

**WATERSHED SURVEY REPORT
STORMWATER PHASE II PROGRAM
BERWICK, SOUTH BERWICK, ELIOT,
AND KITTERY**

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**Prepared for:
The Towns of Berwick, South Berwick, Eliot, and Kittery, Maine**

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**WATERSHED SURVEY
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1.0 Introduction

In May 2003, the Towns of Berwick, South Berwick, Eliot, and Kittery, Maine became subject to the Maine Pollution Discharge Elimination System (MEPDES) General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4 General Permit). The MS4 General Permit required that each Town prepare a five year plan to protect stormwater from becoming polluted. The five-year plan contains six minimum control measures to protect stormwater. One of the measures discusses the need for the regulated communities to participate in a public education program. The general goal of this program is to inform the community of the potential effects of stormwater pollution and ways to protect stormwater. This watershed survey has been conducted to identify specific stormwater issues, allowing future public education efforts to be focused towards issues that have an impact on the region.

2.0 Methodology

To develop an effective public education program, it is necessary to have an understanding of the public's perception of potential stormwater issues, and then combine it with a formal evaluation of the potential pollution sources. Section 2.1 discusses the Maine Department of Environmental Protection (MDEP) Municipal Survey which represents the public's perceptions, and Section 2.2 describes the desktop analysis done in preparation for the field survey to identify the pollution sources.

2.1 The Public's Perception

It is important to understand what issues the public thinks are important because those issues are ripe for effecting change. In 2003, the MDEP developed a survey to be used to assess the public's general knowledge and awareness of stormwater issues. All regulated MS4 communities were asked to send the

survey to their municipal employees. The survey was conducted during the spring/summer of 2004 for the Towns of Berwick, South Berwick, Eliot and Kittery. These towns distributed a total of 285 surveys to municipal employees; and returned 143 completed surveys to MDEP for evaluation. The survey targeted the following activities that are documented to have a high potential to pollute stormwater. These activities include:

- Fertilizer use
- Pesticide application
- Lack of vegetation
- Pet waste
- Road related issues
- Petroleum products leaking from vehicles
- Soil erosion
- Septic system maintenance
- Household hazardous waste disposal

The Municipal Survey results provide baseline data for the respondents' perceptions of water quality and pollution sources. It is important to understand that their perception of the issues is directly correlated to their willingness to help correct the problems (see Figure 1). The MDEP Survey and Report of Results for Berwick, South Berwick, Eliot, and Kittery are contained in Appendix A.

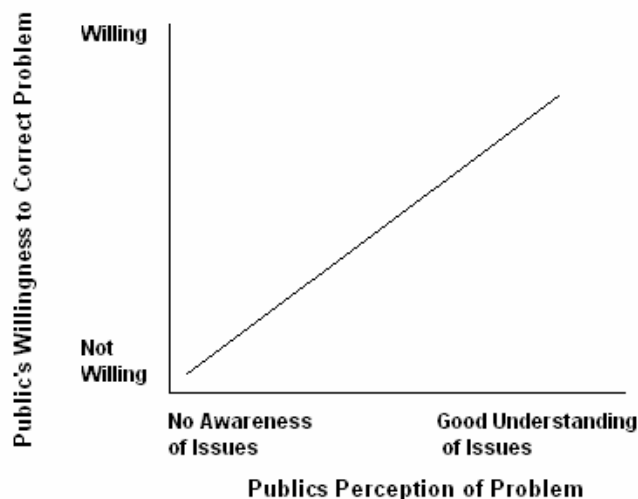


Figure 1: Correlation of the Public's Perception vs. Public's Willingness

Table 1 shows the MDEP municipal survey results.

Table 1: MDEP Survey Results: Perceptions of what impacts water quality (reported as % of respondents).

Order of Importance	Severe/Moderate %	D3 %*
Petroleum	52	22
Fertilizer	50	23
Pesticides	50	31
Roads	45	20
Industry	45	40
Septic	43	34
Lack of vegetation	40	46
Municipal WWTP	38	49
Soil	36	31
Pet waste	22	45

*D3 = **D**o not know, **D**oes not apply, or **D**oes not effect.

According to the results, the top three perceived water pollution sources are petroleum, fertilizer/pesticides, and roads/industry. In general, MDEP reported that 43% of respondents think that water quality of local waterbodies is good to excellent, 44% expressed it as fair, 7% thought it was poor, and 6% did not know. It can be interpreted from these results that there is no strong perception of a problem; therefore in the public's eye there is no driving need to change their behaviors in relation to stormwater practices. However, their perception that their local water quality is impacted by petroleum, fertilizer/pesticides, and road/industry, may make it easier to convince them that they need to change those behaviors. In addition to these three issues, the MDEP report documents the following information regarding soil erosion as a pollutant:

There is some evidence that people are now starting to think of soil erosion as a source of water pollution. From MDEP's previous work, [they] know that in 1996 when asked a top of the mind question about water pollution, soil was never mentioned as a source. In 2004, 6% said soil. In [the municipal survey] 36% said soil had a severe/moderate effect. However the 31% who

said “don’t know, doesn’t apply and does not affect water quality” are an indication that many people don’t think it is a problem.

The data from the Municipal Survey shows that the public perceives petroleum, fertilizer, and pesticides as water quality pollutants. To a lesser extent, the public is beginning to perceive soil erosion as an issue. Combining this information with the results of the Watershed Survey shows which behaviors can be most efficiently and effectively changed to protect stormwater from potential pollutants.

2.2 Desktop Analysis

The Center for Watershed Protection (CWP) has developed a series of manuals to assist municipalities and not-for profit groups in evaluating watershed issues and stormwater impacts. This watershed survey draws from the methodology as outlined in the CWP Manual 11 in the Urban Subwatershed Restoration Manual Series, *“Unified Subwatershed and Site Reconnaissance: A User’s Manual”* Version 1.0 March 2004. There are four major assessment components of a Unified Subwatershed and Site Reconnaissance (USSR): (1) Neighborhood Source Assessment (NSA), (2) Hotspot Site Investigation (HSI), (3) Pervious Area Assessment (PAA), and (4) Streets and Storm Drains (SSD). For the purpose of this survey, only two were considered: the Neighborhood Source Assessment of residential properties and the Hotspot Site Investigation of commercial properties.

This watershed survey consists of three major components: a desktop analysis, a field survey, and a data analysis/report summary. The purpose of the desktop analysis is to prepare for the field effort. The first step of the desktop analysis was to identify areas to be surveyed. To accomplish this, GIS maps of each community were created using the drainage areas available from the Maine OGIS website (14-digit HUC codes), as well as road, parcel, waterbody, and urbanized-area boundary data layers. The drainage areas overlapping the urbanized area were reviewed to identify neighborhoods that would be suitable

for the NSA portion of the survey. Stakeholders representing each of the four municipalities were involved in the neighborhood selection phase of the desktop analysis; they offered advice on which neighborhoods would most likely benefit from outreach. Town officials and the Conservation Commission in South Berwick, Town officials in Eliot, and the Spruce Creek Association and Conservation Commission in Kittery decided that the NSA would focus on certain neighborhoods within the urbanized area of each municipality as opposed to the entire town. The urbanized area in Berwick was small enough that a sampling of the entire urbanized area was completed through selecting a few neighborhoods.

Once the general neighborhoods were identified, lots were randomly selected in groups of four to represent one neighborhood unit (unit) within a neighborhood. Multiple units were identified for each neighborhood. To obtain a representative sample of a neighborhood, each completed NSA was based on an average of four lots that were of similar size. Lot sizes were determined from GIS data.

In Berwick one neighborhood was chosen with six (6) completed NSAs representing 24 lots located in the Middle and Lower Salmon Falls River subwatersheds. In South Berwick three distinct neighborhoods were identified with a total of 11 completed NSAs representing 44 lots located in the Lower Salmon Falls and Great Works River subwatersheds. In Eliot only one neighborhood was chosen with eight (8) completed NSAs representing a total of 32 lots located near Spinney Creek and the Piscataqua River in the Portsmouth Harbor subwatershed. In Kittery three neighborhoods were chosen with 16 completed NSAs representing a total of 64 lots located in the drainage areas of Spruce Creek and the Piscataqua River both of which are within the Portsmouth Harbor subwatershed. Figures showing the targeted neighborhoods for the region and for each town are located in Appendix B.

For the HSI, a set of commercial properties for each municipality was selected, for the most part, from businesses that were registered with their respective

chambers of commerce. The businesses, selected for the HSI, were categorized into five groups: (1) restaurants/convenient stores, (2) automotive/gas stations, (3) garden centers, (4) commercial cleaners, and (5) light industry. The list of businesses included use and location of each business. The majority of the businesses fell within the urbanized area, except for those that were located in close enough proximity and had considerable characteristics to have a significant potential to affect stormwater in the urbanized area.

The final step in field preparation consisted of modifying the survey forms that were presented in the CWP Manual 11. The NSA form was modified slightly for clarity. The HSI form was not modified. Copies of the forms used are located in Appendix C.

3.0 Field Survey

The survey was performed by a team of two associates from Edwards and Kelcey between the days of May 9 and May 12, 2005. Field maps and an atlas were used to locate the neighborhoods and the hotspots. This survey was conducted as a 'windshield' survey meaning that the observations were made from within the car or from the road. Each NSA was based on an average of four similar lots, and addressed topics of neighborhood characterization, yard and lawn conditions, driveways, sidewalks, and curbs; rooftops, and common areas. After filling out the form, a representative picture was taken of each unit using a digital camera. The HSI addressed topics of site data and basic classification, vehicle operations, outdoor materials, waste management, physical plant, turf/landscaping areas, and stormwater infrastructure. The HSI form that was used was intended for larger, more complex, commercial properties than those that were surveyed; therefore not all topics on the HSI form were observed. The completed forms for both the NSAs and HSIs are located in Appendix E.

The following assumptions were made during the NSA. It should be noted that these assumptions do not significantly affect the outcome of the survey.

- Under the topic of Neighborhood Characterization, decks were not considered in the percentage of infill, redevelopment, and remodeling, but were considered in the percentage of the lot that was impervious.
- Under the topic of Neighborhood Characterization, car garages and large sheds counted as a garage; small sheds were not included in the percentage of homes with garages.
- Under the topic of rooftops, if no downspouts were visible, they were assumed to discharge to a pervious surface.

4.0 Data Analysis/Report Summary

The NSAs and the HSIs completed were subject to the assessors' interpretation of the units and sites, and therefore are qualitative. They are suitable to provide a general interpretation of the areas surveyed, and to predict trends in the watershed. The NSA also provides enough information to define some potential restoration strategies for upland areas of a subwatershed.

4.1 HSI Results

A table of hotspot ranking for the businesses surveyed (Table 2) was created for all four towns based on the results from the HSI. The ranking system used was based on the one outlined in the CWP Manual 11. The marking key used to rank the hotspots is located in Appendix D. Table 2 confirms that no severe hotspots were identified in any of the towns. A total of 6 out of the 37 sites surveyed were considered to be confirmed hotspots, which is approximately 16% of the sites. The majority, 17 out of 37, of the sites were observed to be potential hotspots, and 14 out of 37 of the sites were considered to be non-hotspots. The observations that resulted in ranking the confirmed hotspots were based on issues relating to erosion/sediment control, vehicle maintenance, and good housekeeping. One of the six confirmed hotspots should be commended on their good housekeeping; however attention needs to be paid to the maintenance of a storm drain located in the middle of a gravel material storage area.

Table 2: Hotspot Ranking for Businesses in Berwick, South Berwick, Eliot, and Kittery.

	Berwick	South Berwick	Eliot	Kittery	Total
# of Non-Hotspots	4	4	3	3	14
# of Potential Hotspots	3	4	4	6	17
# of Confirmed Hotspots	1	1	2	2	6
# of Severe Hotspots	0	0	0	0	0
Total Sites	8	9	9	11	37

Since no sites were ranked as severe hotspots, and only a few sites were ranked as confirmed hotspots, public education for commercial businesses in the Southern Maine area would likely not be effective in reducing stormwater pollution.

4.2 NSA Results

A Table of Neighborhood Source Assessment Results (Table 3) was created for all four towns based on the results from the NSA. The results were determined using the outline in the CWP Manual 11. The marking key is located in Appendix D. Table 3 clearly identifies areas of concern and areas that have potential for restoration. Every neighborhood unit (based on an average of four lots) is represented on Table 3 by a single mark. A circular mark represents a pollution source and a diamond mark represents a potential restoration. If the mark is colored, it signifies that the neighborhood unit has this pollution source present or the potential for this restoration. Patterns in the data reveal the key points listed below.

1. It is evident that nearly all the neighborhood units (40 out of 41) have a potential for improved landscaping on their lot, and the majority of these neighborhood units also have



A highly managed lawn that has area down gradient of rooftop downspout for a rain garden or increased landscaping.

lawn present down gradient of the rooftop downspout for planting of a rain garden. Table 3 also shows that 75% of the lots surveyed have less than 40% of their lot covered by forest canopy.

2. Sediment and organics, as well as flowing or standing water was observed in the curbs, gutters, or side of the road for many of the lots. It was observed that 26 out of the 41 units or 63%, had sand, organics, or flowing/standing water, to some degree, in the curbs and gutters. However, it was also observed that there is a potential to restore this pollution source because 18 out of the 26 units had two or more of the following present: sediment, organics, overhead canopy, and/or trash. This data may be skewed because the Towns had not yet completed street sweeping at the time of the survey.

3. Moderate pollution sources revolve around percentage of grass cover and turf management. Thirty-four percent of the units surveyed indicate extensive grass coverage with 50% or more of the lot covered with grass. Half of the units with extensive grass coverage also had highly managed lawns. By percentage, Eliot had more lawns that were ranked as 'highly managed turf' than any other community (4 out of 8 units). However, the turf management data for this survey may be seasonally skewed because the survey occurred in early May before lawn care is typically done; therefore a portion of the lawns displaying medium turf management may actually fall within the percentage of lawns that have highly managed turf. High turf management refers to lawns that are over fertilized, over watered, or treated with pesticides. Indicators of high turf management include lush, dense grass cover that is consistently green with uniform color and no weeds.



A lot with low managed turf with bare soil.



A lot with medium managed turf.



A very large, highly managed lawn with potential for landscaping.

4. Pollution sources that occurred less than 25% of the time, for all four towns, include redevelopment and remodeling, swimming pools, junk or trash in yards, dirty or stained driveways, sidewalks covered with lawn clippings and leaves, and bare soil. It should be noted that improperly disposed yard waste may be an issue in South Berwick with nearly half of the neighborhood units displaying lawn clippings or leaves on the sidewalks. There were 2 units in Berwick and 4 units in South Berwick exhibiting 5% or more of the lot with bare soil. Also, Berwick saw more junk/trash in their units than any other town; however both Berwick and Kittery had accounts of dirty or stained driveways. Swimming pools were observed in all towns, except for Berwick.

5. This survey indicates that septic systems, downspouts directly connected to storm drains or sanitary sewers, permanent or 'non-target' irrigation, and pet waste are not problems within these towns because for each of these pollution sources, at the most, only one neighborhood unit displayed them. No septic systems were observed during the watershed survey.

Eight issues that were identified by the MDEP Municipal Survey as being activities that have a high potential to pollute stormwater were directly or indirectly addressed during this survey; these include all of the activities previously mentioned in Section 2.1 except for household hazardous waste disposal.

Five of these eight issues have a similar resounding theme of sediment/erosion control and lawn care/landscaping. The other remaining issues were found to be minor problems within the towns. The sediment/erosion control issues are not going to be directly targeted because they may represent skewed data (they may have been observed because the Town had not finished street sweeping). An initial public education program would best be focused on homeowner property care.

There is a general lack of vegetation in all of the communities with a high percentage of the units being comprised of impervious surfaces, such as rooftops and pavement, or semi-impervious surfaces, such as lawn. Increased landscaping would decrease the amount of lawn cover and increase the amount of landscaped and buffered areas. This would



A lot with a high percentage of impervious area.

reduce the quantity of stormwater produced and would also reduce the amount of soil erosion. Redirecting stormwater off of impervious surfaces into landscaped areas or rain barrels (to use to water vegetation during dry weather), will help to maximize infiltration. For the remaining lawns, education on proper turf management would help mitigate the amount of nutrients leaching from the lawn. Figure 2 illustrates the public's perception of pollution sources vs. observed sources and the associated public education focus.

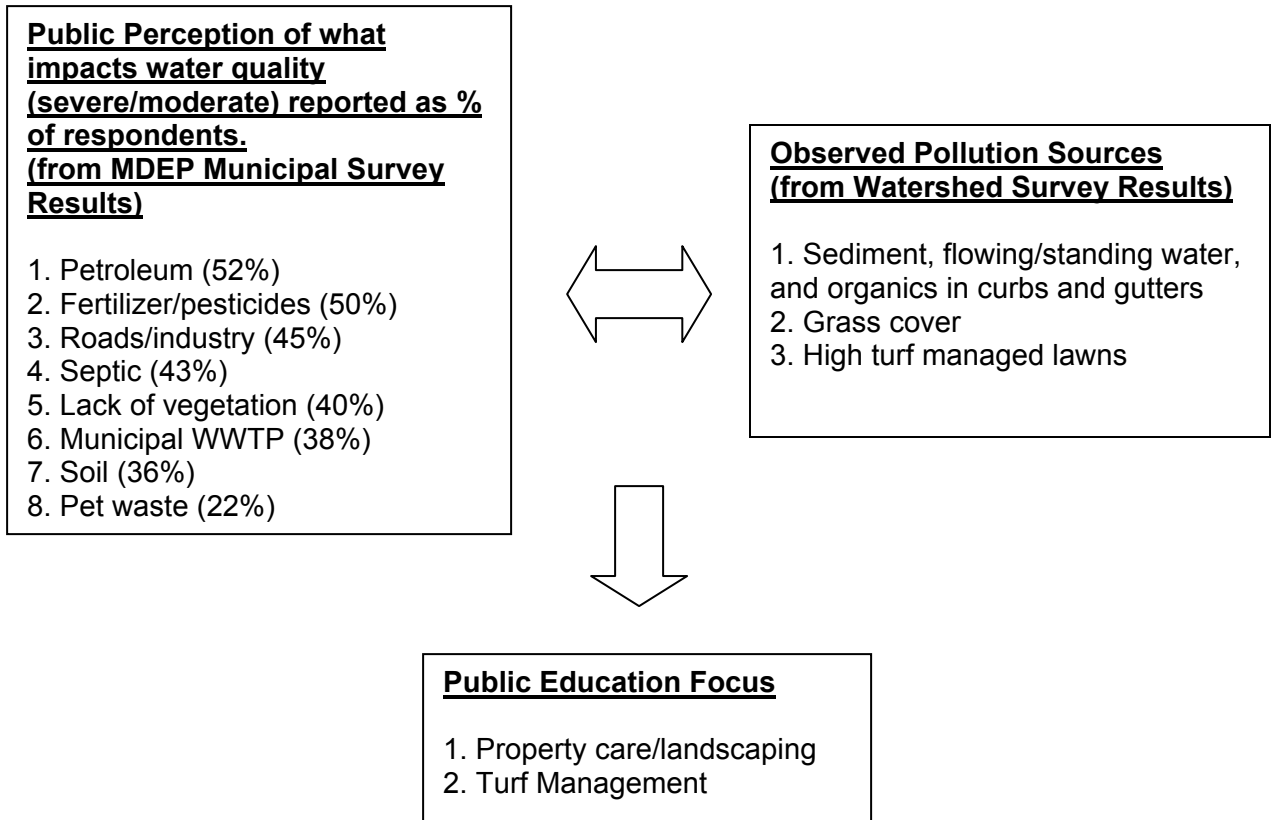


Figure 2: Summary of survey correlation and results.

5.0 Conclusion and Recommendations

The results of this Watershed Survey have been discussed with stakeholders from the four communities and select not-for-profit organizations. As a result, the public education program will focus on homeowner property care, addressing topics of landscaping and turf management. Public education efforts will be concentrated on the neighborhoods that were surveyed.

Turf Management:

Fifty-percent of the respondents of the MDEP Municipal Survey identified fertilizer/pesticides as a pollutant that moderately to severely impacts water quality. Since people already identify this as a potential pollution source, minimal public education would need to be conducted to make the public care. The results of the Watershed Survey show that fertilizer/pesticide use (in the visible form of high turf managed lawns) is a moderate pollution source in Southern

Maine. The data for turf management may be skewed low, meaning that there are more highly managed lawns than recorded, because of the timing of the survey; therefore turf management may be a larger pollution source than observed. Because of this finding, fertilizer/pesticide use will be targeted for public education. Even though the public recognizes that fertilizer/pesticides are a pollution source, it will still take significant effort to convince the public to change their behavior towards fertilizer/pesticide use.

Property Care/Landscaping:

In addition, a lack of vegetation was identified as having a moderate to severe impact on water quality by 40% of the respondents of the MDEP Municipal Survey. Lack of vegetation was observed to be a potentially large restoration strategy in Southern Maine. Addressing the concept of lack of vegetation may require more public education, compared to fertilizer/pesticide use, to convince the public that a lack of vegetation significantly influences water quality.

For the reasons stated above, we recommend addressing both turf management practices and property care/landscaping. Social marketing suggests that rather than offering a suite of behavior changes that it is more effective to identify one simple doable action; however since property care/landscaping and turf management are closely related it is our intention to integrate the two behavior categories into one public education program. By offering a limited suite of actions, for instance three very simple actions with a resounding theme, the public education effort will be successful at effecting behavior change.