreements and homeowners' association restrictions; jurisdictional concerns regarding maintenance of public or abandoned land; and the political difficulties of organizing a group of people to pursue institutional change. There were also two separate inquiries about how the City vets contractors, such as suppliers or service providers. These civic barriers elicited expressions of frustration:

- "I'm dumbfounded" regarding perceived communication failures between coordinating trash services and street cleaners
- "A lot of people don't have control over how their landscaping is maintained" regarding landlord maintenance
- "This is the problem we're up against" regarding inertia within a homeowners association

Other barriers to best management practices were lack of time or money (mentioned four times) and lack of knowledge about BMPs (mentioned twice). Creek cleanup grants were identified as a major reason that two participants started managing their land in a more conscientious way.

Participants spent a lot of time talking about sources of information. In general, participants wanted to see information that is easy to access and read. The *Gazette Times* was mentioned twice, once as a publication the participant did not read, and once as a convenient way to reach a lot of people. The *City* newsletter was mentioned ten times, and was described primarily as a very good source of information and once as "boring." Direct mail was mentioned twice as an effective way to disseminate information, and the water bill was mentioned several times as a place some participants expected to see information regarding stormwater management. One participant said "I'm a lot more apt to read it if it came in the mail than if I have to go looking for it myself." City events such as the farmers' market, DaVinci Days, and the Spring Festival were mentioned favorably as places to pick up flyers and brochures with useful information. Participants suggested a City sponsored "tip of the month or tip of the week" section in the *Gazette Times* regarding land management practices as a way to remind citizens about seasonal practices that they might otherwise forget.

There was a mixed response on using email to disseminate information. One participant was protective of email listings, and one said of a neighborhood listserv: "This feels more personal because it's a small list of south -towners and it's somebody speaking directly to the issues … I feel a lot more apt to read that than the *City* newsletter, which sometimes I just don't read." One participant considered websites too cumbersome to "weed through" to find specific information. One participant pointed out that "(Corvallis) is such a diverse group of people and

age ranges … that one way (of disseminating information) is not going to be effective. It's going to take multiple ways."

Specific content such as information about home rain water catchment, pesticide use, and safe household cleaners were requested four times. There were also requests for information about watershed geography and pollutant assays of the Willamette River. In general, participants did not volunteer talk about the content of the outreach they had seen from the City. Participants generally considered the City, the university, and their friends to be trusted sources of information.

Participants expected the City to take the lead in implementing land management BMPs and in setting an example. One participant said "You would like to see the City being conscientious and hoping that they set the example … my example isn't going to go very far." Another said,

> "The City, if they are going to take any educational or advocacy position … are going to have to lead by example because just violating their own creed would just undermine them entirely … with sustainability sometimes people see it as a brand and if it doesn't work, they write off the entire thing."

One participant also suggested that Corvallis and perhaps Benton County become a model community – a "pesticide-free zone" – for other communities to emulate.

There is no apparent distinction between these participants and survey respondents, especially those respondents who identified themselves as "living near a stream." In general, we found that focus group participants had similar values and concerns about stormwater pollution prevention as survey respondents, but were able to provide concrete examples such as why specific information venues may not work with certain neighborhoods.

V. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

The results of this study suggest that survey respondents who may be a relatively representative group of Corvallis residents have strong environmental values that are expressed in their day-to-day practices related to stormwater pollution prevention although their primary motivations appear to be related to social pressures, economic concerns, and personal preferences more than environmental concern. About three-quarters of respondents describe themselves as "living near a stream," and although that distance is measured in multiple ways, respondents seem to be quite aware of waterways in Corvallis. They are generally knowledgeable about stormwater management and best management practices – two-thirds know that stormwater runs into streams and rivers - although they may be a little shaky about specific details (e.g., chemical practices). Respondents report high pro-environmental values, a strong sense of personal efficacy, and expectations for the City to demonstrate best practices regarding stormwater pollution prevention. The most frequently cited barrier to changing stormwater pollution prevention behaviors is lack of knowledge especially about landscaping practices such as fertilizing, watering, and native planting. There are some cost barriers for a small portion of the sample specifically related to car care (car washes and repair). For the most part, respondents prefer direct contact through the *City* newsletter , a website, the Gazette-Times and direct mail, although they also would like to see more specific examples of City efforts (e.g., watering City spaces, planting natives, etc.) and individual practices they can engage in their own lives.

B. **Recommendations**

The survey respondents and focus group participants present a face of well-educated and well-intentioned citizens who, for the most part, engage in effective stormwater pollution prevention practices. They need specific information about increasingly sophisticated and technical issues, particularly regarding landscaping issues, to take the next step in increasing their pollution prevention behaviors.

Based on our findings and the literature, we make the following recommendations for continuing and/or expanding the Stormwater Pollution Prevention Education and Outreach program in Corvallis:

- Capitalize on the perception that we "all live near a stream" in Corvallis in education and outreach materials. Nearness can be measured by the time it takes to get to your favorite waterway or the distance in blocks to the stream nearest your home. This sense of place provides a strong background for education and behavior change. Utilize this "low hanging fruit" by making specific requests about waterway practices. We all live near a stream can also be the foundation of increasing residents' awareness of the environmental impacts of their behavior.
- Continue providing general information about stormwater pollution prevention, particularly in those places like Ward 5 with transient populations and young residents. Also recognize that many citizens are already be aware of the basic information and need specifics about the next steps they should take. For example, there appears to general confusion among our residents about chemicals in landscaping. Sophisticated information can be provided in the mediums preferred by respondents including the *Gazette-Times*, the *City* Newsletter, and a website. Also, provide information about how wastewater is managed at both at both formal and informal car washes; this information can be disseminated through the *City* newsletter or through posters at carwashes.
- Our respondents look to the City of Corvallis to provide examples for reducing stormwater pollution; how has the City changed its watering schedules, for example, or plantings in common spaces. What is it doing to reduce erosion? If possible, connect these City activities to efforts individuals can take at home or work.
- Another practice that citizens may need additional information about (if our respondents are any indication) is about the use of native plantings in landscapes. This might be a place where the City of Corvallis can demonstrate the use of native plantings as well provide descriptions on the website and the *City* newsletter. The City might also co-sponsor or disseminate information about native plant sales during the spring and fall planting seasons.
- Labor-intensive outreach efforts appear to be the least appreciated by our respondents. They report that the *City* newsletter, the *Gazette Times*, and websites are all preferred sources of information. While a few mentioned field trips, booths at the Saturday market, or stream-side sessions as effective ways to learn about stormwater pollution prevention, most respondents also reported that they weren't likely to take part in those activities. It may also be worth exploring whether other direct mail efforts (e.g., in water bills) are an effective way to communicate about specific activities or actions.

- Expect that those who attend any community outreach activities are already likely to be highly engaged and knowledgeable about stormwater pollution prevention. Make sure that the level of information and activities are suitable to increasing the efficacy of this audience.
- Cost appears to be a barrier for a portion of our respondents when it comes to using a car wash and fixing car leaks immediately. The City of Corvallis may want to consider programs that provide incentives for residents to use car washes and garages that manage stormwater appropriately. Alternatively, community spaces may be a possibility in the future if funding is available. If nothing else, continue to provide education and outreach efforts about the potential impacts of these practices.

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APPENDIX A:STORMWATER POLLUTION PREVENTION SURVEY FREQUENCIES APRIL-JUNE 2010

1. **Gender** (Observed only) (N=592)
   44% Male
   56% Female

2. To get started, do you **own or rent** here? (N=592)
   57% Own
   42% Rent
   1% Other
   0% N/A

3. **How long have you lived in Corvallis**? (N=592)
   0-1 years 11% Mean: 14.2 years Range: less than one year to 68 years
   2-5 years 18%
   6-10 years 18%
   10-15 years 16%
   16+ years 37%

4. Is there a **stream or river nearby**? [let them interpret "near by" while answering Q4] (N=592)
   74% Yes
   20% No
   6% Don't know

5. If yes, approximately how far away is it?

6. What is the **highest level of education** you have completed? (N=592)
   2% Less than HS
   4% HS/GED
   8% 2-year degree
   24% Some college
   32% BA/BS
   28% Post Graduate
   1% Other

Stormwater runoff is water from rain or snow that "runs off" the land.

7. Have you ever **seen or heard information from the City about stormwater pollution preve**ntion? (N=592)
   49% Yes
   46% No
   5% Don't know
   0% N/A

8. If yes, **what have you seen or heard**? (N=287)

41%	City Newsletter/handout	1%	Community meeting
17%	Fish sign on grates	0%	Website
17%	Flyer/handout	11%	Other including general message topics (e.g., don't pollute), booth at market.
5%	Event		
5%	Don't remember		
2%	Class		

9. When water runs into storm drains - the grates in the streets - **where do you think most of it ends up**? (N=592)

68%	Rivers, streams, open ditches
15%	Wastewater treatment plant
2%	Groundwater
0%	Settling or detention ponds
0%	Nearby open space such as fields
8%	Don't know
6%	Other including ocean (2%), sewer (1%), and "down some pipe and out somewhere"

Now I'd like to ask you about some specific activities that you may or may not participate in. The first activity is washing your car.

10. When your car is dirty, do you take it to a **carwash** (as opposed to washing it in the street or driveway)? (N=592)

52%	Yes
40%	No
9%	N/A

11. Why do/don't you? (N=531) (Respondents may provide more than one answer)

37%	Convience	5%	Equipment
18%	Cost	5%	Quality
11%	Environment	5%	Enjoyment
7%	Don't wash car	6%	Other
5%	Time		

12. Do you **landscape with native plants** in your yard? (N=592)

43%	Yes
22%	No
13%	Don't know
22%	N/A

13. Why do/don't you? (N=405) (Respondents may provide more than one answer)

25%	Personal preference	8%	Better for the environment
18%	Less water and care required	8%	Don't plant anything
10%	Convenience	4%	Prevents invasive species from taking over
10%	Someone else does the landscaping	1%	Deer Resistant
9%	Never considered it	7%	Other

14. Do you **cover up standing piles** of dirt, compost, bark dust, etc. that are in your yard or driveway? (N=592)

25%	Yes
37%	No
39%	N/A

15. Why do/don't you? (N=592) (Respondents may provide more than one answer)

16%	No perceived need	4%	Compost related (needs to be covered)
10%	Didn't know I should	1%	Social Pressure
7%	Weather related	11%	Other including concern about fly or mouse infestation, fear about getting materials stolen
7%	Environmental concerns		
5%	Aesthetics		

16a. Do you have a dog?

37%	Yes
63%	No

16b. If you have a dog, do you **pick up its waste**? (N=219)

89%	Yes
11%	No

16. Why do/don't you? (N=219) (Respondents may provide more than one answer)

24%	Don't want others/self to step in it	4%	It is the law
17%	Looks/Smells bad	2%	Let nature take care of it
16%	Social correctness	2%	Too hard
14%	Bad for environment	8%	Other including "inside dogs," "free-ranging dogs," and belief it's no different from farm animals
7%	Sanitation		
6%	Only do it when in town		

17. Do you **repair leaks from your car** right away if you notice them? (N=592)

82%	Yes
7%	No
11%	N/A

18. Why do/don't you? (N-509) (Respondents may provide more than one answer)

57%	Good car maintenance	2%	Concern for others
15%	Dislike stains/mess	2%	Don't know
12%	Environmental Concerns	1%	Type of leak
6%	Costs	4%	Other including claims to never have a leak on drivewa
3%	Values/habits		

20. Have you **ever put anything into a storm drain**, like paint or used car oil? (N=592)

3%	Yes
96%	No
1%	N/A

21. Why do/don't you? (N=547) (Respondents may provide more than one answer)

44%	It's bad for the environment
35%	Dumping in the storm drain is wrong
13%	I put it someplace else
6%	I take it to an official disposal place
1%	I only put grass in the storm drain

We're done with that set of questions. I'm going to read a few statements about the environment. Tell me how much you agree with each one on the scale from strongly agree, agree, disagree, and strongly agree.

22. The **balance of nature** is very delicate and easily upset. (N=592)

44%	Strongly agree	1%	Don't know
47%	Agree	0%	N/A
7%	Disagree		
1%	Strongly disagree		

23. **Humans must live in harmony** with nature in order to survive? (N=592)

51%	Strongly agree	1%	Don't know
43%	Agree	1%	N/A
3%	Disagree		
1%	Strongly disagree		

24. **CITY efforts to protect** the rivers and streams in Corvallis are important? (N=592)

59%	Strongly agree	0%	Strongly disagree
37%	Agree	1%	Don't know
2%	Disagree	0%	N/A

25. **PERSONAL efforts to protect** the rivers and streams in Corvallis are important. (N=592)

58%	Strongly agree	0%	Strongly disagree
38%	Agree	1%	Don't know
3%	Disagree	1%	N/A

We're just about done. The last set of questions is about where you get information about City activities and programs.

26. Have you ever **participated in a City activity** regarding stormwater pollution prevention? (N=592)

7%	Yes
89%	No
3%	Don't know
1%	N/A

27. If yes, what City activities (related to stormwater pollution prevention) have you participated in? (list all) (N=592)

4%	City event
1%	Boy/Girl Scouts
3%	City others

28. What **prevents you from participating** in a City Activity related to stormwater pollution prevention? Check all that apply/mentioned (N=592)

53%	Not aware of city programs
30%	I don't have time
9%	Not interested
4%	Doesn't seem to apply to my situation
2%	Efforts won't make a difference
1%	Program location
1%	Transportation issues

29. What do you **do if you see someone polluting a waterway** or causing stormwater pollution? (N=592)

46%	Take direct action with the person polluting
25%	Take no action
16%	Report person to authority
5%	Don't know
0%	Call the pollution hotline
9%	Other including haven't ever seen anyone polluting (4%)

31. What would be **best way for you to get information** about stormwater pollution prevention programs and activities? (N=592)

25%	The City Newsletter
23%	Website
20%	Information about activities mailed directly to my address
19%	Article in Gazette-Times
16%	E-mail message
10%	TV commercial
10%	Brochures, pamphlets, flyers
7%	Radio announcement
5%	Information booths at local activities like the farmers' market, DaVinci Days, etc.
4%	Barometer
4%	Posters around town
2%	Announcements at other City programs
17%	Other including information in water bill and several who claim not to need or want information.

That's it; we're done with the survey. What questions do you have for me about the survey? (Note any questions about survey and/or stormwater pollution?