West Branch Piscataqua River Watershed Survey Report

Prepared by:

Presumpscot River Watch

with assistance from the
Cumberland County Soil and Water Conservation District
and the
Maine Department of Environmental Protection

September 2008

Acknowledgements

Presumpscot River Watch (PRW) provided project oversight for the West Branch Piscataqua River Watershed Survey. Many volunteers and technical staff donated their time and energy to the project. In particular, Maine Department of Environmental Protection (ME-DEP) and Cumberland County Soil & Water Conservation District (CCSWCD) staff enthusiastically contributed their expertise to the project despite their own substantial watershed survey workloads. The Town of Cumberland also generously provided facilities at their municipal offices for volunteer watershed survey training.

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1. INTRODUCTION

The West Branch of the Piscataqua River (WBPR) **watershed** report is intended to provide community members with specific strategies for helping to improve this important local resource. The report is based on a watershed survey that was mostly conducted in May of 2007. Local volunteers and technical staff from various governmental agencies and nonprofit organizations identified 89 sites within the WBPR watershed that were potential contributors of **polluted runoff**. Given the considerable extent of agriculture and residential development in the watershed (Figure 1), it is likely that the Piscataqua River and its tributaries have been degraded by polluted runoff. This runoff can contain:

A ***watershed*** describes an area of land that contains a common set of streams and rivers that all drain into a single larger body of water, such as a larger river, lake or ocean.

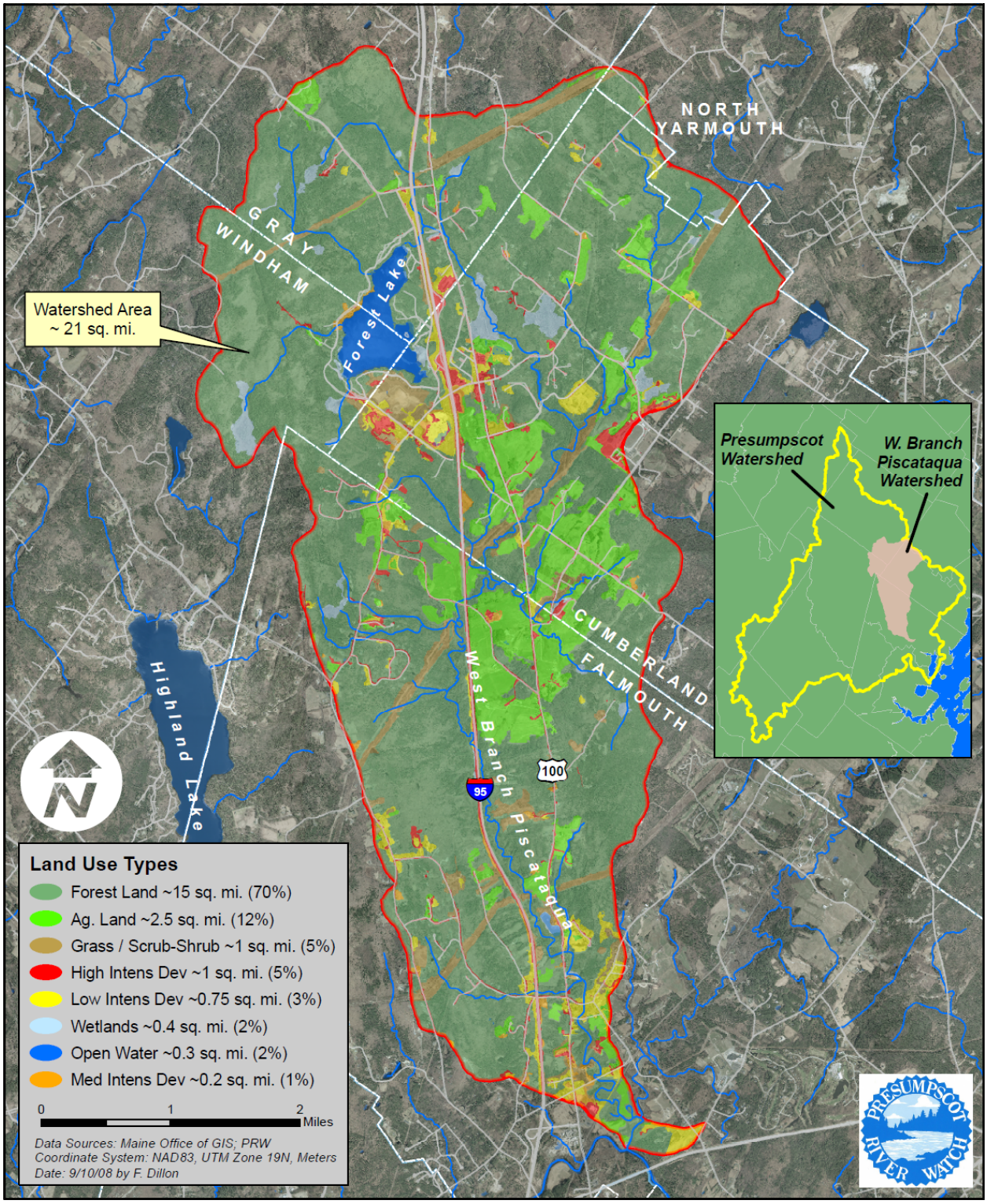
Polluted Runoff - also known as nonpoint source (NPS) pollution - comes from many diffuse sources and is transported by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human made pollutants, finally collecting in lakes, rivers, wetlands, coastal waters.

- Excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas;
- Oil, grease, and toxic chemicals from urban runoff;
- Soil erosion from improperly managed construction sites, crop and forest lands, and eroding stream banks; and
- Bacteria and nutrients from livestock, pet wastes, and faulty septic systems.

Impervious surfaces are constructed surfaces (parking lots, roads, driveways, rooftops, etc.) that prevent the infiltration of precipitation and snowmelt. The amount of polluted runoff increases in relation to the extent of impervious surfaces and results in surface water degradation.

In recent years the WBPR watershed has been increasingly impacted by development and is part of the larger Piscataqua River watershed, which has been named a Nonpoint Source Priority Watershed by the Maine Department of Environmental Protection (DEP). NPS Priority Watersheds are identified for restoration by DEP through the development of watershed management plans. Overall development in the WBPR Watershed as indicated by the extent of **impervious surfaces** is limited (~ 7% of the watershed is covered by impervious surfaces). However, localized higher intensity development, particularly around west Cumberland, has an increased concentration of impervious surfaces and is therefore of greater concern due to the associated potential impacts to nearby surface waters. Water quality monitoring data collected from the WBPR by the Presumpscot River Watch over the past several years are indicative of excessive pollutant loadings. Bacteria results exceeded DEP water quality standards for 6 of 7 years from 2000-2006 and minimum dissolved oxygen results were below state standards for 4 of 7 the years during this period (Appendix A).

Figure 1: WBPR Watershed Land Uses



All of the land in the shaded area (~ 21 square miles) drains into the West Branch of the Piscataqua River before flowing into the Presumpscot River.

2. WATERSHED SURVEY PURPOSE

The primary purpose of the WBPR watershed survey was to identify and prioritize nonpoint source (NPS) pollution sites in the watershed for eventual remediation. Additionally, the WBPR Watershed survey will aid in forming collaborative relationships with local municipal officials and landowners, who can help resolve the water quality issues identified by the survey. Rather than adopting a regulatory approach, the Steering Committee decided to use a collaborative approach to promote greater community involvement.

3. GENERAL WATERSHED CHARACTERISTICS

The WBPR Watershed is located in the towns of Cumberland, Falmouth, Gray, North Yarmouth and Windham in Cumberland County, Maine and has a drainage area of approximately 21 square miles (see Figure 1 on previous page). The WBPR flows in a southerly direction and receives several small tributary inputs along the way before joining with the East Branch of the Piscataqua River just before flowing into the Presumpscot River (also listed as a Nonpoint Source Priority Watershed), which then flows into Casco Bay. As Figure 2 indicates, the land cover in the watershed is dominated by forest lands. Agriculture is the next most prevalent land use followed by grass lands and high intensity development. Low intensity development, wetlands and open water make up the remainder of the watershed.

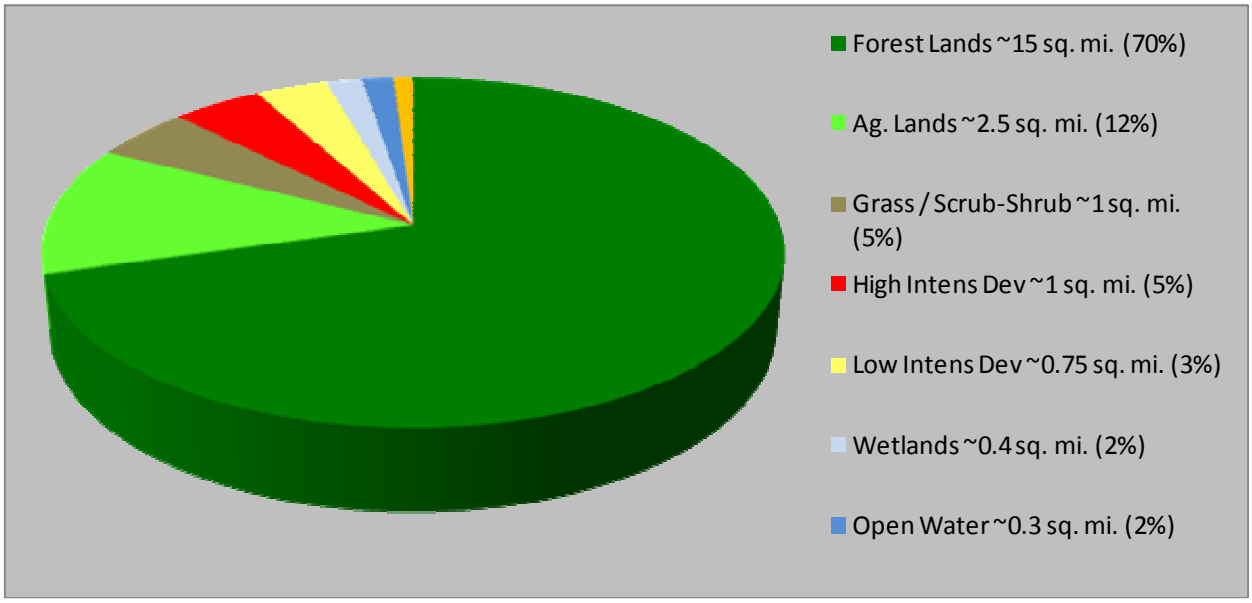


Figure 2: *West Branch Piscataqua River watershed land cover types & areas*

4. WATERSHED SURVEY METHODOLOGY

Prior to the survey, notification letters were sent to landowners (abutting the river or tributaries) that provided an opportunity for them to exclude their property from the survey. A fact sheet was also included that described the project. The WBPR

watershed was divided into 6 sectors (Figure 3) to provide an approximately equal number of potential polluted runoff sites in each sector. (A portion of the watershed around Forest Lake was surveyed previously and was not included in the 2007 NPS watershed survey. The Maine Turnpike corridor was also not surveyed due to access constraints). Binders containing maps and standardized watershed survey field sheets were assembled for each sector.

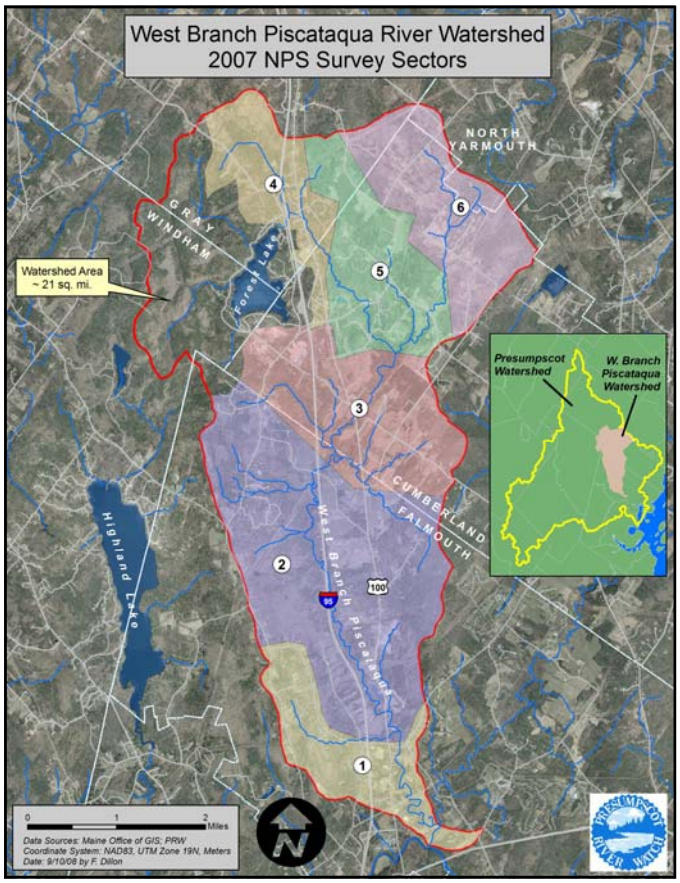


Figure 3. *WBPR watershed survey sectors*

Volunteers were an instrumental part of the watershed survey and were contacted by Steering Committee members and technical staff. Prior to the initial watershed survey, volunteers received two hours of classroom training on field survey techniques to identify various sources of polluted runoff. On May 4, 2008, survey teams traveled throughout the watershed documenting polluted runoff from roads, parking areas, fields, stream banks and footpaths using hand-held global positioning systems (GPS), cameras and the standardized field data sheets. To ensure accurate data collection, technical staff members served as leaders for each team. In all, 82 polluted runoff sites were identified by the survey teams on May 4, 2007. Technical staff identified 7 additional problem sites in the WBPR Watershed on May 22, 2007 for a total of 89 sites. Surveyors developed preliminary recommendations for the remediation of each identified site and ranked sites based the following criteria:

- Impact to surface water quality
- Cost to install Best Management Practices

Best Management Practices (BMPs) are techniques used to reduce or prevent polluted runoff.

Project staff used these criteria to develop an associated scoring system that roughly prioritizes problem sites. Scores were assigned as indicated in Table 1 and Table 2 (following page) provides an example of scoring for a hypothetical site. Thus, a problem site rated with a high impact to water quality and low ***BMP*** installation cost was scored as a high priority since fixing it would result in the "biggest bang for the buck." Sites with lower scores (including those with high impacts that will be more expensive to remediate) are also worthy of consideration but should perhaps receive attention after the higher priority sites are addressed.

Table 1: *Range of possible scores for each NPS assessment category.*

	WQ Impact	Cost
High	6-7	3
Medium	5	5
Low	3-4	7

Table 2: *Example of NPS site prioritization scoring**

	WQ Impact	Cost
High	7	
Medium		
Low		7
	Total Score:	14

** A site with a high WQ impact and low cost would result in the highest possible "score" of 14.*

5. WATERSHED SURVEY RESULTS

Observations for all 89 sites were transferred from the standardized field data sheets into a computer spreadsheet (Appendix B) and the physical locations were plotted on maps using GIS (Geographic Information Systems). The summarized results are as follows.

Land Uses

Most of the documented sites were associated with town roads, residential areas and commercial areas (29% town owned roads, 19% residential areas and 19% commercial areas). The remaining sites were associated with a variety of other land use types (Figure 4). To avoid trespassing on private property, survey teams mostly avoided private roads, so some sites may not have been documented.

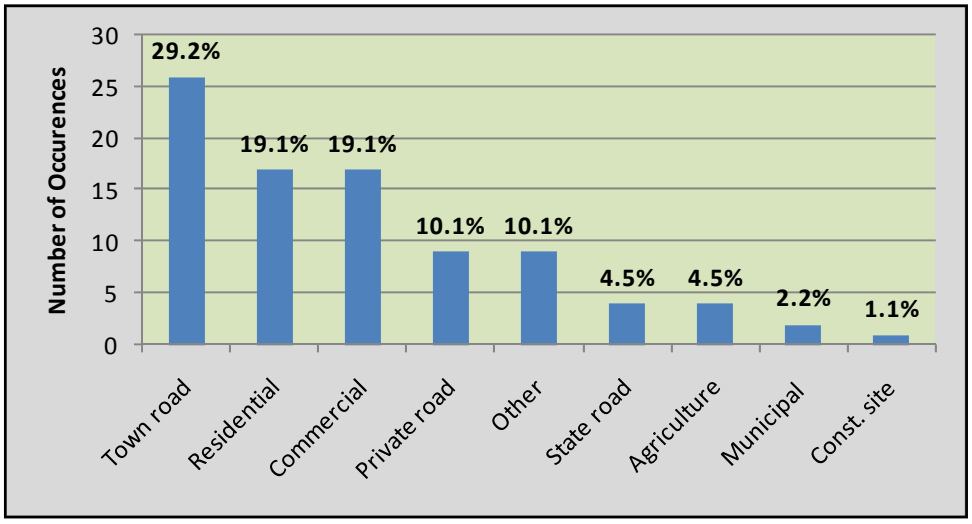


Figure 4*: Observed land use types for polluted runoff sites in WBPR Watershed Survey*

Types of Problems Identified

Survey teams identified a variety of problem types (Figure 5). The most commonly observed problems were related to soil erosion (Figure 6), which is the single largest pollutant source by volume to Maine's surface waters. Soil erosion can originate from a number of places, including unpaved roads and road shoulders, ATV trails and

unstable stream banks to name just a few. Because the nutrient phosphorus is often attached to soil particles, erosion can result in algal blooms in surface waters. Additionally, as rainwater or melting snow flows across paved or unpaved surfaces it can carry a variety of pollutant types into nearby streams. Pollutants can include oil and grease from roads and parking lots; pesticides and herbicides from lawns, gardens and playing fields; and bacteria and viruses from improperly handled animal waste or malfunctioning septic systems (see Appendix C for a more complete list).

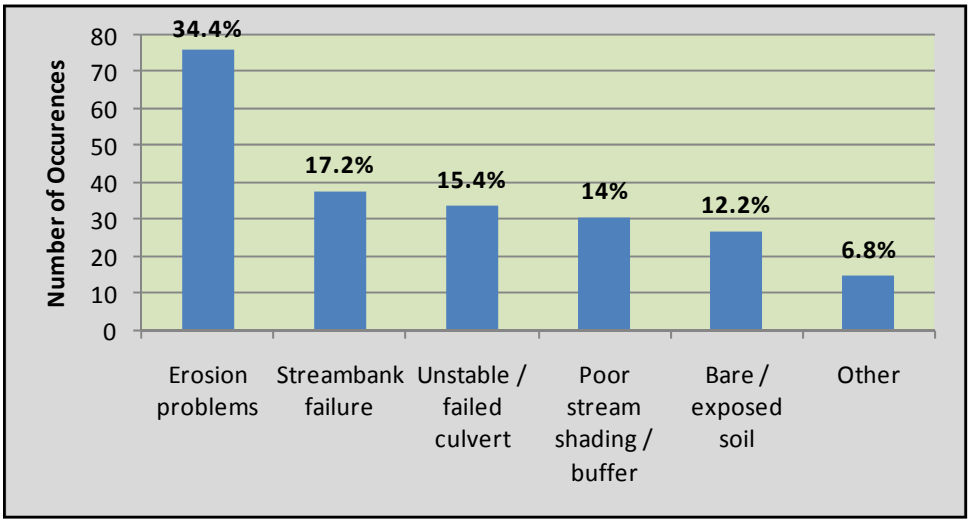


Figure 5: *Frequency and percentage of polluted runoff problems by type.*

Figure 6*: Example of erosion on a road shoulder next to a culvert*

Figure 7*: Example of stream bank failure at an ATV*

The next most commonly observed problems were due to stream bank failure, which often results from a lack of adequate vegetated buffers needed to stabilize riparian soils (or as indicated in Figure 7, vegetation is damaged by recreational ATV activities). Impervious surfaces can also contribute to this problem by increasing and intensifying the effects of surface water runoff, which can scour and erode stream channels during peak or prolonged rain events.

The next most frequently observed problems were culvert related (Figure 8).

Culverts are underground pipes that convey water from one area to another, usually under a road or driveway. They are an important part of the storm water collection system because they can help alleviate roadway flooding and soil erosion. However, culverts can also be sources of polluted runoff if not properly designed, installed and maintained by altering the water flow characteristics of stream channels and resulting in stream bank erosion. Poor stream shading and inadequate shoreline buffers were the next most commonly observed problems (Figures 9 and 10). Shading is important because it allows for lower temperatures that more sensitive aquatic organisms need to survive. Shoreline buffers are strips of vegetated land that are left in their "natural" state and are important because they stabilize soil and prevent or reduce other pollutants from entering a stream.

The remainder of observed polluted runoff problems in the "other" category included excessive sediment buildup (Figure 11), invasive plant species and improperly managed livestock manure.

***Figure 8**: Example of a hanging culvert.*

***Figure 9**: Example of inadequate shoreline buffer.*

***Figure 10**: Example of a manicured lawn without a buffer.*

***Figure 11**: Excess sand left on the road following a cold Maine winter.*

Prioritization of Problem Sites

As discussed earlier, project staff developed a method to prioritize all sites that were rated for the 2 assessment categories: impact to surface water quality and BMP installation cost. Both of these categories were combined so that relative "scores" could be established for each polluted runoff site. The range of scored values for all the sites was from 6 to 12. High, medium and low prioritization classes were established to assist in indentifying which sites should be considered first for remediation. High priority sites were assigned scores of 10-12; medium priority sites were assigned scores of 8 or 9; and low priority sites were assigned scores of 6 or 7. Sites that were not rated could not be prioritized for remediation.

Nearly one quarter of the sites were rated as high remediation priorities; just over 40% were rated as medium remediation priorities; and just under 14% were rated as low remediation priorities. The remaining 21% of the sites that were not rated (primarily on the basis of cost) will need to be revisited by technical staff to determine their relative remediation ranking. The prioritization scoring system employed here is intended to be used merely as a flexible guide for determining which sites to fix first. Therefore, sites that scored as low remediation priorities can certainly be considered for improvements sooner rather than later depending on the availability of resources and interest. Table 3 summarizes the results for all scored sites by landuse type. A map of prioritized sites is presented in Figure 12 on the following page.

A simple pollutant runoff or "hot spots" model was also developed to indicate areas of the watershed most prone to adversely impacting the WBPR and its tributaries (primarily for phosphorus and bacteria loadings). The criteria used to identify these areas were slope (as derived from USDA medium intensity soils data) and proximity to surface waters. The clusters of medium and high priority problem sites generally correspond with the medium and high runoff potential areas (Figure 13, pg. 10).

Table 3: *prioritized polluted runoff sites by landuse type. High priority sites generally have greater water quality impacts and can be fixed with lower cost. Medium and low priority sites tend to have less severe water quality impacts and will require greater cost to fix.*

Landuse Type	High Priority	Medium Priority	Low Priority	Not Rated	Totals	% Total
Tow n road	4	12	5	5	26	*29.2%*
Residential	3	10	1	3	17	*19.1%*
Commercial	9	5	0	3	17	*19.1%*
Private road	1	1	5	2	9	*10.1%*
Other	0	5	1	3	9	*10.1%*
State road	0	1	0	3	4	*4.5%*
Agriculture	3	1	0	0	4	*4.5%*
Municipal	1	1	0	0	2	*2.2%*
Const. site	1	0	0	0	1	*1.1%*
Recreation	0	0	0	0	0	*0.0%*
Municipal/Rec	0	0	0	0	0	*0.0%*
Totals	**22**	**36**	**12**	**19**	**89**	*100.0%*
% Total	*24.7%*	*40.4%*	*13.5%*	*21.3%*	*100.0%*	

Figure 12: WBPR Watershed Survey Prioritized NPS Sites

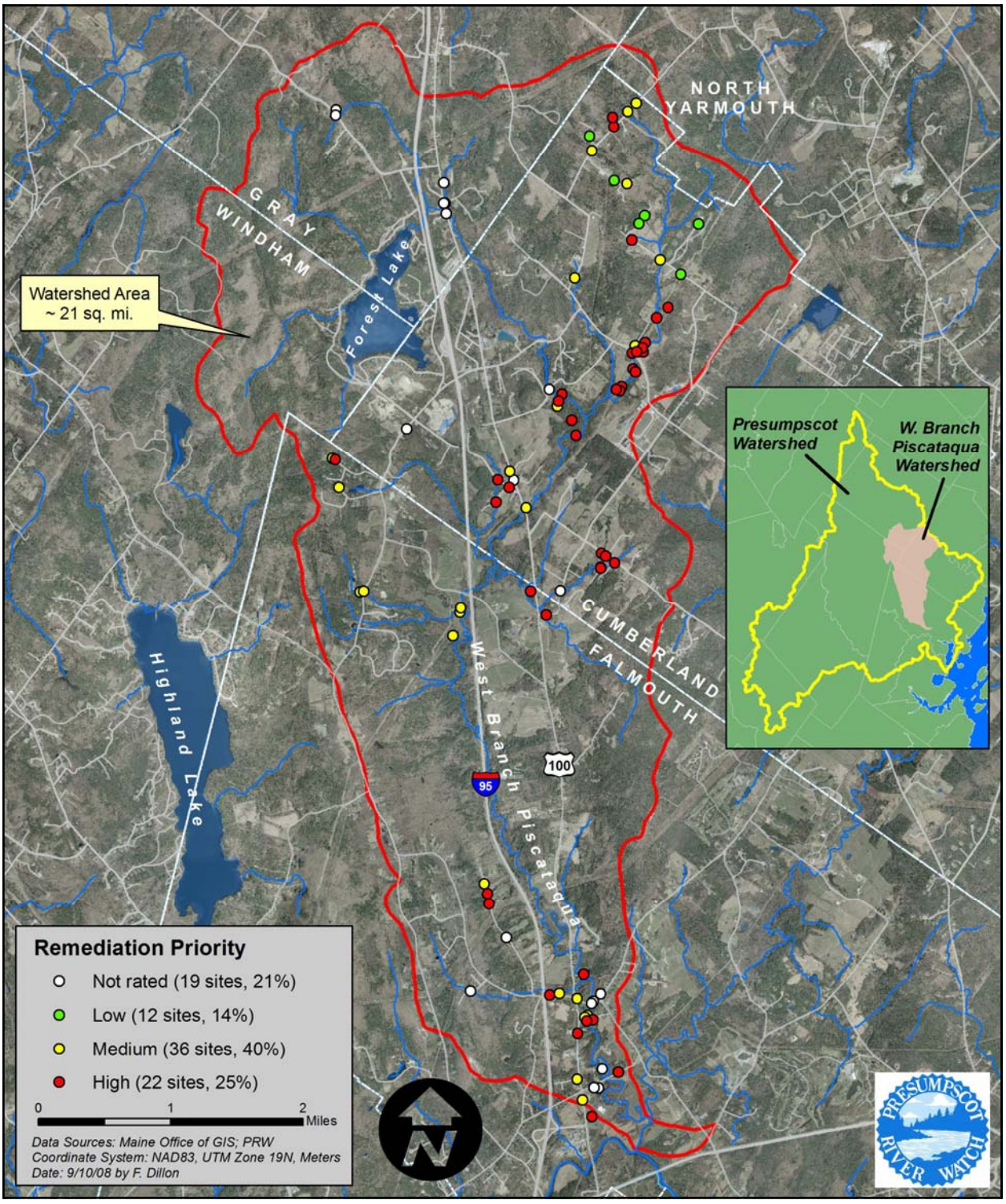
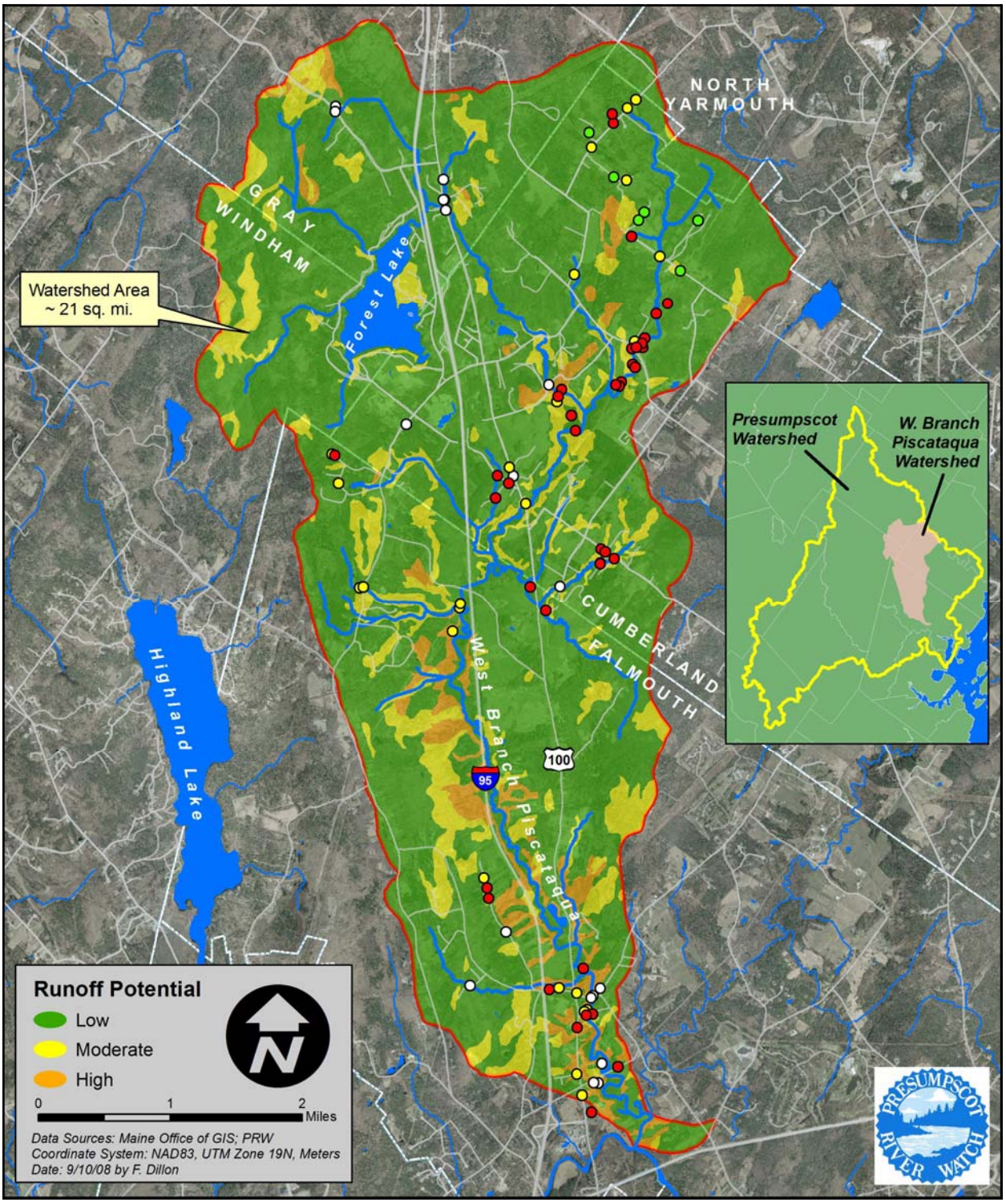


Figure 13: WBPR Watershed Survey Pollutant Runoff Potential & Prioritized NPS Sites



6. RAPID GEOMORPHOLOGY SURVEY RESULTS SUMMARY

On August 15, 2006, technical staff completed a one-day rapid geomorphic assessment of nine reaches in the WBPR watershed, eight of which were located in the WBPR proper and one of which was located in an un-named tributary. The purpose of the assessment was twofold: 1) to provide training for project partners on geomorphic assessment techniques and 2) to assess stream channel dynamics and gain a better understanding of the riparian corridor and substrate conditions for each representative stretch of the river.

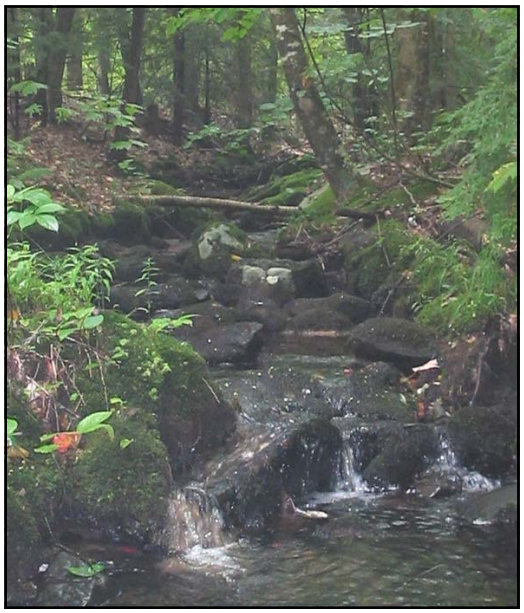


***Figure 14**: One of the reaches selected for the rapid geomorphology survey*

The findings from this limited assessment indicate that selected reaches in WBPR watershed are in relatively good condition from a geomorphological perspective due in large part to the presence of fairly wide forest buffers and the relatively low extent of impervious surfaces (Figure 14). However, other reaches of the river that were not surveyed would likely identify potential geomorphological issues and continuing development in the watershed will pose potential risks to the health of the WBPR and its tributaries if done haphazardly. A full report on the findings from this survey can be found in the Maine DEP's *Piscataqua River Watershed ("West Branch") Stream Corridor Survey - Summary Report*.

7. CULVERT SURVEY & TRAINING SUMMARY

On June 15, 2007, U.S. Fish and Wildlife Service (USFWS) staff provided culvert survey training to technical staff from various water resource organizations using the WBPR watershed as the method testing area (Figure 15). The primary purpose of the training was to instruct participants on the use of a common methodology for identifying culvert stream crossings that impede fish passage with the ultimate goal of improving fish habitat connectivity throughout the state. A full description of the USFWS culvert survey methodology can be found in the *Maine Road-Stream Crossing Survey Manual*.

***Figure 15**: One day culvert survey training seminar*

8. PROJECT CONCLUSIONS

The watershed survey indicates that the WBPR is being adversely affected by adjacent land uses. At least 65% of the identified polluted runoff sites were rated as medium or high priorities for remediation (Table 3, page 8). While the majority of problem sites were related to roads, commercial and residential land uses also figured prominently in contributing polluted runoff to the WBPR and its tributaries (Figure 4, page 5). Well over a third of the identified polluted runoff problems were erosion-related and often contributed to stream bank failure, the next largest problem type. Culvert problems and inadequate shading and buffers were also significant followed by bare soil and the other problem types (Figure 5, page 6).

Most of the high and medium priority sites occurred in close proximity to one another in association with more intensely developed areas (Appendix D, on page 18). While the initial emphasis for remediating problem sites should focus on those with higher priorities, it will also be important to eventually consider the cumulative impacts of low priority sites and to revisit the sites that were not rated assigned cost ratings so that they can also be prioritized.

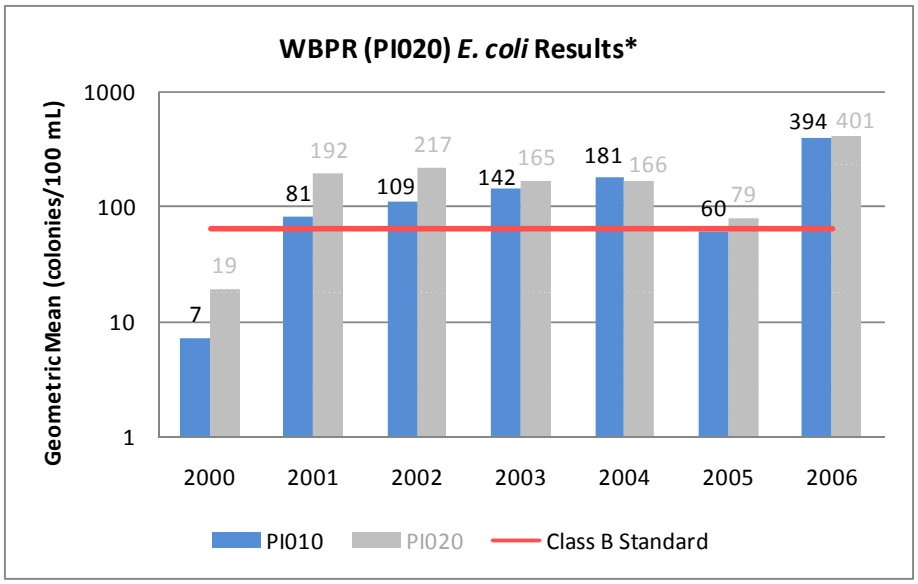
9. RECOMMENDATIONS/ PRELIMINARY ACTION PLAN

Erosion problems are the most common causes of polluted runoff and the greatest concentration of medium and high priority sites are located in the more intensely developed portions of the WBPR watershed. Best Management Practices to mitigate polluted runoff in developed areas generally focus on addressing two broad concerns: storm water flow control and pollutant load reduction. BMPs will also vary depending on whether the developed area under consideration is new or existing. The most effective flow control measures in newly developing areas limit the amount of rainfall that is converted to runoff. Areas with existing development tend to be more complicated since an existing drainage system is already in place, though reducing runoff volume is still usually the primary emphasis. In cases where it is not feasible to reduce runoff volumes due to the density of development, BMPs are implemented to reduce pollutant generation and/or facilitate pollutant removal. Remediating polluted runoff in the WBPR watershed will require a combination of BMPs. However, a number of tasks must be completed before BMP implementation can begin. Table 4 on the next page summarizes a preliminary action plan for this process.

***Table 4**: Preliminary action plan to remediate polluted runoff sites in the West Branch of the Piscataqua River watershed*

TASK	**WHO**	**WHEN**
Present survey findings to Town officials and WBPR Watershed Coalition Steering Committee	PRW / CCSWCD	Fall 2008
Develop soil loss estimates and / or BMP designs for all high and medium priority sites and include in watershed management plan.	CCSWCD	Spring 2009
Continue to monitor the health of WBPR	PRW	Ongoing
Develop grant proposal from multiple funding sources to address high priority BMPs.	WBPR Steering Committee	Spring 2009
Develop plan to address all medium and low priority sites in WBPR watershed.	WBPR Steering Committee	Summer 2009
Complete watershed management plan.	WBPR Steering Committee	Fall 2009
Implement BMPs.	WBPR Steering Committee	2009-2011

APPENDIX A: Presumpscot River Watch Water Quality Monitoring Data



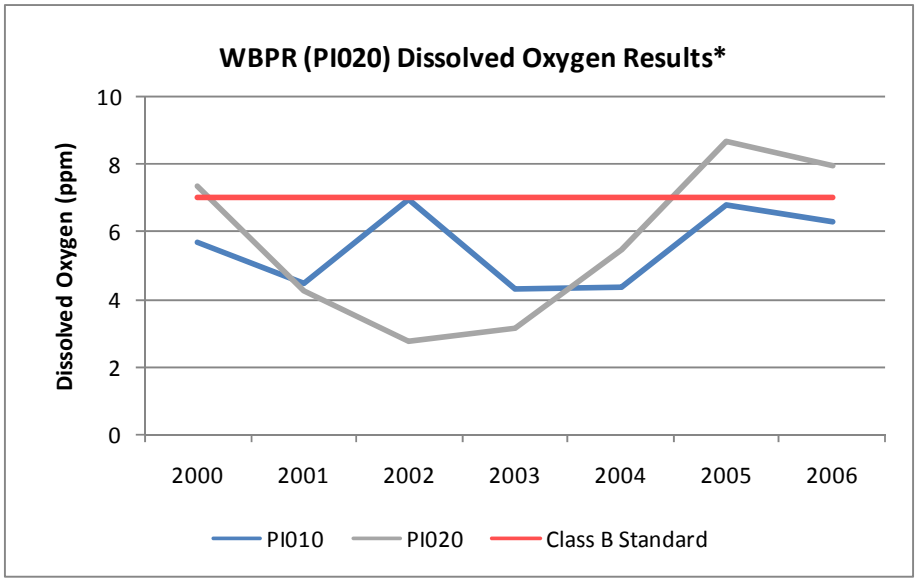
** PI010 (E. Branch Piscataqua) results included for comparison*

PI020							
Sample	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
1		201	165	29	99	25	261
2	1	201	201	104	63	34	
3	2	167	172	2419		225	172
4	200	397	435	166	122	205	238
5		165	194	201	88		435
6	1000	135		138	256		1553
7	116	172		125	2419		1986
8	1	178		130	83		116
N	6	8	5	8	7	4	7
Min	1	135	165	29	63	25	116
Max	1000	397	435	2419	2419	225	1986
Geomean	19	192	217	165	166	79	401

PI010							
Sample	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
1		62	59	14	35	15	649
2	1	38	201	115	83	19	
3	3	147		2419		491	155
4	200	68		79	90	91	194
5	1	118		205	261		548
6	200	66		89	148		2419
7	8	135		228	2419		308
8	1	77		130	260		185
N	7	8	2	8	7	4	7
Min	1	38	59	14	35	15	155
Max	200	147	201	2419	2419	491	2419
Geomean	7	81	109	142	181	60	394

Pink cells for instantaneous exceedances (427 col/100 mL until 2005; 236 col/100 mL thereafter); yellow cells for geomean exceedances (64 col/100 mL).

APPENDIX A (continued)



** PI010 (E. Branch Piscataqua) results included for comparison*

PI020							
Sample	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***
1	10.5	-	-	10.2	8.7	10.5	11.2
2	7.4	9.8	7.7	8.6	9.9	9.0	-
3	8.1	8.1	2.8	8.3	-	10.0	9.6
4	8.1	-	4.2	7.6	8.0	8.7	9.2
5	7.5	6.8	6.7	8.5	8.3	-	8.8
6	8.3	4.2	-	7.8	5.5	-	8.0
7	7.7	-	-	5.5	6.0	-	9.3
8	7.9	-	-	3.2	8.3	-	9.5
N	8	4	4	8	7	4	7
Min	7.4	4.2	2.8	3.2	5.5	8.7	8.0
Max	10.5	9.8	7.7	10.2	9.9	10.5	11.2
Mean	8.2	7.2	5.3	7.5	7.8	9.5	9.4

PI010							
Sample	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***
1	9.7	8.7	9.1	10.3	7.3	9.8	10.4
2	6.5	9.1	6.9	7.5	8.9	8.8	-
3	7.4	4.7	8.2	6.9	-	8.9	8.2
4	6.4	-	-	4.7	6.5	6.8	7.9
5	5.7	4.5	-	6.2	6.3	-	7.5
6	6.7	7.5	-	5.4	6.4	-	6.3
7	5.7	-	-	8.0	5.7	-	7.7
8	7.2	-	-	4.3	4.4	-	8.1
N	8	5	3	8	7	4	7
Min	5.7	4.5	6.9	4.3	4.4	6.8	6.3
Max	9.7	9.1	9.1	10.3	8.9	9.8	10.4
Mean	6.9	6.9	8.1	6.7	6.5	8.6	8.0

Pink cells for failure to meet minimum standard (7 ppm).

APPENDIX B: WBPR Watershed Survey Results and Recommendations

Site #	Date	Surveyor Initials	Area Affected	Land Use	Issues	Reccomendations	Impact Score	Cost Score	Total Score
1-1	5/4/07	TB,FD	3000 sq ft	commercial	Drainage from high-use parking lot; heavy traffic; drainage from large paved area	stormwater controls; stencil storm drain; bioretention cells	6	nr	Not rated
1-2	5/4/07	TB,FD	4000 sq ft	commercial	excessive trash; algal mat at storm drain outlet	clean out culvert; pick up toys	3	nr	Not rated
1-3	5/4/07	TB,FD	200 sq ft	commercial	hillside failure imminent	stabilize banks, plant trees	3	nr	Not rated
1-4	5/4/07	TB,FD		commercial	road shoulder erosion	reshape shoulder; repair curb stone	3	7	10
1-5	5/4/07	TB,FD	1000 sq ft	commercial	unstable culver inlet	stabilize culvert inlet	4	5	9
1-6	5/4/07	TB,FD	1300 sq ft	Residential	bare soil; road shoulder erosion; severe bank erosion; clogged culvert	clean out culvert; stabilize inlet; armour ditch; stabilize banks	4	5	9
1-7	5/4/07	TB,FD	1000 sq ft	Residential	stockpiled soil	remove sand	3	7	10
1-8	5/4/07	TB,FD	2500 sq ft	municipal	stockpiled soil	remove sand	4	7	11
1-9	5/4/07	TB,FD	1000 sq ft	commercial	streambank failure; bank erosion	stabilize banks	5	5	10
1-10	5/4/07	TB,FD	200 sq ft	commercial	streambank failure; bank erosion	stabilize banks	4	5	9
1-11	5/4/07	TB,FD	100 sq ft	municipal	unstable/hanging culvert	stabilize inlet, armour ditch	4	5	9
1-12	5/4/07	TB,FD	250 sq ft	Town road	streambank failure; bank downcutting; severe bank erosion; both sides of road	stabilize banks	4	nr	Not rated
1-13	5/4/07	TB,FD	160 sq ft	Town road	hanging culvert; bank erosion	stabilize inlet; re-align culvert	4	nr	Not rated
1-14	5/4/07	TB,FD	1000 sq ft	Residential	bare soil; unstable con site	install erosion controls	4	5	9
1-15	5/4/07	TB,FD	3000 sq ft	Residential	bare soild; unstable con site; severe bank erosion; excessive sed buildup; large amounts of soil dumped by homeowner burrying culvert	clean out culvert; stabilize banks	6	3	9
1-16	5/4/07	TB,FD	150 sq ft	civic/church	bare soil; parking area shoulder erosion	remove berms; remove winter sand	3	7	10
1-17	5/4/07	TB,FD	250 sq ft	Residential	bare soil; stockpiled soil	cover exposed piles	3	nr	Not rated
1-18	5/4/07	TB,FD	100 sq ft	Residential	streambank failure; unstable culvert inlet; bank erosion	stabilize inlet; stabilize banks.	4	nr	Not rated
1-19	5/4/07	TB,FD	750 sq ft	State road	road shoulder erosion	armour ditch; reshape ditch; reshape shoulder	5	5	10
2-1	5/4/07	MCC/OC/JA	120 sq ft	Town road	road shoulder erosion upstream; unstable culvert inlet; hanging culvert	install plunge pool; stabilize inlet; stabilize banks; remove winter sand; reshape road; excavate upstream and install detentions pond or riprap	4	5	9
2-2	5/4/07	MCC/OC/JA	500 sq ft	Town road	road shoulder erosion; steep swale	remove winter sand; reshape shoulder; plant buffer	3	7	10
2-3	5/4/07	MCC/OC/JA	3000 sq ft	Town road	road shoulder erosion	install plunge pool; armor ditch with stone; stabilize banks; remove winter sand	6	3	9
2-4	5/4/07	MCC/OC/JA	4000 sq ft	CMP row	road surface erosion; unstable culvert inlet; culvert crushed	replace culvert; stabilize inlet; build up road; veg. shoulder	4	5	9
2-5	5/4/07	MCC/OC/JA	1000 sq ft	CMP row	road surface erosion; stream X-ing; fish present; eroded road; hanging culvert no fish passage	enlarge culvert; buildup road; re align culvert	6	3	9
2-6	5/4/07	MCC/OC/JA	400 sq ft	CMP row	road surface erosion; severe bank erosion; culvert damaged	replace culvert; stabilize banks; build up road	5	3	8
2-7	5/22/07	JA/DK	1800 sq ft	Residential	road surface erosion; unstable culvet inlet	clean out culvert; stablilize inlet; build up road; reshape shoulder; reshape road; water is piping under metal culvert	6	3	9
2-8	5/22/07	JA/DK	1200 sq ft	Town road	road shoulder erosion; unstable culvert inlet; excessive sed build up	replace culvert; stabilize inlet; install ditch; reshape shoulder	6	3	9
2-9	5/22/07	JA/DK	2400 sq ft	Residential	stream bank failure; severe bank erosion; excessive sed build up; inlet nearly blocked; structures may be in danger from bank failure	clean out culvert; bank stabilization	6	3	9
2-10	5/22/07	JA/DK	2400 sq ft	Residential	stream bank gulleys at residence; road shoulder erosion; poor buffer; concentrated flow path of stormwater thru buffer; bank erosion	clean out culvert; install plunge pool at end of turn out; plant buffer	5	5	10
2-11	5/22/07	JA/DK	600 sq ft	Town road	road shoulder erosion; livestock (cattle) improper manure storage; lack of stream shading in pasture; poor buffer; excessive sed build up; culvert burried	clean out culvert; reshape ditch; reshape shoulder; stream fencing; establish buffer	6	5	11
2-12	5/22/07	JA/DK	5625 sq ft	Twn rd / res	bare soil; road shoulder erosion; unstable culvert inlet; poor buffer; concentrated flow path of stormwater thu buffer; severe bank erosion	clean out culvert; armor ditch with stone; stabilize banks; install erosion controls		nr	Not rated
2-13	5/22/07	JA/DK		commercial	stockpiled soil, poor bufferexposed commercial activities	install erosion controls, improve buffer, remove stockpiles	6	5	11
3-1	5/4/07	MW, FB, JV	44 sq ft	Town road	road shoulder erosion; bank erosion	stabilize inlet; armour ditch	5	7	12
3-2	5/4/07	mW	3000 sq ft	Agriculture	unstable culvert inlet; livestock; wildlife gathering area; lack of stream shading; buffer not wide enough; poor buffer; bank erosion	stream fencing; establish buffer; extend buffer; plant trees	6	5	11
3-3	5/4/07	mw	1000 sq ft		bare soil	seed abd mulch; plant trees	3	7	10
3-4	5/4/07	mw	120 sq ft		culvert misaligned	re align culvert		3	3
3-5	5/4/07	mw	10000 sq ft	Agriculture	livestock; improper manuer storage; lack of stream shading	stream fencing; establish buffer; extend buffer; plant trees	7	5	12
3-6	5/4/07	mw	1000 sq ft	Town/Private road	road shoulder erosion	extend buffer	3	7	10
3-7	5/4/07	mw		Private road	stream flow; beaver dam at road crossing blocking culvert	beaver dec		nr	Not rated
3-8	5/4/07	mw		Agriculture	lack of stream shading	improve buffer; plant trees	5	5	10
3-9	5/4/07	mw		Agriculture	livestock	improve buffer; plant trees	6	5	11
3-10	5/4/07	mw		stream channel	ditch erosion; culvert misaligned; bank downcutting; bank erosion; excessive build up of sed	reshape shoulder; realign culvert; bank stabilization; restore channel; establish buffer; plant trees	6	3	9
3-11	5/4/07	mw		Town road	road surface erosion	build up road; reshape road	6	3	9

APPENDIX B (continued)

Site #	Date	Surveyor Initials	Area Affected	Land Use	Issues	Reccomendations	Impact Score	Cost Score	Total Score
3-12	5/4/07	mw		State road	road shoulder erosion			nr	Not rated
3-13	5/4/07	mw		Town road	lack of stream shading	improve buffer; plant trees	4	7	11
3-14	5/4/07	mw	10000 sq ft	Residential	lack of stream shading	establish buffer; plant trees	5	5	10
3-15	5/4/07	mw	400 sq ft	Town road	lack of stream shading	plant trees	4	7	11
3-16	5/4/07	mw		Salvage Yard	AIR PHOTO ANALYSIS			nr	Not rated
4-1	5/4/07	KM, TLP	500 sq ft	Residential	Very Green Lawn; lack of stream shading; riprap on streambanks; buffer not wide enough; poor buffer; excessive buildup of sediment from road	Low impact fertilizing; improve buffer; plant trees/shrubs; remove riprap on streambank	6	nr	Not rated
4-2	5/4/07	KM, TLP	480 sq ft	Town road	Road Shoulder; unstable culvert shoulder; excessive buildup of sediment; mild bank erosion; poor repair job of washed out shoulder	Stabilize inlet; reshape shoulder	5	nr	Not rated
4-3	5/4/07	KM, TLP	60 sq ft	Private road	Unstable outlet	Stabilize outlet	4	nr	Not rated
4-4	5/4/07	KM, TLP	360 sq ft	Town/Private road	Road surfafce erosion, road shoulder erosion; unstable outlet	Stabilize outlet; remove plow berm; remove grader berms; reshape shoulder	4	nr	Not rated
4-5	5/4/07	KM, TLP	180 sq ft	State road	road shoulder erosion, unstable culvert outlet	stabilize outlet, reshape shoulder	4	nr	Not rated
4-6	5/4/07	KM, TLP	900 sq ft	State road	road shoulder erosion.	reshape shoulder (already fixed- didn't vegitate shoulder, unsure that is necessary	6	nr	Not rated
5-1	5/4/07	HT, CB	50 sq ft	Town Road	road shoulder erosion, concentrated flow path of stormwater thru buffer; large downstream pool	armour ditch with stone or grass; install turnout; stabilize banks	5	5	10
5-2	5/4/07	HT, CB	500 sq ft	Commercial	Bare soil; road surface erosion; lack of stream shading; severe bank erosion	install turnout; stabilize banks	5	7	12
5-3	5/4/07	HT, CB		Commercial	bare soil; lack of veg; lack of stream shading	stabilize banks (under bridge)	4	7	11
5-4	5/4/07	HT, CB	600 sq ft	Comm / res	Lack of stream shading; streambank failure; bare soil; channel straightened; severe bank erosion; ATV crossing stream	stabilize banks; plant/improve buffer; bank stabilization; plant trees and shrubs	4	7	11
5-5	5/4/07	HT, CB	12,500 sq ft	residential	livestock; improper manuure storage; buffer not wide enough;	extend buffer	3	7	10
5-6	5/4/07	HT, CB	400 sq ft	private road	road shoulder, hanging culvert, pooling downstream	replace culvert?; stablize inlet; install turnout	4	7	11
5-7	5/4/07	HT, CB		Private road	culvert failure	replace culvert.	4	5	9
5-9	5/4/07	HT, CB	750 sq ft	commercial	bare soil; stream bank failure; road surface erosion; lack of stream shading	install turnout; stabilize banks; install erosion controls; plant trees and shrubs	7	5	12
5-10	5/4/07	HT, CB	1250 sq ft	Residential	streambank failure; lack of stream shading; bank failure under 2 large pines that will eventually fall	extent buffer	4	7	11
5-11	5/4/07	HT, CB	400 sq ft	commercial	bare soil; streambank failure; erosion washing into stream from ATV trail	mulch and rock ATV trail	5	7	12
5-12	5/4/07	HT, CB	1500 sq ft	Commercial	bare soil; streambank failure; road surface erosion	stabilize banks; plant trees and shrubs; seed and mulch; redirect ATV trail; mulch and rock ATV stream crossing	6	5	11
5-13	5/4/07	HT, CB	1500 sq ft	commercial	bare soil; lack of stream shading; ATV bridge crossing	plant trees and shrubs; plant low grow shrubs due to pole line; stabilize ATV crossing	4	7	11
5-14	5/4/07	HT, CB	25,000 sq ft	commercial	road surface erosion; lack of stream shading; riprap on streambanks; flood plain washing away bend/point	plant trees/shrubs	5	7	12
5-15	5/4/07	HT, CB			invasive species abundant; bamboo along crossing			nr	Not rated
5-16	5/4/07	HT, CB	375 sq ft	Residential	bare soil; streambank failure(slight); road washed down to what was once a stream crossing	plant trees/shrubs; seed and mulch; install berm along road to block water and sed from entering stream.	5	7	12
5-17	5/4/07	HT, CB	250 sq ft	Residential	road shoulder erosion; culvert for small incoming tributary plugged one end; road washing away at culvert	replace culvert; stabilize inlet	5	5	10
5-18	5/4/07	HT, CB		Residential	bare soil; streambank failure; road surface erosion; stream crossing; trees from last storm are now blocking crossing	plant trees; seed and mulch; creat bridge is road still used	6	5	11
5-19	5/4/07	HT, CB	450 sq ft	Residential	bare soil; road surface erosion; unstable culvert inlet; culvert no longer functioning(burried); trib washing over road	replace culvert; install stone fjord if road still lightly use roather than replace expensice culvert	3	5	8
5-20	5/4/07	HT, CB	1500 sq ft	commercial	lack of stream shading; channel straightened	plant trees/shrubs	3	7	10
6-1	5/4/07	SP	280 ft	Town road	road shoulder erosion; unstable culvert inlet; livestock bedding disposal; improper maure storage; bank downcutting; bank erosion; winter sand pile	replace culvert; stabilizee inlet; armour ditch with stone; remove merms; reshape shoulder; ag waste management; bank stablilization	5	5	10
6-2	5/4/07	WB	260 ft	Private road	Road surface erosion; road shoulder erosion; excessive build up of sed	cleanout/enlarge culvert; replace/legnthen culvert; stabilize inlet; armour ditch with stone; reshape/stabilize ditch; buildup road; reshape road	4	3	7
6-3	5/4/07	WB	215 ft	Private road	road surface erosion; road shoulder erosion; unstable culvert inlet; excessive buildup of sed	cleanout/enlarge culvert; replace/legnthen culvert; stabilize inlet; armour ditch with stone; reshape/stabilize ditch	3	3	6
6-4	5/4/07	WB		Town road	bare soil; streambank failure; lack of stream shading; buffer not wide enough; channel widened; bank undercutting	stablilize banks; extend buffer; plant trees/shrubs	4	5	9
6-5	5/4/07	WB		Town road	bare soil; buffer not wide enough; poor buffer; hanging culvert; bank undercutting; excessive buildup of sed; fish present	stablilize outlet; reset culvert; plant buffer; bank stabilization; establish buffer; plant trees/shrubs	4	3	7

APPENDIX B (continued)

Site #	Date	Surveyor Initials	Area Affected	Land Use	Issues	Reccomendations	Impact Score	Cost Score	Total Score
6-6	5/4/07	WB		Town road	unstable culvert inlet; buildup of sed	install plunge pool; lengthen culvert; stabilize outlet	3	3	6
6-7	5/4/07	WB		Town road	bare soil; streambank failure; road shoulder erosion; unstable culvert inlet; buffer not wide enough; poor buffer; invasive knot weed abundant; hanging culvert; bank downcutting; severe bank erosion; excessive sed buildup; fish abound	stabilize inlet; stabilize banks; reset culvert; reshape shoulder; bank stabilization; extend buffer; plant trees/shrubs	6	3	9
6-8	5/4/07	WB		Town road	road shoulder erosion; unstable culvert inlet;.	replace/lengthen culvert; stabilize inlet; reshape shoulder	3	5	8
6-9	5/4/07	WB	75 ft	town road	road shoulder erosion; unstable culvert inlet; invasive knotweed present;	stabilize inlet; install ditch; reshape shoulder	3	5	8
6-10	5/4/07	WB		Town road	ditch erosion; bank erosion; unstable ditch	stablilize banks; reshape shoulder; pant trees/shrubvs	4	5	9
6-11	5/4/07	WB	75 ft	Town road	road shoulder erosion; excessive sed buildup	armour ditch with stone; install ditch; reshape shoulder	5	5	10
6-12	5/4/07	WB		Construction Site	bare soil; unstable con site	install erosion controls	5	7	12
6-13	5/4/07	WB	1500 ft	Private road	road surface erosion; road shoulder erosion; unstable culvert inlet; excessive buildup of sed	replace culvert; stabilize inlet; armour ditch with stone; reshape ditch; build up road; reshape shoulder; reshape road; pave; install runoff diverter	4	3	7
6-14	5/4/07	WB	50 ft	Town road	road shoulder; unstable culvert inlet; buffer not wide enough; knot weed present; hanging culvert	replace/lengthen culvert; stabilize inlet; armour ditch with stone; reshape ditch; reset culvert; reshape shoulder; plant buffer; plant trees	5	3	8
6-15	5/4/07	WB	100 ft	Private road	road surface erosion; road shoulder erosion; unstable culvert; hanging culvert	replace culvert; stabilize inlet; build up road; remove grader berms; re shape shoulder; reshape road; plant trees	5	3	8
6-16	5/4/07	WB	50 ft	Private road	road surface erosion; road shoulder erosio; unstable culvert inlet; excessive sed buildup	enlarge culvert/replace, stabilize inlet; build up road, remove grader berms, reshape road/shoulder	4	3	7

APPENDIX C: Common Storm Water Runoff Pollutant Sources[1]

Contaminant	Contaminant Sources
Sediment and Floatables	Streets, lawns, driveways, roads, construction activities, atmospheric deposition, drainage channel erosion
Pesticides and Herbicides	Residential lawns and gardens, roadsides, utility right-of-ways, commercial and industrial landscaped areas, soil wash-off
Organic Materials	Residential lawns and gardens, commercial landscaping, animal wastes
Metals	Automobiles, bridges, atmospheric deposition, industrial areas, soil erosion, corroding metal surfaces, combustion processes
Oil and Grease/ Hydrocarbons	Roads, driveways, parking lots, vehicle maintenance areas, gas stations, illicit dumping to storm drains
Bacteria and Viruses	Lawns, roads, leaky sanitary sewer lines, sanitary sewer cross-connections, animal waste, septic systems
Nitrogen and Phosphorus	Lawn fertilizers, atmospheric deposition, automobile exhaust, soil erosion, animal waste, detergents

1. Preliminary Data Summary of Urban Storm Water Best Management Practices. EPA, 1999.