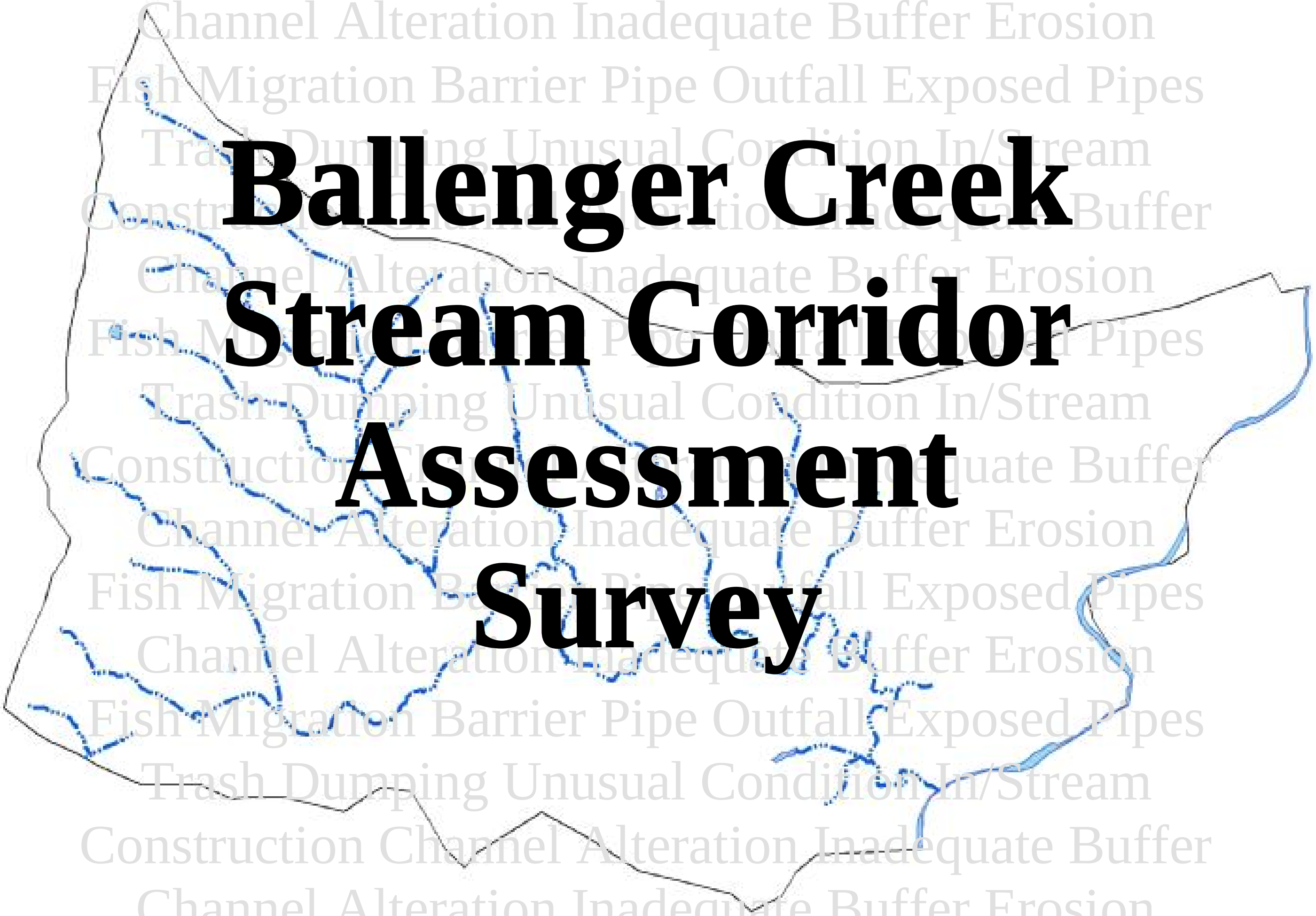

Ballenger Creek Stream Corridor Assessment Survey

Watershed Assessment and Targeting Division
Watershed Services
Maryland Department of Natural Resources
June 2005

Robert L. Ehrlich, Jr.
Governor

Michael S. Steele
Lieutenant Governor

A Message To Maryland Citizens

The Maryland Department of Natural Resources (DNR) seeks to preserve, protect and enhance the living resources of the state. Working in partnership with the citizens of Maryland, this worthwhile goal will become a reality. This publication provides information that will increase your understanding of how DNR strives to reach that goal through its many diverse programs.

C. Ronald Franks
Secretary

Maryland Department of Natural Resources
Tawes State Office Building
580 Taylor Avenue
Annapolis, Maryland 21401

Toll free in Maryland: 1-(877) 620-8DNR (ext. 8796)
Out of state call: 410-260-8796
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BALLENGER CREEK
STREAM CORRIDOR ASSESEMENT SURVEY
Frederick County, Maryland

PREPARED BY
Jessica Hunicke & Kenneth T. Yetman

WATERSHED SERVICES UNIT
TECHNICAL AND PLANNING SERVICES
MARYLAND DEPARTMENT OF NATURAL RESOURCES
ANNAPOLIS, MARYLAND

FOR

FREDERICK COUNTY DIVISION OF PUBLIC WORKS
DEPARTMENT OF PROGRAM DEVELOPMENT AND MANAGEMENT
NATIONAL POLLUTANT DISCHARGE ELLIMINATION SYSTEM
FREDERICK, MARYLAND

2005

SUMMARY

The Ballenger Creek watershed is located in the Lower Monocacy watershed in Frederick County, Maryland. According to Table 7-12 from the 2003 Frederick County Annual Report for NPDES Storm Sewer System Permit # MD0068357, the Ballenger Creek watershed encompasses approximately 13,958 acres. The Frederick County Division of Public Works hired the Maryland Department of Natural Resources to complete a Stream Corridor Assessment (SCA) survey of the stream network within the watershed. This assessment is necessary to complete the required tasks under the County's National Pollutant Discharge Elimination System (NPDES) storm sewer system permit under the Clean Water Act. The results of this survey will be used by Frederick County DPW to determine problem areas that could be fixed through community restoration projects, stormwater management (SWM) facility retrofits, and to reduce untreated impervious urban areas by 10 percent. The County plans to use the data to target areas where more involved stream restoration and stormwater management facility retrofit assessments are required.

Standing alone, the SCA survey is not a detailed scientific evaluation of the watershed. Instead, the SCA survey is designed to provide a rapid overview of the entire stream network to determine the location of potential environmental problems and to collect some basic habitat information about its streams. The value of the present survey is its help in placing individual stream problems into their watershed context and its potential use among resource managers and land-use planners to cooperatively and consistently prioritize future restoration work.

The Stream Corridor Assessment fieldwork consisted of walking approximately 32.93 miles of stream, the majority of the mapped stream miles in Ballenger Creek. Fieldwork was completed in March 2004. The County sent out letters to landowners with stream frontage property describing the process and requesting permission to walk their land. The landowners were asked to return an enclosed postcard indicating if they granted permission for our teams to walk the streams through their property. Based on landowner response, survey teams did not have access to all streams.

Survey teams identified 192 potential environmental problems within the Ballenger Creek watershed. At the time of the survey, the most frequently observed environmental problem was pipe outfalls, reported at 50 sites. Other potential environmental problems recorded during the survey include: 42 inadequately forested buffers, 38 fish passage barriers, 34 erosion sites, 10 unusual conditions, 8 channel alterations, 6 trash dumping sites, 4 exposed pipes, and no in or near-stream construction sites. Additionally, the survey recorded descriptive information for 27 representative sites and 3 comment sites.

In order to document each potential environmental problem, survey teams collected data, recorded the location, and took a photograph at each of these sites. As an aid to prioritizing future restoration work, field crews rated all problem sites on a scale of 1 to 5 in three categories: 1) how severe the problem is compared to others in its category; 2) how correctable the specific problem is using current restoration techniques; and 3) how

accessible the site is for work crews and any necessary machinery. In addition, field teams collected descriptive information of both in- and near-stream habitat conditions at representative sites spaced at approximately ½- to 1-mile intervals along the stream.

The Maryland Department of Natural Resources (DNR) Watershed Services Unit developed the Stream Corridor Assessment Survey (SCA) as a watershed management tool. All of the problems identified as part of the SCA survey can be addressed through existing State or Local government programs. One of the main goals of the SCA survey is to compile a list of observable environmental problems in a watershed in order to target future restoration efforts. Once this list is compiled and distributed, county planners, resource managers, and others can initiate a dialog to cooperatively set the direction and goals for the watershed's management and plan future restoration work at the most effective problem sites.

ACKNOWLEDGMENTS

Without the hard work and dedication of the National Civilian Community Corps, this survey would not have been possible. The crew chief during the survey was Stefanie Warner. The crewmembers were Sara Lander, Meuy Saechao, Nisa Karimi, Ali Nguyen, Micah Coach, Adam Malgren, Neal Schmidt, Emily "Danger" Scott-Texler, Dana Siebers, and Laura Hale.

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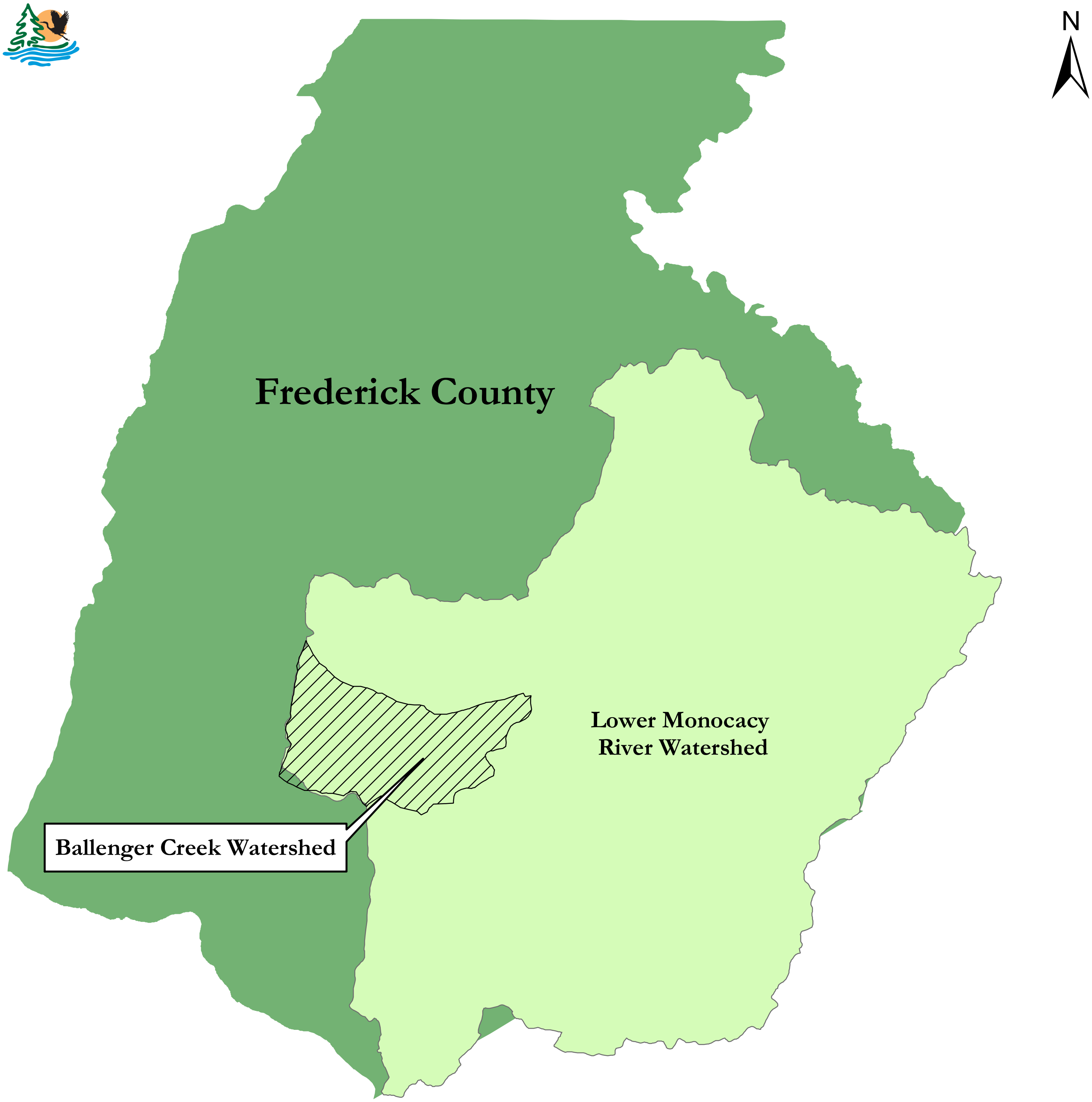
INTRODUCTION

The Ballenger Creek watershed is located within the Lower Monocacy watershed, an 8-digit watershed located in Frederick County, Maryland. The Frederick County Division of Public Works hired the Maryland Department of Natural Resources (DNR) to determine potential sites for stream restoration or stormwater management (SWM) facility retrofits. This assessment is required by the County's National Pollutant Discharge Elimination System (NPDES) storm sewer system permit under the Clean Water Act.

To provide specific information on the location of environmental problems and restoration opportunities within the watershed, teams performed a Stream Corridor Assessment (SCA) survey of Ballenger Creek in March 2004. Developed by DNR's Watershed Services Unit, the Stream Corridor Assessment survey is a watershed management tool used to identify environmental problems and help prioritize restoration opportunities on a watershed basis. As part of the survey, specially trained personnel walk the watershed's stream network and record information on a variety of environmental problems that can be easily observed within the stream corridor.

The Ballenger Creek watershed encompasses 13,958 acres (21.81 mi^2) of land and has 36.49 miles of stream. However, approximately 3.56 miles of stream were not walked because of a lack of landowner permission. The watershed lies within the Lower Monocacy watershed and is approximately centered in the county. Of the land area surveyed, 42.6 percent is categorized as urban with the total impervious area equaling 2,752 acres or 19.7 percent of the watershed. Of the urban impervious area (2,605 acres), 804 acres have untreated stormwater (5.8 %). Figure 1 shows the geographic location of the watershed targeted in this survey. Figure 2 shows the Ballenger Creek watershed stream network. The 2002 land use of the Ballenger Creek watershed in Frederick County is shown in Figure 3.



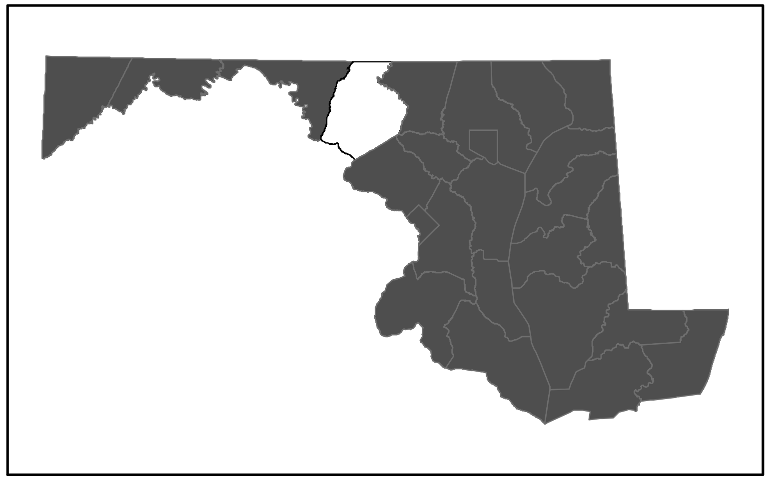
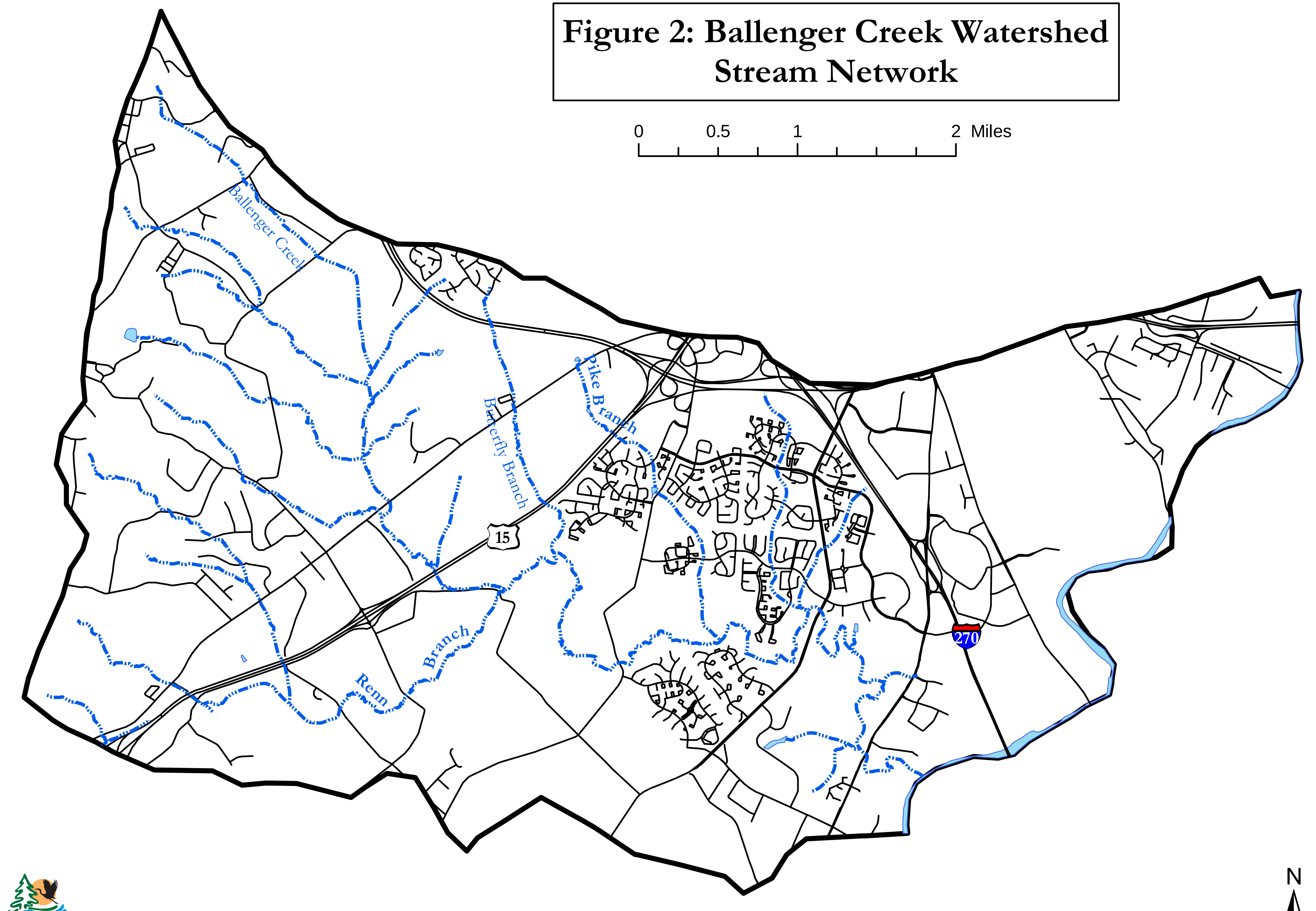


Figure 1:
Ballenger Creek Watershed
Frederick County, Maryland

Figure 2: Ballenger Creek Watershed Stream Network



Roads, Streams, and River and Lakes shapefiles provided by Frederick County DPW GIS

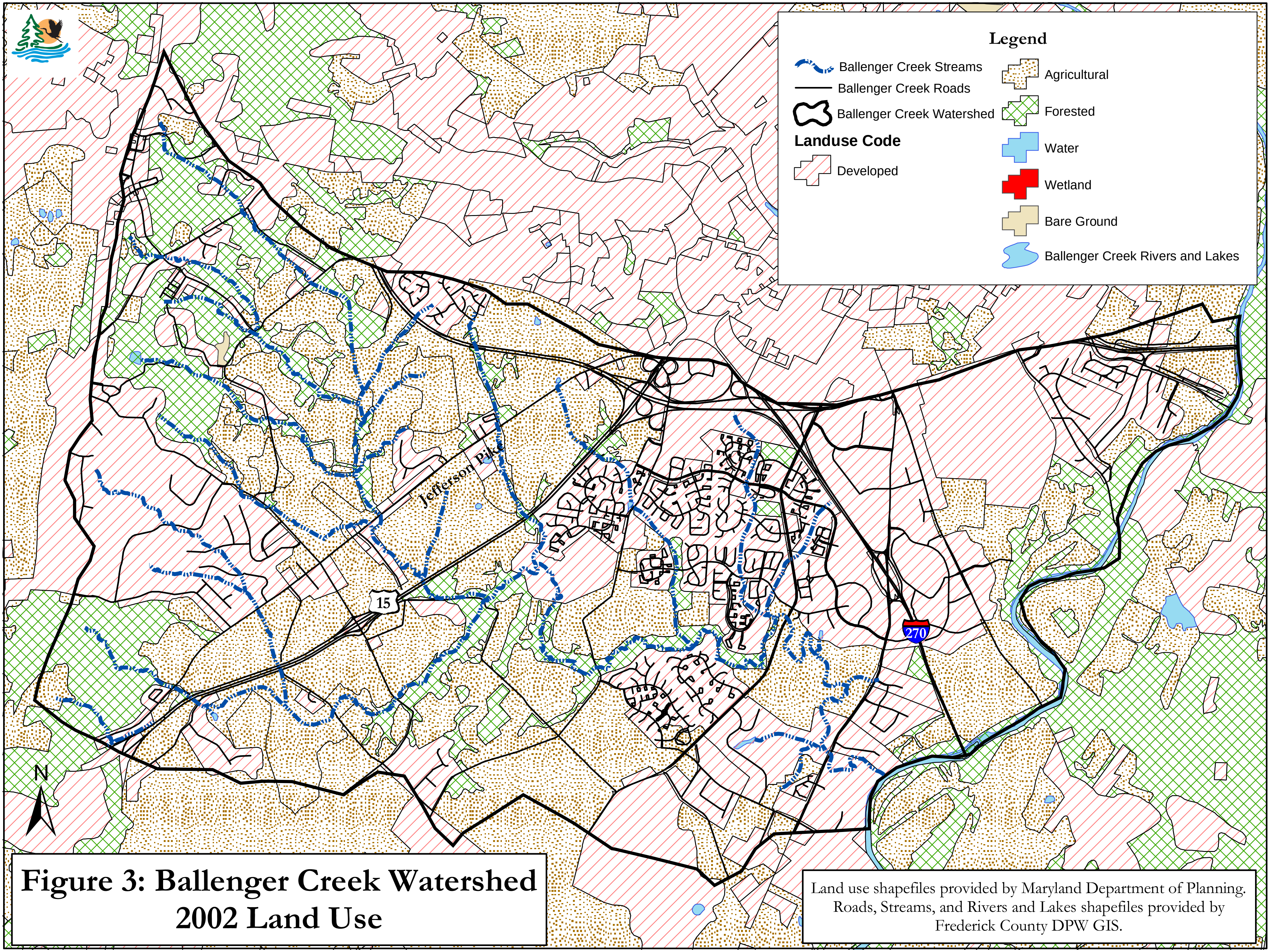


Figure 3: Ballenger Creek Watershed 2002 Land Use

Land use shapefiles provided by Maryland Department of Planning. Roads, Streams, and Rivers and Lakes shapefiles provided by Frederick County DPW GIS.

METHODS

Goals of the SCA Survey

To help identify some of the common problems that affect streams in a rapid and cost effective manner, the Watershed Services Unit of the Maryland Department of Natural Resources developed the Stream Corridor Assessment (SCA) survey. The four main objectives of the survey are to provide:

1. A list of observable environmental problems present within a stream system and along its riparian corridor.

2. Sufficient data on each problem in order to make a preliminary determination of both the severity and correctibility of each problem.

3. Sufficient data to prioritize restoration efforts.

4. A quick assessment of both in- and near-stream habitat conditions to make comparisons among the conditions of different stream segments.

The SCA survey provides a rapid method of examining and cataloguing the observable environmental problems within an entire drainage network to better target future monitoring, management and/or conservation efforts. This survey is not a detailed scientific survey, nor will it replace chemical and biological surveys in determining overall stream conditions and health. One advantage of the SCA survey over chemical and biological surveys is that the SCA survey can be done on a watershed basis both quickly and at relatively low cost.

Maryland's SCA survey is both a refinement and systematization of an old approach – the stream walk survey. Many of the common environmental problems affecting streams can be straightforward to identify by an individual walking along a stream. These include: excessive stream bank erosion, blockages to fish passage, stream segments without trees along their banks, or a sewage pipeline exposed by stream bank erosion leaking sewage into the stream. With a limited amount of training, most people can correctly identify these common environmental problems.

Over the years, many groups standardized a stream walk survey approach for their particular purpose or interest. Many earlier approaches, such as EPA's, "Streamwalk Manual" (EPA, 1992), Maryland Save our Stream's "Conducting a Stream Survey," (SOS, 1970) and Maryland Public Interest Research Foundation "Streamwalk Manual" (Hosmer, 1988), focused on utilizing citizen volunteers with little or no training. While these surveys can be a good guide for citizens interested in seeing their community's streams, the data collected during these surveys can vary significantly based on the background of the surveyor. In the Maryland Save our Stream "Stream Survey," for example, training for citizen groups includes giving guidance on how to organize a survey and a slide show explaining how to complete the field work. After approximately one hour of training, citizen volunteers are sent out in groups to walk designated stream segments. During the survey, volunteers usually walk their assigned stream segment in under a few hours and return their data sheets to the survey organizers for analysis. While these surveys can help make communities more aware of the problems present in their local stream, citizen groups normally do not have the expertise or resources to properly analyze or fully interpret the collected information. In addition, the data collected from these surveys often only indicates that a potential environmental problem exists at a specific location, but it does not provide sufficient information to judge the severity of the problem.

Other visual stream surveys, such as the National Resources Conservation Service's "Stream Visual Assessment Protocols" (NRCS, 1998), are designed for use by trained professionals analyzing a very specific stream reach type, such as at a stream passing through an individual farmer's property. While this survey can provide useful information on a specific stream segment, it is usually not carried out on a watershed basis.

The Maryland SCA survey bridges the gap between these two approaches. The survey is designed to be completed by a small group of well-trained individuals who walk the entire stream network in a watershed. While those working on the survey are usually not professional natural resource managers, they do receive several days of training in both stream ecology and SCA survey methods.

Field Training and Procedure

While almost any group of dedicated volunteers can be trained to do a SCA survey, the National Civilian Community Corps (NCCC) has proven to be an ideal group to do this work in Maryland. The National Civilian Community Corps is part of the AmeriCorps Program, initiated to promote greater involvement of young volunteers in their communities and the environment. Volunteers with the NCCC are 17-25 years old and can have educational backgrounds ranging from high school to graduate degrees. With the proper training and supervision, NCCC volunteers are able to significantly contribute to the State's efforts to inventory and evaluate water quality and habitat problems from a watershed perspective. For more information on the National Civilian Community Corps visit their website at http://www.americorps.org/nccc/index.html.

Prior to the start of the Ballenger Creek SCA Survey, the members of the NCCC's Perry Point Crew received training in assessing both environmental problem sites and habitat conditions in and along Maryland streams. For problem sites, crewmembers learned how to identify common problems observable within the stream corridor, record problem locations on survey maps, and accurately complete data sheets for each specific problem type. For habitat conditions, the crew learned and practiced assessing stream health based on established criteria indicating both favorable conditions for macroinvertebrates and fish and healthy riparian habitat. These reference sites for habitat condition are located at approximately 1/2- to 1-mile intervals along the stream. In addition, the field crew reviewed a standard procedure for assigning site numbers based on the 4-digit map number, 1-digit team number, and 2-digit problem number for each problem and reference site during the survey. Lastly, in order to have a visual record of existing conditions at the time of the SCA survey, the NCCC Crew received guidelines for taking photographs at all problem and reference sites.

Several weeks prior to the beginning of the survey, property owners along the stream reach received letters informing them of what the survey is and when it is scheduled to be completed. Included with the letter is a postcard for the landowner to return giving permission for our crews to enter their property. This letter also provided a phone number to call if individuals had any questions regarding the stream walk. In addition, survey crews were not to cross fence lines or enter any areas that were marked "No Trespassing" unless they had specific permission from the property owner, based on conditions set forth by the State Annotated Code.

The NCCC crew conducted field surveys of the Ballenger Creek Watershed from March to April 2004. The survey teams walked a part of the watershed's drainage network, collecting information on potential environmental problems. Those commonly identified during the SCA Survey include: inadequate stream buffers, excessive bank erosion, channelized stream sections, fish passage blockages, in or near stream construction, trash dumping sites, unusual conditions, and pipe outfalls. In addition, the survey recorded information on the general condition of in-stream and riparian habitats and the location of potential wetland creation sites.

More detailed information on the procedures used in the Maryland SCA survey can be found in, "Stream Corridor Assessment Survey – Survey Protocols" (Yetman, 2001). A copy of the survey protocols can found on DNR's web site at http://www.dnr.maryland.gov/streams/pubs/other.html. Hard copies of the protocols also can be obtained by contacting the Watershed Services Unit of the Maryland Department of Natural Resources, Annapolis, MD.

Overall Rating System

The SCA survey field crews evaluate and score all problems on a scale of 1 to 5 in three separate areas: problem severity, correctibility, and accessibility. A major part of the crew's training on survey methods is devoted to properly rating the different problems identified during the survey. This rating system developed from an earlier survey that found 453 potential environmental problems along 96 miles of stream of the Swan Creek Watershed in Harford County. The most frequently reported problem during the survey was stream bank erosion, reported at 179 different locations (Yetman et. al., 1996). Follow-up surveys found that while stream bank erosion was a common problem throughout the watershed, the severity of the erosion problem varied substantially among the sites and that the erosion problems at many sites were minor in severity. Based on this experience and its goal of helping to prioritize restoration work, the SCA survey rates the severity, correctibility, and access of each problem site.

While the ratings are subjective, they have proven to be very valuable in providing a starting point for more detailed follow-up evaluations. Once the SCA survey is completed, the collected data can be used by different resource professionals to help target future restoration efforts. A regional forester, for example, can use data collected on inadequate stream buffers to help plan future riparian buffer plantings, while the local fishery biologist can use the data on fish blockages to help target future fish passage projects. The inclusion of a rating system in the survey gives resource professional an idea of which sites the field crew believed were the most severe, easiest to correct and easiest to access. This information combined with photographs of the site can help resource managers focus their own follow up evaluations and fieldwork at the most important sites.

A general description of the rating system is given below. More specific information on the criteria used to rate each problem category is provided in the SCA – Survey Protocols (Yetman, 2000). It is important to note that the rating system is designed to contrast problems within a specific problem category and is not intended to be applied across categories. When assigning a severity rating to a site with an inadequate stream buffer for example, the rating is only intended to compare the site to others in the watershed with inadequate stream buffers. A trash dumping site with a very severe rating may not necessarily be a more significant environmental problem than a stream bank erosion site that received a moderate severity rating.

The severity rating indicates how bad a specific problem is relative to others in the same problem category. It is often the most useful rating because it answers questions such as: where are the worst stream bank erosion sites in the watershed, or where is the largest section of stream with an inadequate buffer? The scoring is based on the overall impression of the survey team of the severity of the problem at the time of the survey, based on the established criteria for each problem category (Yetman, 2000).

- A <u>very severe rating</u> of 1 is used to identify problems that have a direct and wide reaching impact on the stream's aquatic resources. Within a specific problem category, a very severe rating indicates that the problem is among the worst that the field teams have seen or would expect to see. Examples include a discharge from a pipe that was discoloring the water over a long stream reach (greater than 1000 feet) or a long section of stream (greater than 1000 feet) with high raw vertical banks that are unstable and eroding at a rapid rate.

- A <u>moderate severity rating</u> of 3 identifies problems that have some adverse environmental impacts but the severity and/or length of affected stream is fairly limited. While a moderate severity rating would indicate that field crews did believe it was a significant problem, it also indicates that they have seen or would expect to see worse problems in the specific problem category. Examples include: a small fish blockage that is passable by strong swimming fish like trout, but a barrier to resident species such as sculpins or a site where several hundred feet of stream has an inadequate forest buffer.

- A <u>minor severity rating</u> of 5 identifies problems that do not have a significant impact on stream and aquatic resources. A minor rating indicates that a problem is present, but compared to other problems in the same category it is considered minor. One example of a site with a minor rating is a pipe outfall from a storm water management structure that is not discharging during dry weather and does not have an erosion problem at the outfall or immediately downstream. Another example is a section of stream with stable banks that has a partial forest buffer less than 50 feet wide along both banks.

The correctibility rating provides a relative measure on how easily the field teams believe the problem can be corrected. The correctibility rating can be helpful in determining which problems can be easily dealt with when developing a restoration plan for a drainage basin. One restoration strategy, for example, would initially target the severest problems that are the easiest to fix. The correctibility rating also can be useful in identifying simple projects that can be done by volunteers, as opposed to projects that require more significant planning and engineering efforts to complete.

- A minor correctibility rating of 1 indicates problems that can be corrected quickly and easily using hand labor, with a minimal amount of planning. These types of projects would usually not need any Federal, State or local government permits. It is a job that a small group of volunteers (10 people or less) could fix in a day or two without using heavy equipment. Examples include removing debris from a blocked culvert pipe, removing less than two pickup truck loads of trash from an easily accessible area or planting trees along a short stretch of stream.

- A moderate correctibility rating of 3 indicates sites that may require a small piece of equipment, such as a backhoe, and some planning to correct the problem. This would not be the type of project that volunteers would usually do alone, although volunteers could assist in some aspects of the project, such as final landscaping. This type of project would usually require a week or more to complete. The project may require some local, State or Federal government notification or permits. However, environmental disturbance would be small and approval should be easy to obtain.

- A very difficult correctibility rating of 5 indicates problems that would require a large expensive effort to correct. These projects would usually require heavy equipment, significant amount of funding ($100,000 or more), and construction could take a month or more. The amount of disturbance would be large and the project would need to obtain a variety of Federal, State and/or local permits. Examples include a potential restoration area where the stream has deeply incised several feet over a long distance (i.e., several thousand feet) or a fish blockage at a large dam.

The accessibility rating provides a relative measure of how difficult it is to reach a specific problem site. The rating is made at the site by the field survey team, using a survey map and field observations. While factors such as land ownership and surrounding land use can enter into the field judgments of accessibility, the rating assumes that access to the site could be obtained if requested from the property owner.

- A very easy accessibility rating of 1 indicates sites that are readily accessible both by car and on foot. Examples include a problem in an open area inside a public park where there is sufficient room to park safely near the site.

- A moderate accessibility rating of 3 indicates sites that are easily accessible by foot but not easily accessible by a vehicle. Examples would include a stream section that can be reached by crossing a large field or a site that is accessible only by 4-wheel drive vehicles.

- A very difficult accessibility rating of 5 is assigned to sites that are difficult to reach both on foot and by a vehicle. To reach the site it would be necessary to hike at least a mile, and if equipment were needed to do the restoration work, an access road would need to be built through rough terrain. Examples include a site where there are no roads or trails nearby.

Data Analysis and Presentation

Following the completion of the survey, crews entered information from the field data sheets into a Microsoft Access database and verified the accuracy of the data. Field crews labeled and organized the 277 photographs taken during the survey by site number and placed them in folders in both print and digital form. Members of the Department of Natural Resources' Watershed Services Unit incorporated the map location, recorded data, and digitized photographs into the ArcView GIS computer software. The GIS project is a geographic database that integrates all the collected problem locations and descriptive data by site number, links photographs to each potential problem site, and produces the maps presented in this report. This data can then be used alongside other digital geographic datasets available for features within the watershed. A final copy of the ArcView files are given to the Frederick County Division of Public Works for their use in determining potential sites for stream restoration or stormwater management (SWM) facility retrofits.

RESULTS

The Stream Corridor Assessment identified a total of 192 problem sites, 27 representative sites and 3 comments in the Ballenger Creek watershed. Problem sites include: 50 pipe outfalls, 42 inadequately forested buffers, 38 fish passage barriers, 34 erosion sites, 10 unusual conditions, 8 channel alterations, 6 trash dumping sites, and 4 exposed pipes. Table 1 presents a summary of survey results and Appendices A and B list the data collected during the survey. Appendix A provides a listing of information by site number and location, referenced by northing and easting coordinates. When working with maps, information in this format is useful to determine what problems are present along a specific stream reach. In Appendix B, the data is presented by problem type and lists more detailed descriptive data about each problem. Presenting the data by problem type allows the reader to see which problems the field crews rated as most severe or easiest to correct within each category and gives other details about the problem or surrounding area.

Table 1: Summary of results from Ballenger Creek SCA Survey

Identified Problem	Number of Sites	Total Estimated Length	Very Severe	Severe	Moderate	Low Severity	Minor
Channel Alterations	8	N/A	0	1	4	1	2
Inadequate Buffers	42	Left bank: 96,796 feet (18.33 miles) Right bank: 87,036 feet (16.48 miles)	10	9	9	5	9
Trash Dumping	6	N/A	0	1	2	1	2
Erosion Site	34	73,387 feet (13.9 miles)	1	6	14	11	2
Exposed Pipe	4	N/A	0	0	2	2	0
Fish Barrier	38	N/A	0	5	13	10	10
Pipe Outfalls	50	N/A	0	1	6	19	24
Unusual Condition	10	N/A	1	2	2	4	1
Total	**192**		**12**	**25**	**52**	**53**	**50**
Representative Sites	27						
Comments	3						

Pipe Outfalls

Pipe outfalls include any pipes or small, constructed channels that discharge into the stream through the stream corridor. Pipe outfalls are considered a potential environmental problem in the survey because they can carry uncontrolled runoff and pollutants such as oil, heavy metals and nutrients to a stream system. The survey crew identified a total of 50 pipe outfalls with varying severity ratings (Figure 4a). The locations of pipe outfalls are shown in Figures 4b, 4c, and 4d.

Fifty-two percent, or 26 of the 50, pipe outfalls observed during the survey were recorded as having a discharge. Of these, twenty-five had a clear discharge with no odor associated with it at the time of the survey (Appendix B). Site 1104104 was recorded as having an orange discharge but no odor. All but six of the pipe outfalls were marked as stormwater pipes. Those that were not marked as stormwater were either for an unknown use (0708305, 0905203, 0905204, 1103401, 1104104) or were marked as other (0906404). In these cases, it is recommended that further investigation is performed to determine the type of outfall. It is also recommended that the pipe with an orange discharge be reported to the Environmental Compliance Section for further investigation of the source of discharge.

No immediate follow up actions were taken by the survey crew as part of this study to determine the source of the color or smell coming from the pipe. In some cases, coloration or smell from a storm drainpipe may be a sporadic occurrence. No estimates of the amount of fluid released from the pipes were made.

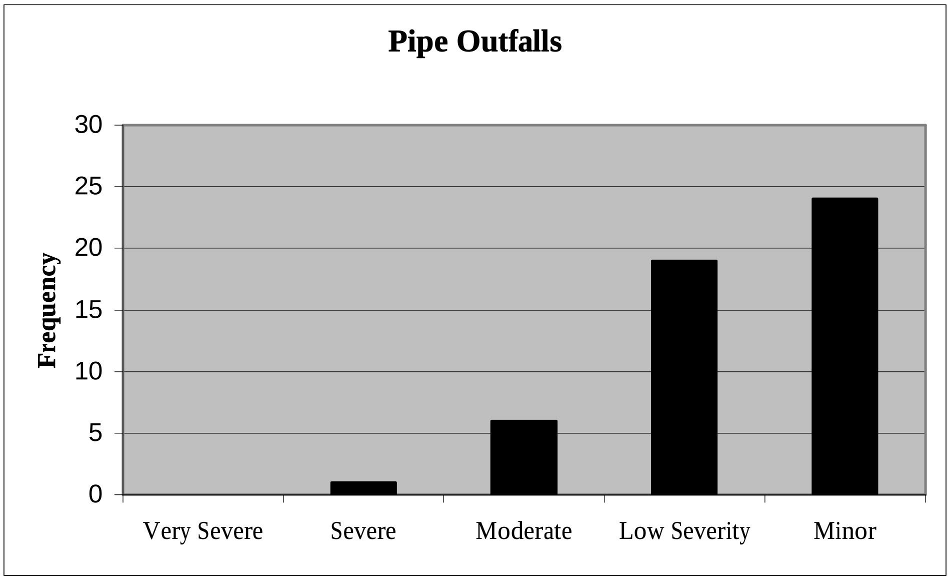
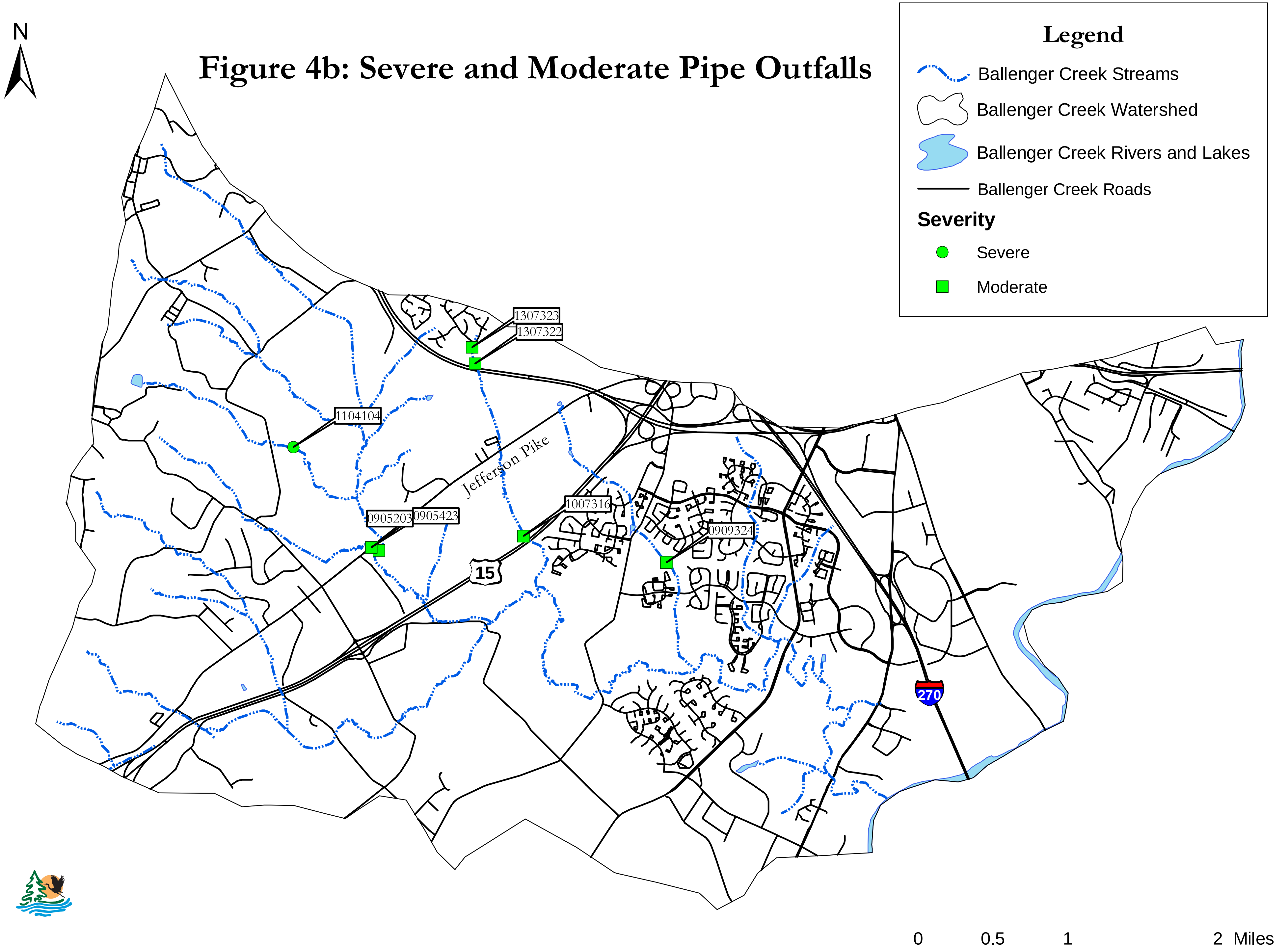


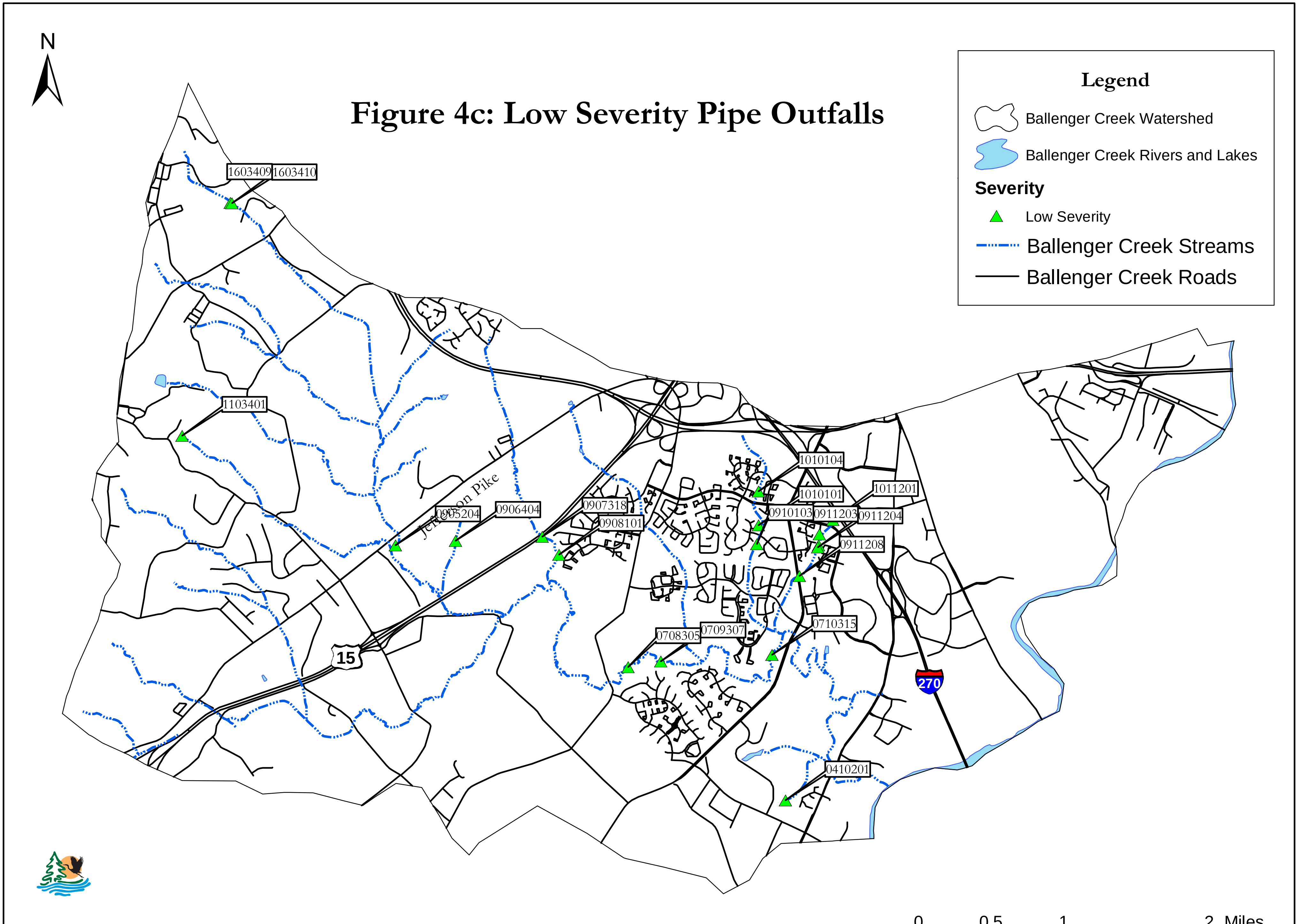
Figure 4a: Histograph showing the frequency of severity ratings given to pipe outfall sites during the Ballenger Creek SCA survey

Figure 4b: Severe and Moderate Pipe Outfalls



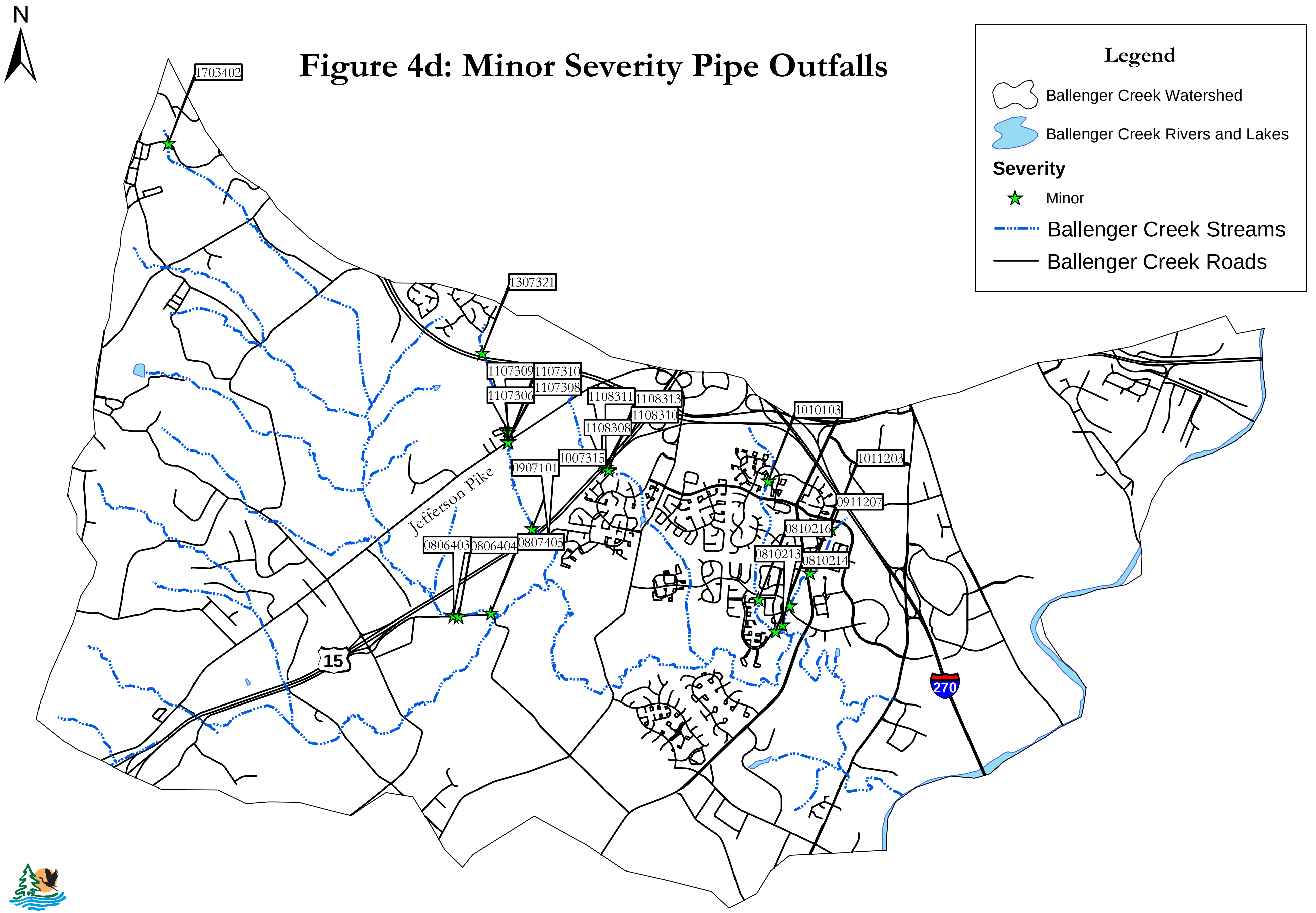
Stream, Roads and Rivers and Lakes layers provided by Frederick County DPW GIS

Figure 4c: Low Severity Pipe Outfalls



Stream, Roads and Rivers and Lakes layers provided by Frederick County DPW GIS

Figure 4d: Minor Severity Pipe Outfalls



Stream, Roads and Rivers and Lakes layers provided by Frederick County DPW GIS

Inadequate Buffers

Forests are the historically occurring ecosystem around Maryland streams and are very important for maintaining stream health. Forested buffer areas along streams play a crucial role in increasing water quality, stabilizing stream banks, trapping sediment, mitigating floods, and providing the required habitat for all types of stream life, including fish. Tree roots capture and remove pollutants and excess nutrients from shallow flowing water, and their structure helps prevent erosion and slows water flow, reducing sediment load and the risk of flooding. Shading from the tree canopy provides the cooler water temperatures necessary for most stream life, especially cold-water species like trout. In smaller streams, terrestrial plant material falling into the stream can be the primary source of plant food for stream life. Tree leaves provide seasonal, instant food for stream life, while fallen tree branches and trunks provide a more consistent, slow-release food source throughout the year. Tree roots and snags also provide necessary fish and benthic habitat. Maintaining healthy streams is important in reducing the nutrient and sediment loadings to the Chesapeake Bay. Because of the importance of forest stream buffers, the state of Maryland has set a goal of restoring 1,200 miles of forest stream buffers by the year 2010.

While there is no single minimum standard for how wide a stream buffer should be in Maryland, for the purposes of this study a buffer is considered inadequate if it is less than 50 feet wide, measured from the edge of the stream. The severity of inadequate buffers is based on both the length and width of the site. Those sites over 1,000 feet long with no forest on either side of the stream rank as the most severe.

The survey crew identified 42 inadequate buffers sites (Figure 5b) and provided an estimate of the length of the inadequate stream buffer at all sites (Appendix B). Based on the collected data, there are approximately 96,796 feet (18.33 miles) of inadequate buffers on the left bank and 87,036 feet (16.48 miles) on the right bank of the streams (Table 2). Field teams found inadequate buffers ranging in distance from 65 feet to 7,987 feet (1.51 miles). Severity ratings varied from very severe to minor with the greatest number of sites being ranked as very severe (Figure 5a). Inadequate buffer sites are distributed throughout the watershed, with approximately 50.23 percent of the left bank and 47.34 percent of the right bank inadequately buffered.

Of those sites ranked as very severe, six of the ten sites have zero feet of buffer on both the left and right stream banks. The land uses noted for the very severe sites on the left bank are: 6 pasture, 2 crop field, 1 shrubs and small trees, and 1 lawn. On the right bank, the land uses are as follows: 3 pasture, 2 crop field, 2 shrubs and small trees, 1 lawn, 1 forest, and 1 subdivision. Two sites were noted as having recently established buffers: 0810210 and 0608101.

As survey crews evaluate buffer sites, they are asked to consider wetland potential and livestock access to the stream. In the case of wetland potential, the rating is based on slope, bank height, and current conditions. A rating of one is given to a site that has low slope, low bank height, and might already be an area with saturated soils. The crews gave only 6 of the 42 sites a rating of one indicating good wetland potential (0606101, 0710317, 0810210, 0810212, 0810215, 1703401). It is recommended that these sites be further investigated for the potential of wetland restoration projects. In the case of livestock access to the streams, the survey crews observed only 5 occasions (4 sites with cattle and 1 site with horses) where it was apparent that livestock had access to the stream. The sites where cattle have access are 0511201, 1103408, 1104102, 1307303 and the site where horses have access is 0804101.

Wetlands and livestock access are two important areas to consider for restoration as they both affect the amount of nutrients reaching the stream. Wetlands help to slow the flow of water and act as a sponge, absorbing excess nutrients from the water, while livestock access can have negative effects on the stream. Cattle and horses can cause additional erosion by compromising the stability of the banks at crossing points and thus increasing sediment levels. Nutrient and bacteria levels can also increase due to the increased possibility of animal feces entering the water. It is recommended that sites that could benefit from livestock fencing and sites that may be suitable to restore wetlands be further investigated.

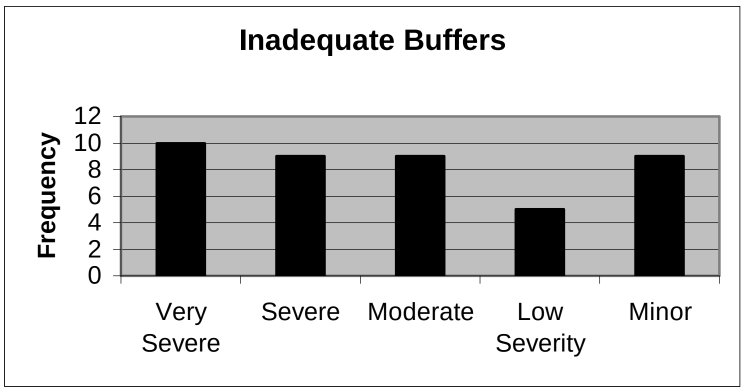
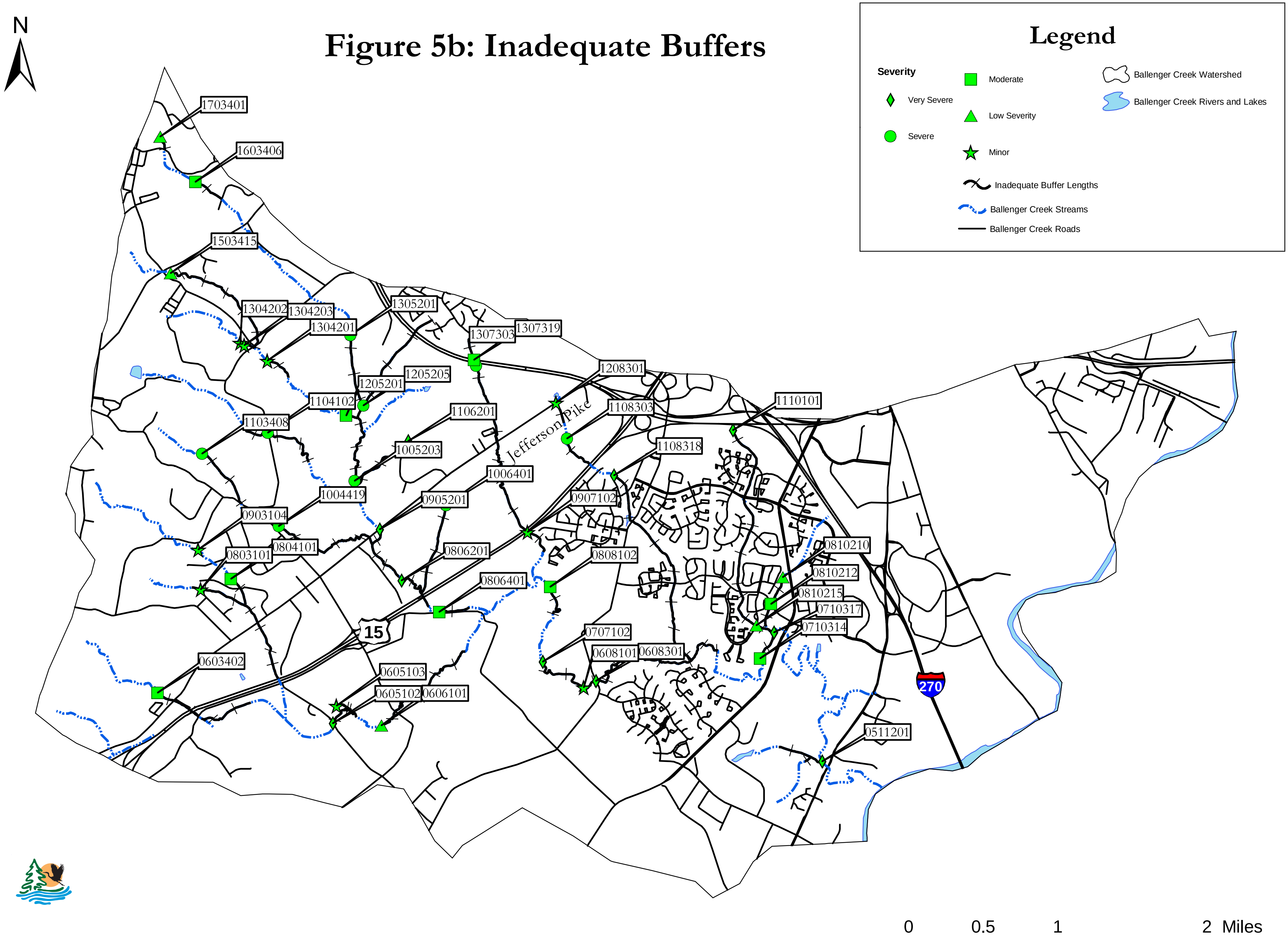


Figure 5a: Histograph showing the frequency of severity ratings given to inadequate buffer sites during the Ballenger Creek SCA survey

Table 2: Summary of Inadequate Buffer Lengths and Widths by Severity Rating

Severity	Number of Sites	Affected Length (Left)	Affected Length (Right)	Mean Length (Left)	Mean Width (Right)	Mean Width (Left)	Mean Width (Right)	Minimum Width	Maximum Width
		Miles		Feet					
Very Severe	10	6.36	5.91	3358.08	3120.48	3.8	2.8	0	25
Severe	9	5.88	5.88	3449.6	3449.6	8.2	9.8	0	25
Moderate	9	2.47	1.43	1449.067	838.9333	4.6	9.3	0	30
Low Severity	5	2.36	2.36	2492.16	2492.16	9	2	0	30
Minor	9	1.26	0.91	739.2	533.8667	3.7	3.3	0	20
Total	**42**	**18.33**	**16.49**						

Figure 5b: Inadequate Buffers



Stream, Roads and Rivers and Lakes layers provided by Frederick County DPW GIS

Fish Passage Barriers

Fish passage barriers include anything in the stream that significantly interferes with the free, upstream movement of fish. Unobstructed upstream movement is important for resident fish species, many of which travel both up and down stream during different parts of their life cycles. In addition, without free fish passage, certain sections in a stream network become isolated from others. This becomes detrimental to species survival when a disturbance occurs in an isolated stretch of stream. A sediment discharge from a construction project, for example, or a sewage line break discharging into a small tributary can eliminate some or all of the fish species in an isolated stream stretch. With a fish blockage present, there is no avenue for fish to repopulate the inaccessible section. As a result, the disturbance will reduce diversity of the fish community in the area, and the remaining biological community may deviate from its natural balance and composition. Ironically, barriers can also isolate species in a beneficial manner to prevent predation.

Fish blockages can be caused by man-made structures such as dams or road culverts and by natural features such as waterfalls or beaver dams. A structure becomes a blockage for fish if the stream water over or under it is too high, shallow, or fast. First, a vertical water drop such as a dam can be too high for fish to jump. A vertical drop as little as 6 inches may cause a fish passage problem for some resident fish species. Second, water too shallow for fish passage can occur in channelized stream sections or at road crossings, where the entire stream volume is spread over a large, flat area. Finally, a structure may be a fish blockage if the water is moving too fast for fish to swim through. This can occur at road crossings where the culvert pipe is placed at a steep angle, and the water moving through the pipe has a velocity higher than a fish's swimming speed.

In restoration work, priority is given to removing fish barriers that will yield access to the greatest quality and quantity of upstream habitat per dollar spent. The mainstem is ideally kept as barrier-free as possible, allowing resident fish to migrate for spawning and to provide a source of fish species for tributaries in the event of a disturbance. Restoration planning includes targeting barriers for removal that isolate entire tributaries, those that isolate significant portions of the upper tributary, and those that isolate quality fish habitat. The best restoration sites also are far from other existing fish barriers. However, in some cases, the optimal situation is to allow a barrier to remain because it is protecting upstream native species from downstream predators.

The Ballenger Creek SCA survey found 38 fish passage barriers. The locations of fish blockages are shown in Figure 6b. The fish barriers found in the Ballenger Creek watershed are due to road crossings (14), debris dams (11), debris (7), natural falls (9), a dam (1), an instream pond (1), and unknown/other (2). Figure 6a shows that most sites were ranked as moderate to minor with five sites ranked as severe. These sites were 0710316, 0710318, 0807102, 1004414, and 1604411. All but one of the sites were noted as being too high, with one marked as too shallow. Total structures blocking full movement of fish were observed at 24 sites, while partial barriers allowing some flow were found in 14 cases.

In all cases, areas should be assessed for viable fish habitat before restoration work begins, giving preference to sites with the most potential habitat area created.

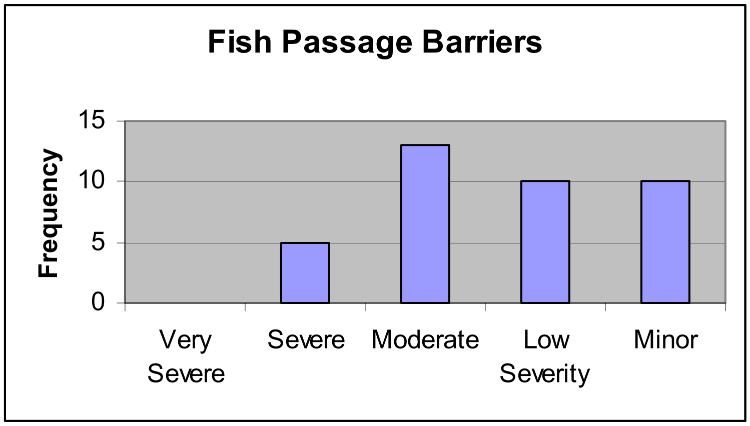
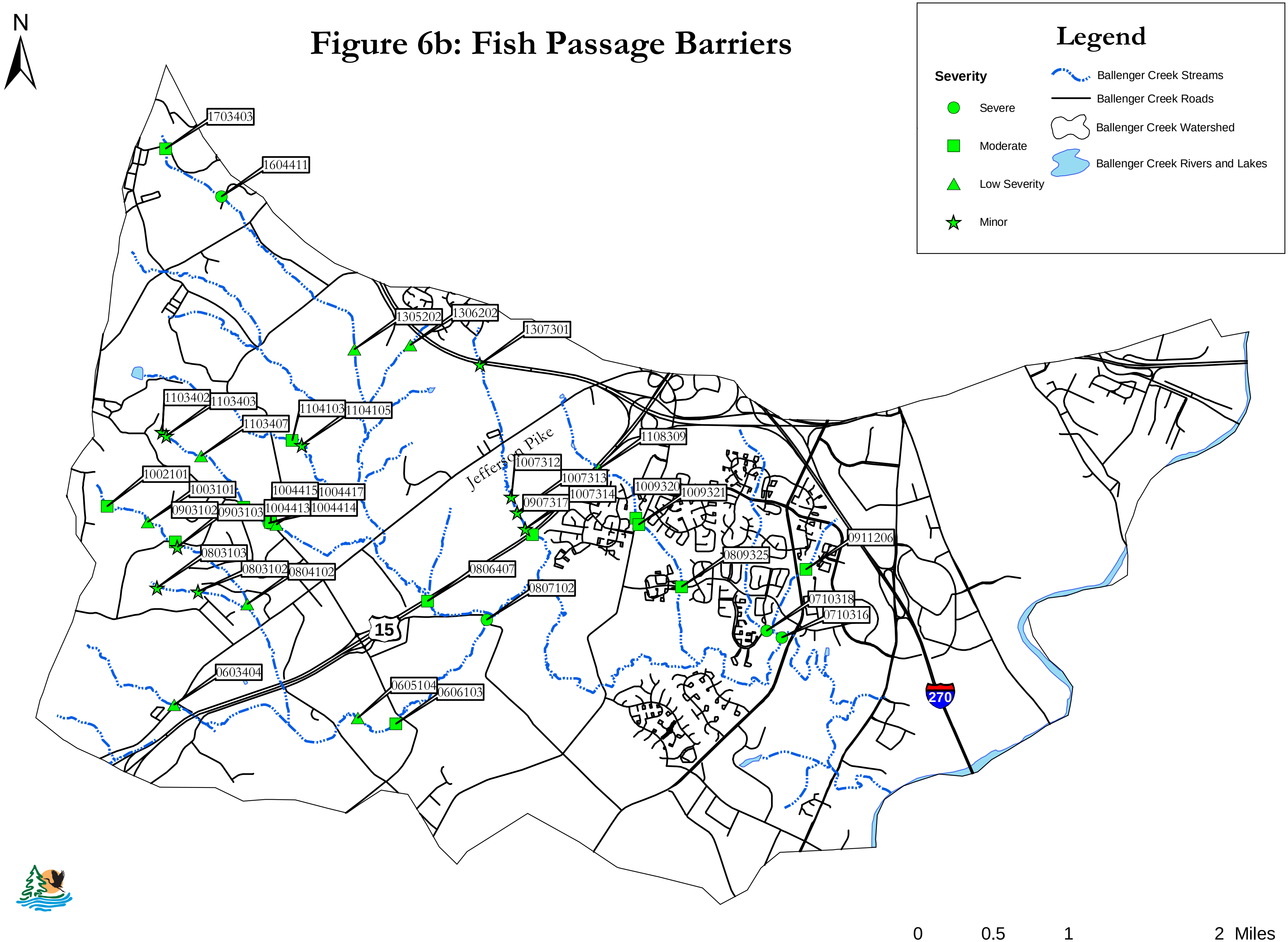


Figure 6a: Histograph showing the frequency of severity ratings given to fish passage barrier sites during the Ballenger Creek SCA survey

Figure 6b: Fish Passage Barriers



Stream, Roads and Rivers and Lakes layers provided by Frederick County DPW GIS

Erosion Sites

Erosion is a natural process necessary to maintain good aquatic habitat. Too much erosion, however, can have the opposite effect on the stream by destabilizing stream banks, destroying in-stream habitat, and causing significant sediment pollution problems downstream. Erosion problems occur when either a stream's hydrology and/or sediment supply are significantly altered. This often occurs below a specific alteration, such as a pipe outfall or road crossing, or when land use in a watershed changes. For example, as a watershed becomes more urbanized, forest and agricultural fields are developed into residential housing complexes and commercial properties. As a result, the amount of impervious surface, or land area where rainwater cannot seep into the groundwater directly, increases in a drainage basin. This causes the amount of runoff entering a stream to increase. Over time, a stream channel will adjust to the greater rain-induced flows by eroding the streambed and banks to raise water-carrying capacity. This channel readjustment can extend over decades, during which time excessive amounts of sediment from unstable eroding stream banks can have very detrimental impacts on a stream's aquatic resources.

In this survey, unstable eroding streams are defined as areas where the stream banks are almost vertical, and the vegetative roots along the stream are unable to hold the soil onto the banks. While survey teams are asked to visually assess whether the stream was down-cutting, widening, or headcutting at a specific site, the only way to evaluate the full significance of the erosion processes at a specific site is to do more detailed monitoring over time.

The SCA survey found 34 eroding stream banks with a total length of 73,387 feet (13.9 miles). Erosion sites are located throughout the Ballenger Creek watershed. Based on the land use, soil type and gradient within the watershed, levels of erosion vary. According to the Frederick County Annual Report, the Ballenger Creek watershed has a total urban impervious surface equaling 2,752 acres. These surfaces can be infrastructure such as parking lots, roads, rooftops, or sidewalks. Of this acreage, 804 acres have no stormwater management treatment. Areas having a high ratio of imperviousness and lacking SWM typically have higher rates of erosion because the storm water is leaving the surrounding landscape at an accelerated rate and flowing directly into the stream.

The severity and location of erosion sites in the Ballenger Creek watershed are shown in Figure 7b. Severity ratings ranged from minor to very severe. The frequency of the severity ratings is shown in Figure 7a. Only one site, 0708302, was ranked as being very severe.

In addition, survey crews are asked to evaluate whether there is a threat to infrastructure due to the erosion. Crews cited 4 instances where this was the case. Threatened infrastructures included: a parking lot, a foot path, a road, and sheds in a landowner's backyard.

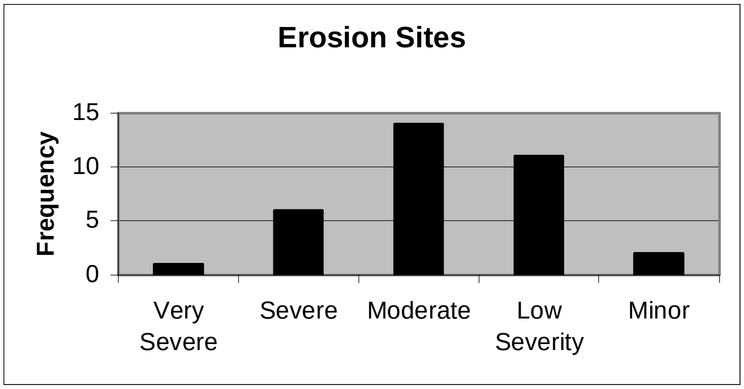
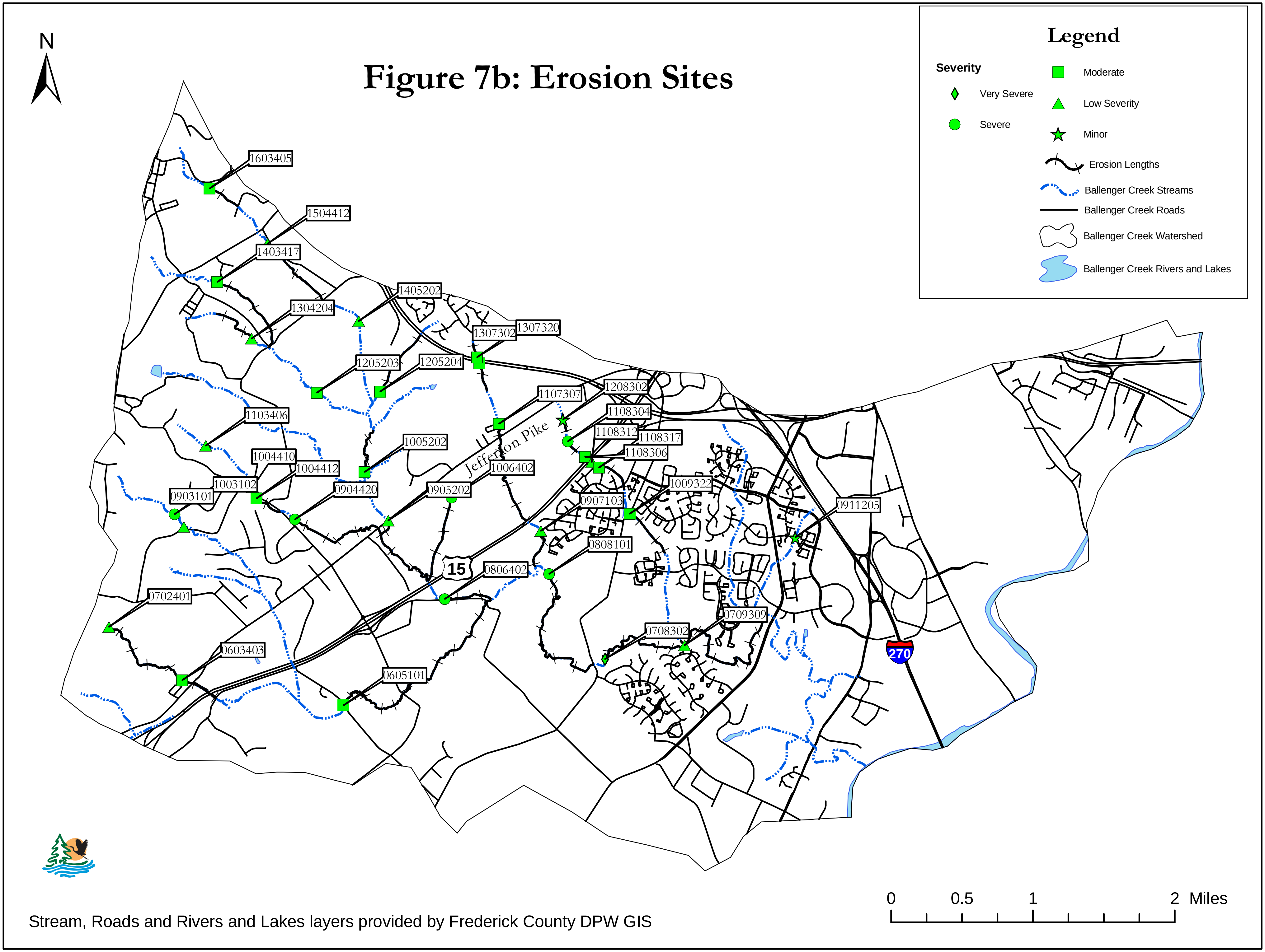


Figure 7a: Histograph showing the frequency of severity ratings given to erosion sites during the Ballenger Creek SCA survey.

Figure 7b: Erosion Sites



Unusual Conditions or Comments

Survey teams record unusual conditions or comments to note the location of anything out of the ordinary observed during the survey or to provide additional written comments on a specific problem site. The survey crews identified 7 unusual conditions and 3 comments throughout the Ballenger Creek watershed. The conditions and comments noted vary from a dry stream to excessive algae to a car in the stream. It is recommended that unusual conditions be further investigated to determine cause and potential correctibility (Figure 8b).

Only sites marked as unusual conditions are given a severity rating. The severity of the sites ranged from very severe to unknown. The frequency of these rating can be seen in Figure 8a.

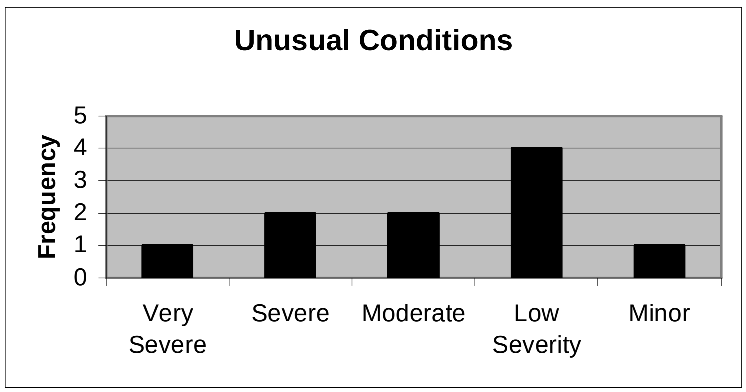
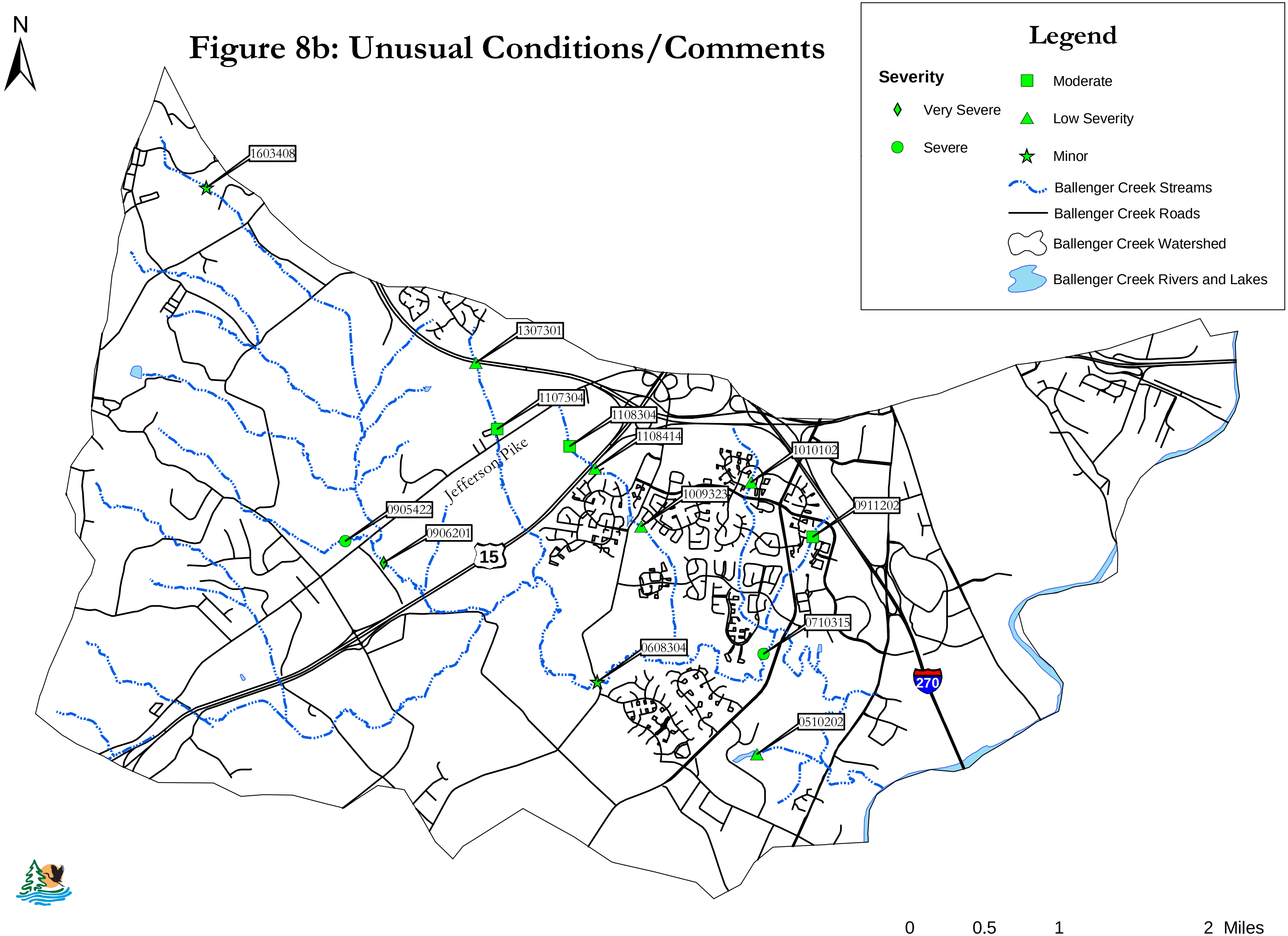


Figure 8a: Histograph of the frequency of severity ratings given to unusual condition sites in the Ballenger Creek SCA survey.

Figure 8b: Unusual Conditions/Comments



Stream, Roads and Rivers and Lakes layers provided by Frederick County DPW GIS

Channel Alterations

Channel alterations sites are stream sections where the stream's banks and channel have been significantly altered from a natural condition. This includes areas where the stream may have been straightened and/or where the stream banks have been hardened using rock, gabion baskets or concrete over a significant length. It does not include road crossings unless a significant portion of the stream above and below the road has also been channelized. In addition, places where a small section of only one side of the stream's banks may have been stabilized to reduce erosion were not reported as channel alterations. However, if human alterations to the channel were performed in an effort to protect the channel, this may indicate a stormwater problem upstream/upland from the site. It is recommended that Frederick County DPW investigate such situations. For the purposes of this survey, channel alteration also does not include tributaries where storm drains were placed in the stream channel, and the entire tributary is now piped underground. While these streams sections have been significantly altered, it is not possible to tell by walking the stream corridor precisely where this was done.

In the Ballenger Creek watershed, survey crews found 8 areas where the stream channel had been recognizably altered. Locations of channel alteration sites are shown in Figure 9b. Channel alterations were found throughout the watershed but were clustered primarily in the eastern, more developed portion. The channel alterations were approximately 1,767 feet in total length. Six were rip rap, 1 concrete, and 1 cinder block. Severity ratings varied from minor to severe (Figure 9a).

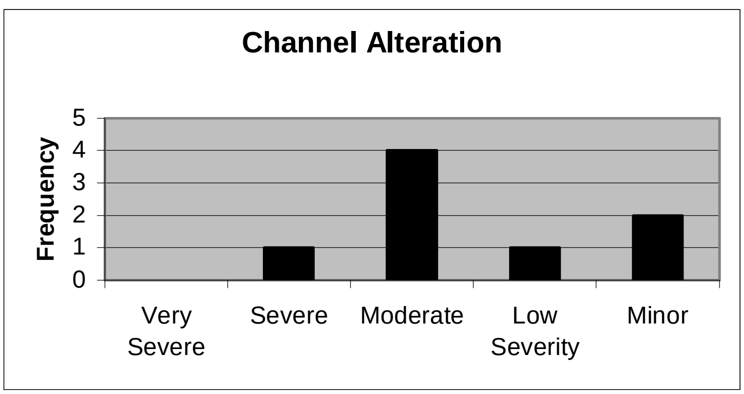


Figure 9a: Histograph showing the frequency of severity ratings given to channel alteration sites during the Ballenger Creek SCA survey

The severity of channel alterations is based on both the channel type and the length of the site. The presence of hardened stream banks using concrete or rock for a total length of over a thousand feet increases the severity of a site. This is due to the greater habitat potential of earth channels, which can easily develop and support vegetation, stream sinuosity, and refuge areas for wildlife within the channel bed more than areas with a hardened stream channel.

In addition to channel type and site length, the potential fish and wildlife habitat available within the channel is a factor in evaluating severity. Sites that showed signs of forming bends, having natural banks, or supporting forest or wetland vegetation over a considerable length of the total site rank as less severe than those sites without these characteristics. The presence of vegetation and sediment in the channel are two factors recorded in the survey that may indicate a higher habitat potential for the earth channel. Five of the 8 sites were reported to have perennial flow, 6 were reported to have sedimentation along the bottom of the streambed, and 6 had vegetation growing in the channel (Appendix B).

Restoring channel alteration sites can increase fish and wildlife habitat and may allow for additional nutrient uptake in the waterway. In its simplest form, restoration for earth channels would include allowing vegetation and/or tree roots to stabilize the sediment along the channel, causing sinuosity to re-form naturally. This sinuosity may reform within the bed of the channelization or along its banks, depending on the site and the depth of the channel alteration.

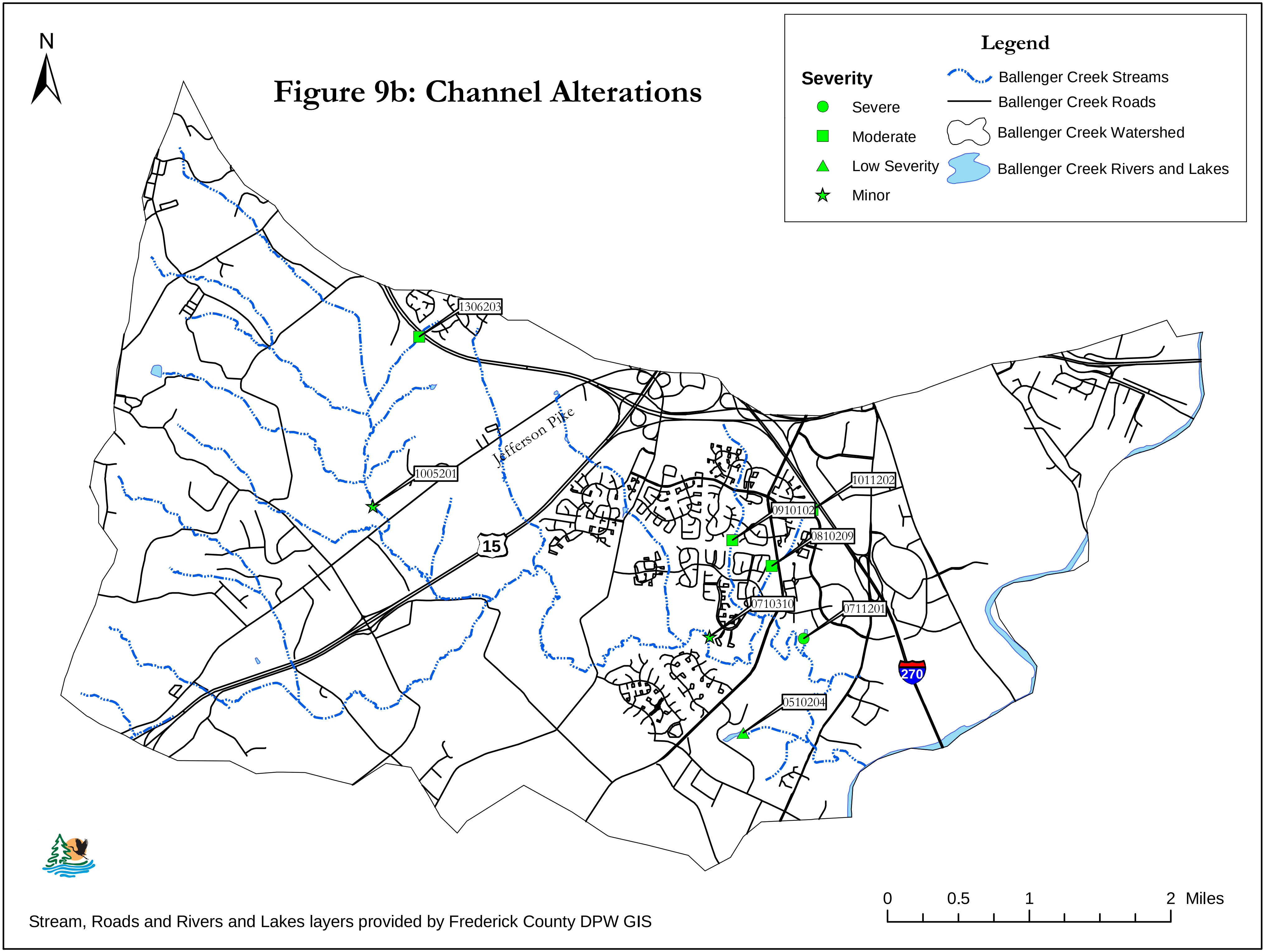


Figure 9b: Channel Alterations

Stream, Roads and Rivers and Lakes layers provided by Frederick County DPW GIS

Trash Dumping

Trash dumping sites are places where large amounts of trash are inside the stream corridor; either as a site of deliberate dumping or as a place where trash tends to accumulate (often a result of storm drainage). Site severity ratings are based on size, contents of trash, and potential impact on the stream.

Survey crews found a total of 6 trash dumping sites dispersed throughout the western portion of the Ballenger Creek watershed (Figure 10b). This is a low number of sites compared to other watersheds previously surveyed throughout Maryland. In terms of severity, the six sites are ranked as severe (1), moderate (2), low severity (1), and minor (2), as shown in Figure 10a. The sites contained residential waste (5) and farm equipment (1). All sites were found on private land and were considered suitable for a volunteer clean up project.

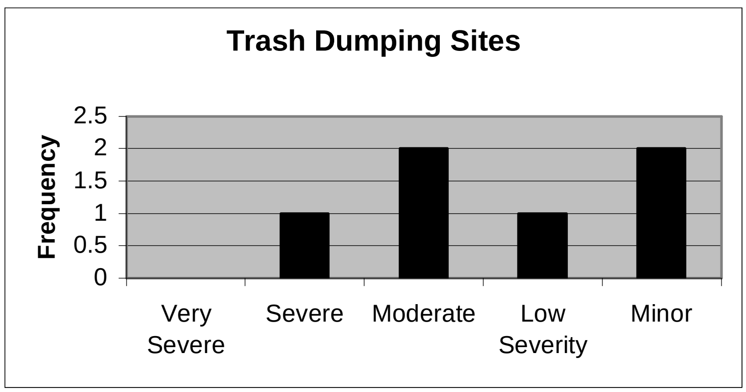


Figure 10a: Histograph showing frequency of severity ratings given to trash dumping sites in the Ballenger Creek SCA survey.

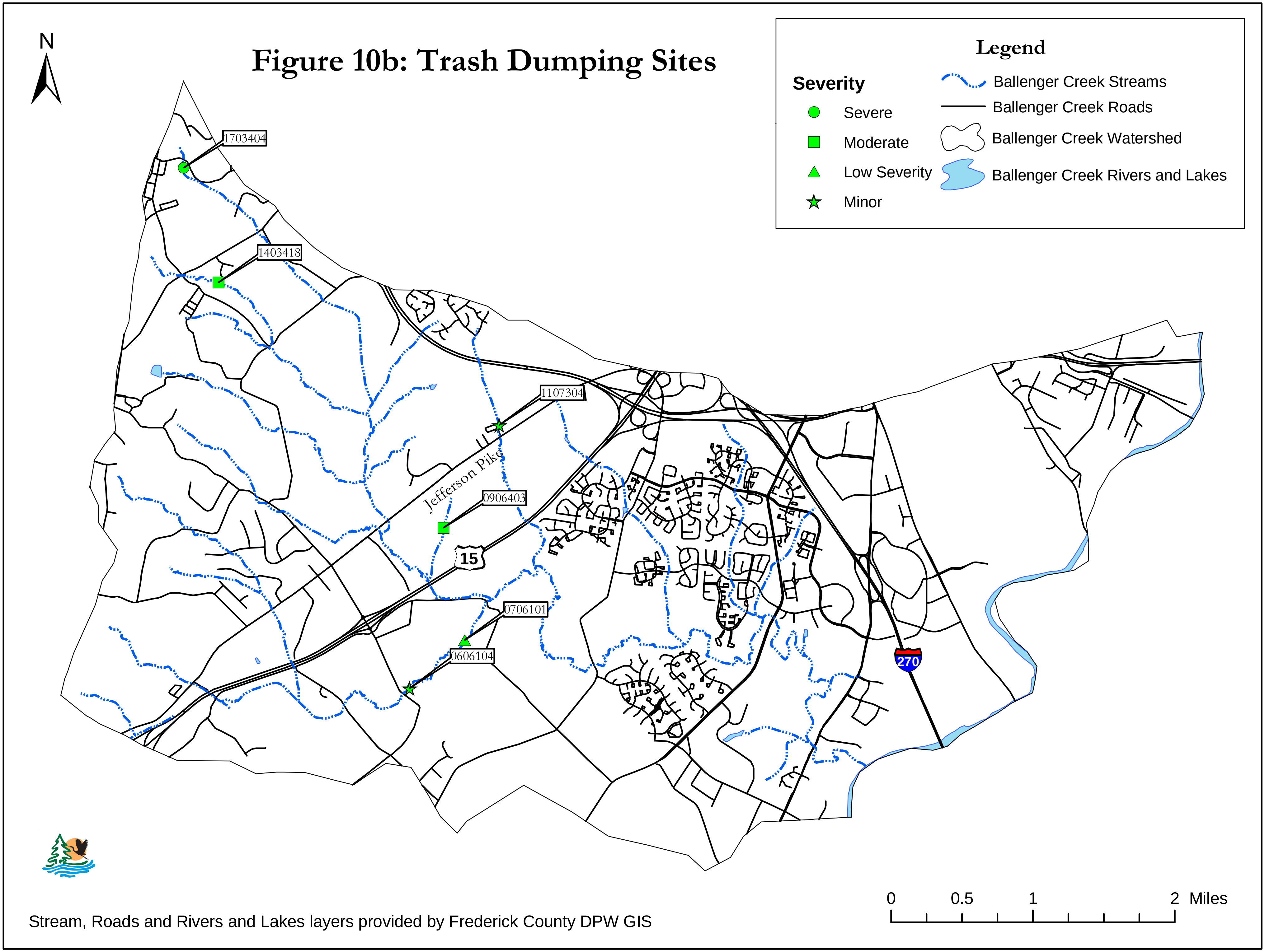


Figure 10b: Trash Dumping Sites

Exposed Pipes

Any pipes that are in the stream or along the stream's immediate banks that could be damaged by a high flow event are recorded as exposed pipes in the SCA survey. Exposed pipes include: 1) manhole stacks in or along the edge of the stream channel, 2) pipes that are exposed along the stream banks, 3) pipes that run under the stream bed and were exposed by stream down-cutting, and 4) pipes built over a stream that are low enough to be affected by frequent high storm flows. Exposed pipes do not include pipe outfalls, where only the open end of the pipe is exposed to the stream bed.

In urban areas, it is very common for pipelines and other utilities to be placed in the stream corridor. This is especially true for gravity sewage lines, which depend on the continuous downward slope of the pipeline to move sewage to a pumping station or treatment plant. Since streams flow through the lowest points of the local landscape, engineers often build sewage lines paralleling streams to collect sewage from adjacent neighborhoods. While the pipelines are stationary, streams migrate to different areas within the floodplain. Over time, this variance in stream location can expose previously buried pipelines, making them vulnerable to puncture by debris in the stream. Fluids in the pipelines can be discharged into the stream, causing a serious water quality problem.

Field crews observed four exposed pipes during the survey with a moderate or low severity rating (Figure 11a). Figure 11b shows the locations of the exposed pipes cited within the Ballenger Creek watershed. All of the pipes were exposed above the stream and none of the pipes had a discharge at the time of the survey. All of the pipes were noted as having a diameter less than ten inches. Three of the pipes were made of smooth metal with the final pipe made of plastic. In all cases, survey crews were unable to determine the purpose of the pipe (Appendix B).

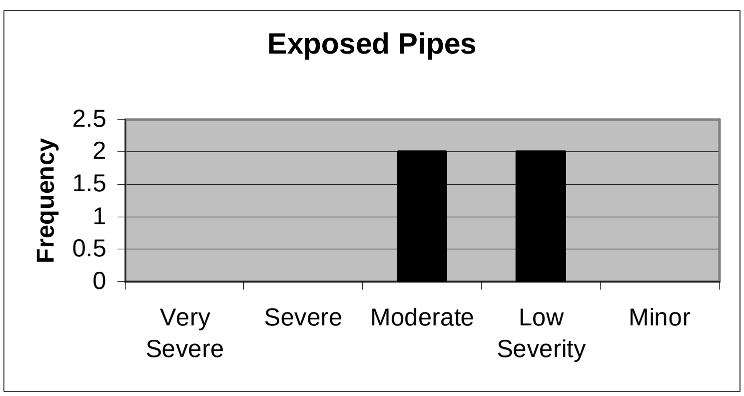
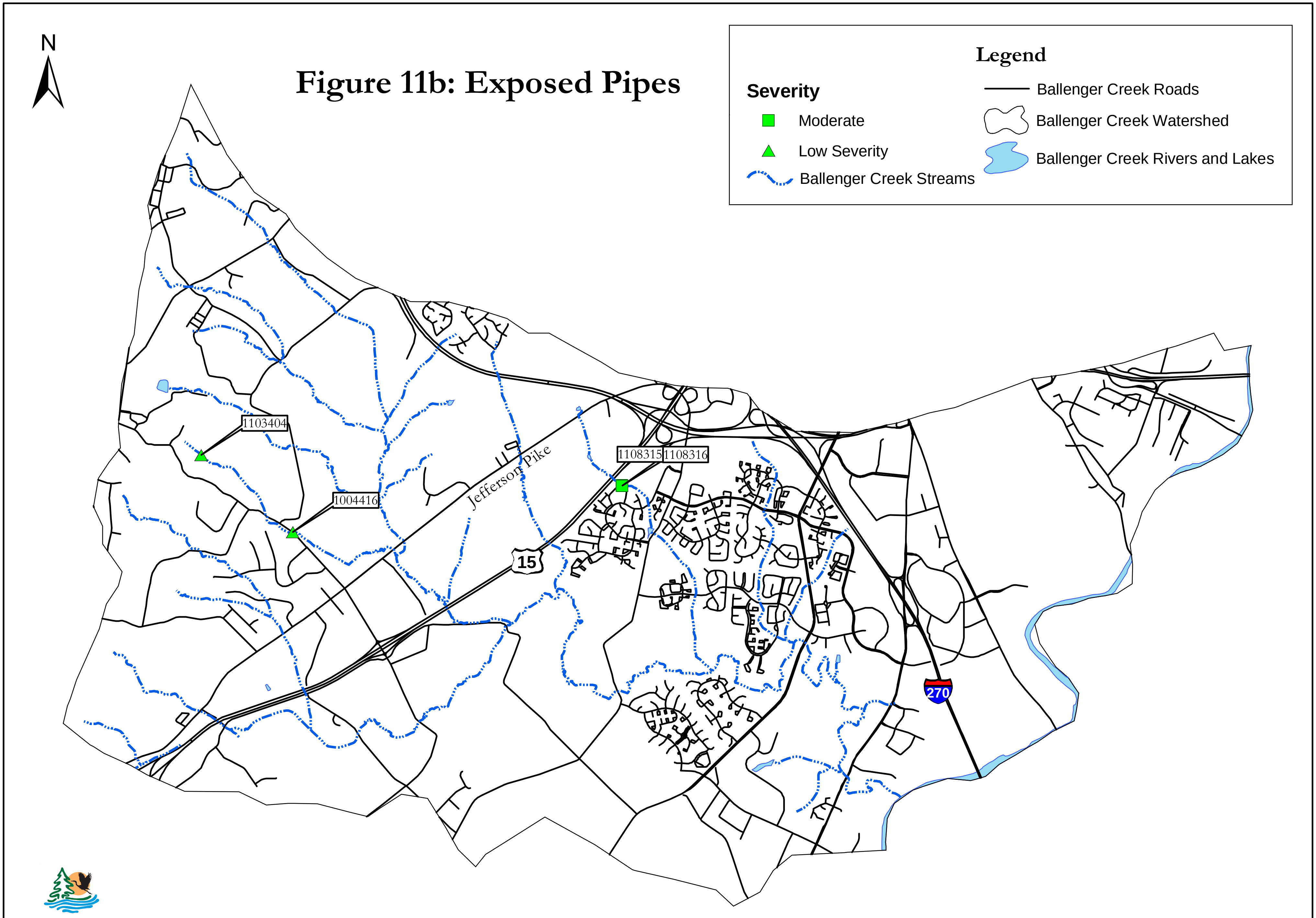


Figure 11a: Histograph showing the severity rating given to exposed pipe sites during the Ballenger Creek SCA survey.

Figure 11b: Exposed Pipes



Stream, Roads and Rivers and Lakes layers provided by Frederick County DPW GIS

Representative Sites

Representative sites are used to document the general condition of both in-stream habitat and the adjacent riparian corridor (including and up to 50 feet beyond the stream bank). The SCA survey's representative site evaluations are based on the habitat assessment procedures outlined in EPA's rapid bioassessment protocols (Plafkin, et. al., 1989), and they are very similar to the habitat evaluations of Maryland Save-Our-Stream's Heartbeat Program. At each representative site, the following 10 separate categories related to stream habitat health are evaluated:

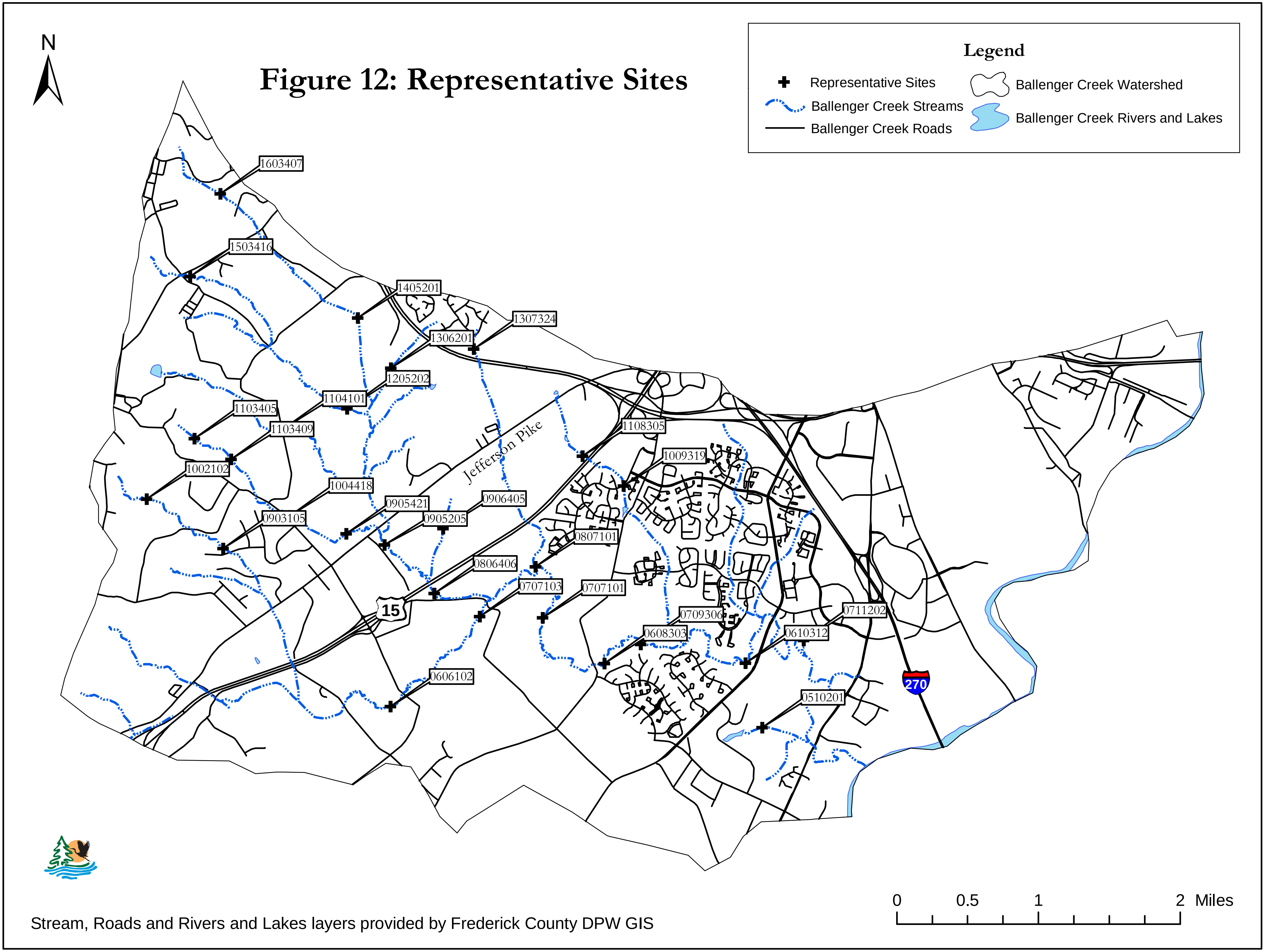
- Attachment Sites for Macroinvertebrates
- Embeddedness
- Shelter for Fish
- Channel Alteration
- Sediment Deposition
- Velocity and Depth Regime
- Channel Flow Status
- Bank Vegetation Protection
- Condition of Banks
- Riparian Vegetative Zone Width

Under each category, field crews base a rating of optimal, suboptimal, marginal or poor on established grading criteria developed to reflect ideal wildlife habitat for rocky bottom streams. In addition to the habitat ratings, teams collect data on the stream's wetted width and pool depths at both runs and riffles at each representative site. Depth measurements are taken along the stream thalweg (main flow channel). At representative sites, field crews also indicate whether the bottom sediments are primarily silt, sand, gravel, cobble, boulder, or bedrock.

Representative sites are located at approximately ½- to one-mile intervals along the stream. Survey crews evaluated 27 representative sites in the Ballenger Creek watershed. Locations of representative sites are shown in Figure 12, and data collected for all categories are listed in Appendix B.

Since representative sites provide an overall assessment of the in-stream and riparian corridor habitat, they can be used to target areas for restoration. If there are areas that Frederick County DPW has already identified for targeted restoration, the representative sites can be used to give additional information on the condition of the stream corridor as well. These sites also can be used to identify areas of the stream corridor where the in-stream and riparian corridors are pristine and should thus be targeted with preservation. There were no sites that were given optimal ratings across the board, but there are quite a few that have a combination of optimal and suboptimal ratings such as sites 1103405 and 1103409. These areas could possibly be targeted for preservation with minimal amounts of restoration. In addition, no sites were given poor ratings across the board. However, Frederick County DPW can suggest further investigation of areas given poor ratings in multiple categories such as sites 0510201, 1009319, and 1306201. It is suggested the representative sites listed in Appendices A and B be used to assist in restoration and preservation targeting.

Figure 12: Representative Sites



DISCUSSION

The results of the Ballenger Creek SCA survey, list, summarize, and show the location of the observable environmental problems along the stream corridor network in this watershed. Each potential problem site has a corresponding rating for severity, correctibility, and access and a photograph of the site. The data from this survey can be used to target future restoration efforts. With this list of potential problem sites, county planners, resource managers, and others can initiate a dialog to cooperatively set the direction and goals for the watersheds' management and plan future restoration work at specific sites.

During the SCA survey, the most frequently observed potential problem sites were pipe outfalls, reported at 50 sites, and inadequately forested buffers, reported at 42 sites (or 18.33 miles of stream on the left bank and 16.48 miles of stream on the right bank). Other potential environmental problems recorded during the survey included: 38 fish barriers, 34 erosion sites, 10 unusual conditions/comments, 8 channel alterations, 6 trash dumping sites, 4 exposed pipes, and no in- or near-stream construction sites (Table 1). Additionally, crews recorded descriptive habitat condition data at 27 representative sites.

Pipe outfalls were the most commonly observed problem within the Ballenger Creek watershed. Inadequately forested buffer sites were the second most common observed problem within the Creek. This is not surprising considering the almost 50% of the land in the Ballenger Creek watershed is urban. Figures 4b and 4c show that the majority of the pipe outfalls identified were located between US Highway 15 and Interstate 270, an area where the majority of the development has occurred. These areas would require stormwater drainage and would most likely have limited buffers due to development. In most cases, erosion sites were found either in conjunction with or just downstream from inadequate buffer sites. The occurrence is most likely due to increased flow rates of water and scour from stream banks and the streambed through the stream channel. However, the degree of soil erodibility and surface impermeability play important roles in the erosion process as well.

The GIS and attribute data for the sites described in the SCA survey can be combined with other existing GIS datasets to further prioritize areas for restoration. By combining survey results with other natural resource data sets, restoration projects can be targeted to areas where rare or threatened species, gaps in continuous forest or the state's Green Infrastructure, or quality fish and wildlife habitat are found. In addition, sites can be prioritized for restoration based on their location in headwater areas, areas of specific local interest, or sites where the surrounding land use is particularly suited to restoration projects.

The Maryland Department of Natural Resources (DNR) Watershed Restoration Division developed the Stream Corridor Assessment Survey (SCA) as a watershed management tool. The present survey helps to place individual stream problems into their watershed context. It has potential use among resource managers and land-use planners to cooperatively and consistently prioritize restoration work. Results of the survey will be given to Frederick County DPW in order to initiate a dialog to cooperatively set the direction and goals for the watershed's management and more effectively plan future restoration work for specific problem sites within the watershed.

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Appendix A

Listing of sites by site number

Location	Problem	Severity	Correctibility	Access	X Coordinates	Y Coordinates	Stream
0410201	Pipe Outfall	4	5	2	363529.47958	188184.16206	Ballenger Creek
0510201	Representative Site				363493.89099	188777.86650	Ballenger Creek
0510202	Unusual Condition/Comment	4	5	3	363310.94813	188712.45057	Ballenger Creek
0510204	Channel Alteration	4	5	3	363278.79454	188721.32053	Ballenger Creek
0511201	Inadequate Buffer	1	4	3	364026.08840	188622.64226	Ballenger Creek
0603402	Inadequate Buffer	3	2	2	356846.96713	189367.40502	Ballenger Creek
0603403	Erosion Site	3	2	3	356905.84195	189319.08783	Ballenger Creek
0603404	Fish Barrier	4	1	2	357007.73510	189285.35792	Ballenger Creek
0605101	Erosion Site	3	4	2	358742.38158	189032.78687	Ballenger Creek
0605102	Inadequate Buffer	1	1	3	358741.81165	189036.99913	Ballenger Creek
0605103	Inadequate Buffer	5	1	1	358782.83520	189226.59445	Ballenger Creek
0605104	Fish Barrier	4	1	2	358971.32178	189145.65610	Ballenger Creek
0606101	Inadequate Buffer	4	3	2	359262.92161	189013.71549	Ballenger Creek
0606102	Representative Site				359277.33529	189015.93298	Ballenger Creek
0606103	Fish Barrier	3	1	3	359376.01356	189080.24017	Ballenger Creek
0606104	Trash Dumping	5	1	1	359489.10550	189224.37697	Ballenger Creek
0608101	Inadequate Buffer	5	1	3	361450.65756	189426.65611	Ballenger Creek
0608301	Inadequate Buffer	1	5	3	361579.81685	189494.45349	Ballenger Creek
0608303	Representative Site				361703.26847	189507.10684	Ballenger Creek
0608304	Unusual Condition/Comment	5	1	1	361592.39401	189492.69316	Ballenger Creek
0610312	Representative Site				363305.40441	189510.43307	Ballenger Creek
0702401	Erosion Site	4	3	4	356075.28089	189922.57245	Ballenger Creek
0706101	Trash Dumping	4	3	1	360116.65495	189774.00068	Ballenger Creek
0707101	Representative Site				361003.65062	190023.46821	Ballenger Creek
0707102	Inadequate Buffer	1	1	2	361004.75937	189701.93228	Ballenger Creek
0707103	Representative Site				360288.51036	190040.09938	Ballenger Creek
0708302	Erosion Site	1	5	3	361709.92093	189558.90423	Ballenger Creek
0708305	Pipe Outfall	4	1	2	361788.64180	189660.90873	Ballenger Creek
0709306	Representative Site				362113.50397	189720.78094	Ballenger Creek
0709307	Pipe Outfall	4	4	1	362148.98379	189725.21591	Ballenger Creek
0709309	Erosion Site	4	3	3	362610.71506	189716.45922	Ballenger Creek
0710310	Channel Alteration	5	3	3	362897.13893	189816.64864	Ballenger Creek
0710314	Inadequate Buffer	3	3	3	363355.65284	189737.67581	Ballenger Creek
0710315	Pipe Outfall	4	3	1	363382.76292	189794.25336	Ballenger Creek
0710315	Unusual Condition/Comment	2	3	1	363382.76292	189793.07466	Ballenger Creek
0710316	Fish Barrier	2	3	2	363501.81152	190005.24048	Ballenger Creek
0710317	Inadequate Buffer	1	3	2	363504.16892	190015.88459	Ballenger Creek
0710318	Fish Barrier	2	3	1	363341.50845	190078.31982	Ballenger Creek
0711201	Channel Alteration	2	5	3	363966.21893	189793.07466	Ballenger Creek
0711202	Representative Site				363966.21893	189767.14328	Ballenger Creek
0803101	Inadequate Buffer	5	2	2	357315.58291	190486.23731	Ballenger Creek
0803102	Fish Barrier	5	2	2	357263.85510	190495.47980	Ballenger Creek
0803103	Fish Barrier	5	1	4	356825.90098	190539.82959	Ballenger Creek
0804101	Inadequate Buffer	3	2	2	357640.93859	190599.35497	Ballenger Creek
0804102	Fish Barrier	4	1	3	357788.29129	190360.21296	Ballenger Creek
0806201	Inadequate Buffer	1	4	4	359482.45304	190579.74439	Ballenger Creek
0806401	Inadequate Buffer	3	2	3	359891.35122	190238.01457	Ballenger Creek

Location	Problem	Severity	Correctibility	Access	X Coordinates	Y Coordinates	Stream
0806402	Erosion Site	2	4	1	359890.54229	190238.13969	Ballenger Creek
0806403	Pipe Outfall	5	1	1	359933.71209	190243.79478	Ballenger Creek
0806404	Pipe Outfall	5	1	1	359989.14932	190237.14231	Ballenger Creek
0806406	Representative Site				359771.83538	190299.23201	Ballenger Creek
0806407	Fish Barrier	3	3	1	359717.50689	190395.69279	Ballenger Creek
0807101	Representative Site				360919.38604	190605.24552	Ballenger Creek
0807102	Fish Barrier	2	2	1	360352.81755	190195.01002	Ballenger Creek
0807405	Pipe Outfall	5	1	1	360331.75140	190271.51339	Ballenger Creek
0808101	Erosion Site	2	4	3	361073.71526	190522.58836	Ballenger Creek
0808102	Inadequate Buffer	3	1	4	361090.13270	190513.21972	Ballenger Creek
0809325	Fish Barrier	3	2	1	362431.71367	190546.48205	Ballenger Creek
0810209	Channel Alteration	3	5	1	363601.43922	190614.11547	Ballenger Creek
0810210	Inadequate Buffer	4	3	2	363600.58432	190613.90175	Ballenger Creek
0810211	Pipe Outfall	5	5	1	363485.02103	190346.90803	Ballenger Creek
0810212	Inadequate Buffer	3	3	2	363473.93359	190324.73313	Ballenger Creek
0810213	Pipe Outfall	5	5	1	363408.51766	190150.66023	Ballenger Creek
0810214	Pipe Outfall	5	5	2	363334.23177	190083.02681	Ballenger Creek
0810215	Inadequate Buffer	4	3	2	363314.27437	190094.11426	Ballenger Creek
0810216	Pipe Outfall	5	4	1	363156.83263	190415.65019	Ballenger Creek
0903101	Erosion Site	4	3	1	356924.57925	191060.62594	Ballenger Creek
0903102	Fish Barrier	3	1	1	357019.93129	191026.25486	Ballenger Creek
0903103	Fish Barrier	5	1	2	357042.10618	190974.14386	Ballenger Creek
0903104	Inadequate Buffer	5	1	3	357288.21636	190914.77034	Ballenger Creek
0903105	Representative Site				357375.83830	190812.26715	Ballenger Creek
0904420	Erosion Site	2	4	4	358189.15814	191144.71692	Ballenger Creek
0905201	Inadequate Buffer	1	5	4	359245.11045	191132.89907	Ballenger Creek
0905202	Erosion Site	4	4	5	359245.11045	191133.15291	Ballenger Creek
0905203	Pipe Outfall	3	3	4	359215.24559	191009.62369	Ballenger Creek
0905204	Pipe Outfall	4	3	4	359214.13684	191009.62369	Ballenger Creek
0905205	Representative Site				359205.26689	190853.29070	Ballenger Creek
0905421	Representative Site				358772.85649	190978.57884	Ballenger Creek
0905422	Unusual Condition/Comment	2	3	3	358871.53476	191009.62369	Ballenger Creek
0905423	Pipe Outfall	3	3	1	359134.30723	191039.55979	Ballenger Creek
0906201	Unusual Condition/Comment	1	5	4	359283.98775	190775.67858	Ballenger Creek
0906403	Trash Dumping	3	2	4	359876.05737	191047.32100	Ballenger Creek
0906404	Pipe Outfall	4	3	3	359880.49235	191057.29970	Ballenger Creek
0906405	Representative Site				359873.83988	191036.23356	Ballenger Creek
0907101	Pipe Outfall	5	1	1	360937.12595	191058.40845	Ballenger Creek
0907102	Inadequate Buffer	5	1	1	360843.99140	191101.64949	Ballenger Creek
0907103	Erosion Site	4	2	2	360978.47458	191011.76993	Ballenger Creek
0907317	Fish Barrier	3	5	2	360839.55642	191104.97572	Ballenger Creek
0907318	Pipe Outfall	4	1	1	360840.66517	191104.97572	Ballenger Creek
0908101	Pipe Outfall	4	1	2	361022.49928	190906.51044	Ballenger Creek
0909324	Pipe Outfall	3	3	3	362299.77306	190879.90057	Ballenger Creek
0910102	Channel Alteration	3	3	2	363154.61514	190909.83667	Ballenger Creek
0910103	Pipe Outfall	4	1	1	363212.26986	191024.03737	Ballenger Creek
0911201	Pipe Outfall	4	5	1	363908.56147	191129.36810	Ballenger Creek

Location	Problem	Severity	Correctibility	Access	X Coordinates	Y Coordinates	Stream
0911202	Unusual Condition/Comment	3	5	1	363911.88770	191052.86473	Ballenger Creek
0911203	Pipe Outfall	4	5	1	363897.47402	191008.51494	Ballenger Creek
0911204	Pipe Outfall	4	5	1	363888.60407	190987.44879	Ballenger Creek
0911205	Erosion Site	5	2	1	363871.97290	190939.77278	Ballenger Creek
0911206	Fish Barrier	3	5	2	363763.31593	190733.54628	Ballenger Creek
0911207	Pipe Outfall	5	5	2	363696.79125	190696.95771	Ballenger Creek
0911208	Pipe Outfall	4	5	1	363683.48632	190671.45658	Ballenger Creek
1002101	Fish Barrier	3	1	1	356294.81232	191408.45813	Ballenger Creek
1002102	Representative Site				356507.69128	191374.08705	Ballenger Creek
1003101	Fish Barrier	4	1	4	356726.11397	191241.03770	Ballenger Creek
1003102	Erosion Site	2	3	4	356820.35726	191204.44913	Ballenger Creek
1004410	Erosion Site	4	2	2	357708.06535	191510.67636	Ballenger Creek
1004411	Fish Barrier	3	3	1	357755.02895	191399.58818	Ballenger Creek
1004412	Erosion Site	3	3	3	357752.34390	191384.60456	Ballenger Creek
1004413	Fish Barrier	4	3	1	357752.81146	191357.45588	Ballenger Creek
1004414	Fish Barrier	2	4	1	358022.23640	191227.73276	Ballenger Creek
1004415	Fish Barrier	3	3	1	358037.75883	191236.60272	Ballenger Creek
1004416	Exposed Pipe	4	2	1	358032.21510	191235.49398	Ballenger Creek
1004417	Fish Barrier	4	4	1	358104.28350	191213.31908	Ballenger Creek
1004418	Representative Site				358137.54584	191183.38298	Ballenger Creek
1004419	Inadequate Buffer	2	4	3	358155.97707	191168.41272	Ballenger Creek
1005201	Channel Alteration	5	3	3	359074.43503	191296.47493	Ballenger Creek
1005202	Erosion Site	3	5	4	358978.11673	191683.93448	Ballenger Creek
1005203	Inadequate Buffer	2	5	4	358973.53927	191653.49069	Ballenger Creek
1006401	Inadequate Buffer	2	4	4	359962.53945	191392.93571	Ballenger Creek
1006402	Erosion Site	2	4	4	359963.99836	191394.75806	Ballenger Creek
1007312	Fish Barrier	5	1	3	360611.15504	191509.35389	Ballenger Creek
1007313	Fish Barrier	5	1	4	360675.46222	191343.04220	Ballenger Creek
1007314	Fish Barrier	5	1	4	360764.16179	191168.96930	Ballenger Creek
1007315	Pipe Outfall	5	1	1	360768.59677	191164.53432	Ballenger Creek
1007316	Pipe Outfall	3	3	1	360767.48803	191164.53432	Ballenger Creek
1009319	Representative Site				361920.58241	191521.55008	Ballenger Creek
1009320	Fish Barrier	3	3	1	361943.86604	191278.73502	Ballenger Creek
1009321	Fish Barrier	3	4	1	361974.91089	191213.31908	Ballenger Creek
1009322	Erosion Site	3	4	1	361987.10708	191208.91523	Ballenger Creek
1009323	Unusual Condition/Comment	4	3	2	362059.17548	191166.75181	Ballenger Creek
1010101	Pipe Outfall	4	1	1	363233.33601	191228.84151	Ballenger Creek
1010102	Unusual Condition/Comment	4	1	1	363246.64095	191641.29450	Ballenger Creek
1010103	Pipe Outfall	5	1	1	363261.05463	191669.01311	Ballenger Creek
1010104	Pipe Outfall	4	1	1	363234.44475	191604.70593	Ballenger Creek
1011201	Pipe Outfall	4	5	1	364057.13325	191289.82246	Ballenger Creek
1011202	Channel Alteration	3	5	1	364066.00320	191251.01640	Ballenger Creek
1011203	Pipe Outfall	5	4	1	363918.54017	191160.09934	Ballenger Creek
1103401	Pipe Outfall	4	2	2	356854.72834	192221.96306	Ballenger Creek
1103402	Fish Barrier	5	1	2	356879.12072	192202.00566	Ballenger Creek
1103403	Fish Barrier	5	1	2	356927.90548	192162.09085	Ballenger Creek
1103404	Exposed Pipe	4	4	3	357036.56245	192077.82626	Ballenger Creek

Location	Problem	Severity	Correctibility	Access	X Coordinates	Y Coordinates	Stream
1103405	Representative Site				357050.97613	192062.30384	Ballenger Creek
1103406	Erosion Site	4	2	3	357176.26427	191980.25674	Ballenger Creek
1103407	Fish Barrier	4	2	3	357298.22618	191943.66817	Ballenger Creek
1103408	Inadequate Buffer	2	4	3	357328.01980	191950.57448	Ballenger Creek
1103409	Representative Site				357466.75536	191825.03249	Ballenger Creek
1104101	Representative Site				358062.15121	192172.06955	Ballenger Creek
1104102	Inadequate Buffer	2	3	2	358041.08506	192177.61328	Ballenger Creek
1104103	Fish Barrier	3	3	1	358269.48645	192113.30609	Ballenger Creek
1104104	Pipe Outfall	2	3	1	358296.09632	192115.52358	Ballenger Creek
1104105	Fish Barrier	5	1	3	358371.49095	192064.52133	Ballenger Creek
1106201	Inadequate Buffer	1	5	4	359554.52144	192084.47873	Ballenger Creek
1107304	Trash Dumping	5	2	1	360508.00187	192215.55718	Ballenger Creek
1107304	Unusual Condition/Comment	3	2	2	360508.91016	192215.10304	Ballenger Creek
1107305	Pipe Outfall	5	1	1	360507.54773	192209.65333	Ballenger Creek
1107306	Pipe Outfall	5	1	1	360511.63501	192178.77169	Ballenger Creek
1107307	Erosion Site	3	4	1	360504.95662	192229.97948	Ballenger Creek
1107308	Pipe Outfall	5	1	1	360508.91016	192085.21848	Ballenger Creek
1107309	Pipe Outfall	5	1	1	360511.63501	192080.22292	Ballenger Creek
1107310	Pipe Outfall	5	1	1	360509.36430	192077.49807	Ballenger Creek
1108303	Inadequate Buffer	2	4	4	361269.48412	192112.69229	Ballenger Creek
1108304	Erosion Site	2	3	4	361288.48356	192031.62088	Ballenger Creek
1108304	Unusual Condition/Comment	3	3	3	361290.61235	192029.35017	Ballenger Creek
1108305	Representative Site				361456.94178	191861.31771	Ballenger Creek
1108306	Erosion Site	3	3	3	361481.98631	191856.20411	Ballenger Creek
1108307	Pipe Outfall	5	1	1	361513.14183	191841.44901	Ballenger Creek
1108308	Pipe Outfall	5	1	1	361506.32970	191834.63688	Ballenger Creek
1108309	Fish Barrier	4	5	1	361544.93175	191804.54999	Ballenger Creek
1108310	Pipe Outfall	5	1	1	361534.14589	191807.95605	Ballenger Creek
1108311	Pipe Outfall	5	1	1	361540.95801	191811.92979	Ballenger Creek
1108312	Erosion Site	4	2	3	361559.12369	191793.76412	Ballenger Creek
1108313	Pipe Outfall	5	1	1	361570.47723	191785.24896	Ballenger Creek
1108315	Exposed Pipe	3	4	3	361626.27813	191744.32520	Ballenger Creek
1108316	Exposed Pipe	3	4	3	361630.71311	191741.66421	Ballenger Creek
1108317	Erosion Site	3	3	4	361641.72185	191734.44749	Ballenger Creek
1108318	Inadequate Buffer	1	4	4	361775.41964	191712.94969	Ballenger Creek
1108414	Unusual Condition/Comment	4	2	1	361564.23278	191790.92574	Ballenger Creek
1110101	Inadequate Buffer	1	3	1	363060.84673	192202.33235	Ballenger Creek
1205201	Inadequate Buffer	3	4	3	358884.52321	192363.52164	Ballenger Creek
1205202	Representative Site				358782.51870	192401.66245	Ballenger Creek
1205203	Erosion Site	3	4	4	358438.52972	192583.65549	Ballenger Creek
1205204	Erosion Site	3	5	5	359158.05945	192595.02328	Ballenger Creek
1205205	Inadequate Buffer	2	5	5	359069.32832	192471.26754	Ballenger Creek
1208301	Inadequate Buffer	5	2	1	361151.11366	192503.27058	Ballenger Creek
1208302	Erosion Site	5	2	3	361234.15814	192281.80663	Ballenger Creek
1304201	Inadequate Buffer	5	4	2	358032.21510	192954.21602	Ballenger Creek
1304202	Inadequate Buffer	5	3	4	357741.72402	193149.35507	Ballenger Creek
1304203	Inadequate Buffer	5	3	4	357787.18255	193119.41897	Ballenger Creek

Location	Problem	Severity	Correctibility	Access		Y Coordinates	Stream
1304204	Erosion Site	4	4	4	357695.15675	193200.35732	Ballenger Creek
1305201	Inadequate Buffer	2	3	4	358928.08074	193231.40217	Ballenger Creek
1305202	Fish Barrier	4	2	3	358932.51572	193086.15663	Ballenger Creek
1306201	Representative Site				359280.66152	192859.97273	Ballenger Creek
1306202	Fish Barrier	4	3	4	359532.34654	193128.28892	Ballenger Creek
1306203	Channel Alteration	3	4	4	359598.87122	193220.31473	Ballenger Creek
1307301	Fish Barrier	5	2	1	360279.64040	192928.71490	Ballenger Creek
1307301	Unusual Condition/Comment	4	5	1	360280.21830	192931.61217	Ballenger Creek
1307302	Erosion Site	3	2	2	360281.85789	192919.84494	Ballenger Creek
1307303	Inadequate Buffer	2	3	3	360288.55048	192898.99252	Ballenger Creek
1307319	Inadequate Buffer	3	2	2	360266.26423	192964.23484	Ballenger Creek
1307320	Erosion Site	3	3	2	360257.29190	192983.65343	Ballenger Creek
1307321	Pipe Outfall	5	1	1	360241.94309	193019.63195	Ballenger Creek
1307322	Pipe Outfall	3	1	1	360246.37806	193014.08823	Ballenger Creek
1307323	Pipe Outfall	3	3	2	360215.33322	193188.16113	Ballenger Creek
1307324	Representative Site				360220.87694	193077.28667	Ballenger Creek
1403417	Erosion Site	3	3	4	357308.06240	193841.53927	Ballenger Creek
1403418	Trash Dumping	3	2	4	357321.50982	193836.46311	Ballenger Creek
1405201	Representative Site				358905.90585	193431.77134	Ballenger Creek
1405202	Erosion Site	4	4	3	358912.02850	193398.50900	Ballenger Creek
1503415	Inadequate Buffer	4	3	4	356987.77769	193900.45669	Ballenger Creek
1503416	Representative Site				356999.51583	193898.67019	Ballenger Creek
1504412	Erosion Site	4	3	3	357874.77337	194276.32111	Ballenger Creek
1603405	Erosion Site	3	3	5	357218.87839	194905.20450	Ballenger Creek
1603406	Inadequate Buffer	3	3	2	357257.63008	194886.13312	Ballenger Creek
1603407	Representative Site				357343.68471	194841.46725	Ballenger Creek
1603408	Unusual Condition/Comment	5	1	1	357372.51207	194821.50984	Ballenger Creek
1603409	Pipe Outfall	4	3	2	357389.14324	194798.22621	Ballenger Creek
1603410	Pipe Outfall	4	2	2	357405.77441	194793.79123	Ballenger Creek
1604411	Fish Barrier	2	4	1	357512.30270	194718.58964	Ballenger Creek
1703401	Inadequate Buffer	4	2	1	356874.68574	195372.55591	Ballenger Creek
1703402	Pipe Outfall	5	3	2	356926.79674	195236.18032	Ballenger Creek
1703403	Fish Barrier	3	3	2	356919.03553	195230.63660	Ballenger Creek
1703404	Trash Dumping	2	2	1	356926.79674	195137.50205	Ballenger Creek

Appendix B

Listing of sites by problem category

Pipe Outfalls

Note: Please see the Methods Section-Overall Rating System (page 9) for discussion of severity, correctibility, and access ratings

Problem	Location	Outfall Type	Pipe Type	Location of Pipe	Diameter (in)	Channel Width	Discharge	Color	Odor	Severity	Correctibility	Access
Pipe Outfall	0410201	Stormwater	Plastic	Left Bank	10	1	Yes	Clear	None	4	5	2
Pipe Outfall	0708305	Unknown	Plastic	Right Bank	6		Yes	Clear	None	4	1	2
Pipe Outfall	0709307	Stormwater	Concrete Pipe	Right Bank	48		Yes	Clear	None	4	4	1
Pipe Outfall	0710315	Stormwater	Concrete Pipe	Left Bank	24	0	Yes	Clear	None	4	3	1
Pipe Outfall	0806403	Stormwater	Smooth Metal Pipe	Right Bank	24		Yes	Clear	None	5	1	1
Pipe Outfall	0806404	Stormwater	Corrugated Metal	Right Bank	24		Yes	Clear	None	5	1	1
Pipe Outfall	0807405	Stormwater	Smooth Metal Pipe	Right Bank	18		Yes	Clear	None	5	1	1
Pipe Outfall	0810211	Stormwater	Concrete Pipe	Left Bank	16	3	No			5	5	1
Pipe Outfall	0810213	Stormwater	Concrete Channel	Right Bank	14	3	No			5	5	1
Pipe Outfall	0810214	Stormwater	Concrete Pipe	Left Bank	12	3	No			5	5	2
Pipe Outfall	0810216	Stormwater	Plastic	Left Bank	6	1	No			5	4	1
Pipe Outfall	0905203	Unknown	Plastic	Right Bank	2		No			3	3	4
Pipe Outfall	0905204	Unknown	Plastic	Right Bank	4		No			4	3	4
Pipe Outfall	0905423	Stormwater	Smooth Metal Pipe	Right Bank	6	7	Yes	Clear	None	3	3	1
Pipe Outfall	0906404	Other	Smooth Metal Pipe	Right Bank	8	5	Yes	Clear	None	4	3	3
Pipe Outfall	0907101	Stormwater	Concrete Pipe	Left Bank	18		No			5	1	1
Pipe Outfall	0907318	Stormwater	Concrete Channel	Right Bank		2.5	No			4	1	1
Pipe Outfall	0908101	Stormwater	Concrete Pipe	Left Bank	36		Yes	Clear	None	4	1	2
Pipe Outfall	0909324	Stormwater	Plastic	Left Bank	6		Yes	Clear	None	3	3	3
Pipe Outfall	0910103	Stormwater	Concrete Pipe	Left Bank	24		No			4	1	1
Pipe Outfall	0911201	Stormwater	Corrugated Metal	Right Bank	18	2.5	No			4	5	1
Pipe Outfall	0911203	Stormwater	Rip-Rap	Right Bank		2	No			4	5	1
Pipe Outfall	0911204	Stormwater	Other	Right bank		4	No			4	5	1
Pipe Outfall	0911207	Stormwater	Corrugated Metal	Right Bank	36	1	No			5	5	2
Pipe Outfall	0911208	Stormwater	Concrete Pipe	Right Bank		36	No			4	5	1
Pipe Outfall	1007315	Stormwater	Concrete Channel	Right Bank		3	Yes	Clear	None	5	1	1
Pipe Outfall	1007316	Stormwater	Concrete Channel	Left Bank		3	Yes	Clear	None	3	3	1

Problem	Location	Outfall Type	Pipe Type	Location of Pipe	Diameter (in)	Channel Width	Discharge	Color	Odor	Severity	Correctibility	Access
Pipe Outfall	1010101	Stormwater	Concrete Pipe	Right Bank	36	2	Yes	Clear	None	4	1	1
Pipe Outfall	1010103	Stormwater	Concrete Pipe	Left Bank	24		No			5	1	1
Pipe Outfall	1010104	Stormwater	Concrete Pipe	Right Bank	24	31	Yes	Clear	None	4	1	1
Pipe Outfall	1011201	Stormwater	Corrugated Metal	Head of Stream	18	10	No			4	5	1
Pipe Outfall	1011203	Stormwater	Rip-Rap	Right Bank		3	No			5	4	1
Pipe Outfall	1103401	Unknown	Concrete Channel	Head of Stream	36	7	Yes	Clear	None	4	2	2
Pipe Outfall	1104104	Unknown	Concrete Pipe	Left Bank	12		Yes	Orange	None	2	3	1
Pipe Outfall	1107305	Stormwater	Corrugated Metal	Right Bank	12		No			5	1	1
Pipe Outfall	1107306	Stormwater	Corrugated Metal	Right Bank	10		No			5	1	1
Pipe Outfall	1107308	Stormwater	Smooth Metal Pipe	Right Bank	6		Yes	Clear	None	5	1	1
Pipe Outfall	1107309	Stormwater	Corrugated Metal	Under Road	18		Yes	Clear	None	5	1	1
Pipe Outfall	1107310	Stormwater	Corrugated Metal	Left Bank	18		Yes	Clear	None	5	1	1
Pipe Outfall	1108307	Stormwater	Concrete Channel	Left Bank		1.5	No			5	1	1
Pipe Outfall	1108308	Stormwater	Concrete Channel	Right Bank		1.5	No			5	1	1
Pipe Outfall	1108310	Stormwater	Rip-Rap	Right Bank		3.5	No			5	1	1
Pipe Outfall	1108311	Stormwater	Rip-Rap	Left Bank		3.5	No			5	1	1
Pipe Outfall	1108313	Stormwater	Plastic	Right Bank	18		Yes	Clear	None	5	1	1
Pipe Outfall	1307321	Stormwater	Smooth Metal Pipe	Left Bank	4		No			5	1	1
Pipe Outfall	1307322	Stormwater	Plastic	Left Bank	2		Yes	Clear	None	3	1	1
Pipe Outfall	1307323	Stormwater	Concrete Pipe	Head of Stream	36		Yes	Clear	None	3	3	2
Pipe Outfall	1603409	Stormwater	Corrugated Metal	Left Bank	30		Yes	Clear	None	4	3	2
Pipe Outfall	1603410	Stormwater	Smooth Metal Pipe	Left Bank	3		Yes	Clear	None	4	2	2
Pipe Outfall	1703402	Stormwater	Corrugated Metal	Right Bank	36		Yes	Clear	None	5	3	2

Inadequate Buffers

Note: Please see the Methods Section-Overall Rating System (page 9) for discussion of severity, correctibility, and access ratings. For wetland rating 1=best wetland potential, 5=worst wetland potential

Problem	Location	Sides	Unshaded	Width Left (ft)	Width Right (ft)	Length Left (ft)	Length Right (ft)	LandUseLeft	LandUse Right	Recentlyestablished	Livestock	Severity	Correctibility	Access	Wetland
Inadequate Buffer	0511201	Both	Both	0	0	1475	1475	Crop Field	Crop Field	No	Cattle	1	4	3	2
Inadequate Buffer	0603402	Both	Neither	10	10	1705	1705	Crop Field	Crop Field	No	No	3	2	2	4
Inadequate Buffer	0605102	Both	Neither	0	0	1520	1520	Pasture	Shrubs & Small Trees	No	No	1	1	3	5
Inadequate Buffer	0605103	Both	Both	0	0	560	560	Pasture	Pasture	No	No	5	1	1	5
Inadequate Buffer	0606101	Left	Neither	30	0	4825	4825	Pasture	Forest	No	No	4	3	2	1
Inadequate Buffer	0608101	Left	Left	0		552		Pasture	Forest	Yes	No	5	1	3	4
Inadequate Buffer	0608301	Both	Both	0	0	5100	5100	Pasture	Pasture	No	No	1	5	3	5
Inadequate Buffer	0707102	Left	Left	0		2396		Pasture	Forest	No	No	1	1	2	4
Inadequate Buffer	0710314	Both	Neither	10	15	1070	1070	Lawn	Shrubs & Small Trees	No	No	3	3	3	5
Inadequate Buffer	0710317	Both	Both	0	0	606	606	Pasture	Pasture	No	No	1	3	2	1
Inadequate Buffer	0803101	Both	Neither	10	20	2035	2035	Shrubs & Small Trees	Shrubs & Small Trees	No	No	5	2	2	5
Inadequate Buffer	0804101	Left	Neither	4	30	5224		Pasture	Forest	No	Horses	3	2	2	5
Inadequate Buffer	0806201	Both	Both	0	0	1931	1931	Crop Field	Crop Field	No	No	1	4	4	4
Inadequate Buffer	0806401	Right	Right		10		1100	Forest	Road	No	No	3	2	3	3
Inadequate Buffer	0808102	Left	Neither	5		1407		Shrubs & Small Trees	Forest	No	No	3	1	4	4
Inadequate Buffer	0810210	Both	Right	5	0	1049	1049	Lawn	Lawn	Yes	No	4	3	2	1
Inadequate Buffer	0810212	Both	Both	2	2	845	845	Lawn	Lawn	No	No	3	3	2	1
Inadequate Buffer	0810215	Both	Both			1300	1300	Lawn	Lawn	No	No	4	3	2	1
Inadequate Buffer	0903104	Left	Neither	3		65		Lawn	Forest	No		5	1	3	2
Inadequate Buffer	0905201	Both	Neither	6	3	2275	2275	Pasture	Lawn	No	No	1	5	4	4
Inadequate Buffer	0907102	Left	Neither	20		1028		Forest	Forest	No	No	5	1	1	5
Inadequate Buffer	1004419	Both	Both	10	10	4303	4303	Pasture	Pasture	No	No	2	4	3	5
Inadequate Buffer	1005203	Both	Both	7	10	3130	3130	Pasture	Pasture	No	No	2	5	4	3

Problem	Location	Sides	Unshaded	Width Left (ft)	Width Right (ft)	Length Left (ft)	Length Right (ft)	LandUseLeft	LandUse Right	Recentlyestablished	Livestock	Severity	Correctibility	Access	Wetland
Inadequate Buffer	1006401	Both	Both	3	3	3283	3283	Crop Field	Crop Field	No	No	2	4	4	4
Inadequate Buffer	1103408	Both	Neither	5	10	2366	2366	Pasture	Pasture	No	Cattle	2	4	3	5
Inadequate Buffer	1104102	Both	Neither	15	25	3334	3334	Crop Field	Pasture	No	Cattle	2	3	2	5
Inadequate Buffer	1106201	Both	Right	7	0	2519	2519	Pasture	Pasture	No	No	1	5	4	3
Inadequate Buffer	1108303	Both	Both	0	0	1350	1350	Shrubs & Small Trees	Pasture	No	No	2	4	4	5
Inadequate Buffer	1108318	Both	Both	25	25	7769	7769	Shrubs & Small Trees	Shrubs & Small Trees	No	No	1	4	4	5
Inadequate Buffer	1110101	Both	Both	0	0	7987	7987	Lawn	Subdivision	No	No	1	3	1	5
Inadequate Buffer	1205201	Both	Neither	10	15	432	432	Pasture	Pasture	No	No	3	4	3	2
Inadequate Buffer	1205205	Both	Both	10	10	4002	4002	Pasture	Pasture	No	No	2	5	5	3
Inadequate Buffer	1208301	Both	Both	0	0	782	782	Crop Field	Lawn	No	No	5	2	1	2
Inadequate Buffer	1304201	Right	Neither	50	10	1047	1047	Shrubs & Small Trees	Lawn	No	No	5	4	2	2
Inadequate Buffer	1304202	Left	Left	0	50	190		Lawn	Forest	No	No	5	3	4	3
Inadequate Buffer	1304203	Both	Both	0	0	376	376	Lawn	Lawn	No	No	5	3	4	3
Inadequate Buffer	1305201	Both	Neither	24	20	2567	2567	Pasture	Lawn	No	No	2	3	4	2
Inadequate Buffer	1307303	Both	Both	0	0	6731	6731	Pasture	Pasture	No	Cattle	2	3	3	2
Inadequate Buffer	1307319	Both	Both	0	2	1240	1240	Lawn	Lawn	No	No	3	2	2	5
Inadequate Buffer	1503415	Both	Both	10	10	4774	4774	Shrubs & Small Trees	Shrubs & Small Trees	No	No	4	3	4	5
Inadequate Buffer	1603406	Left	Left	0	50	1138	1138	Lawn	Forest	No	No	3	3	2	4
Inadequate Buffer	1703401	Both	Both	0	0	508	508	Pasture	Pasture	No	No	4	2	1	1

Fish Passage Barriers

Note: Please see the Methods Section-Overall Rating System (page 9) for discussion of severity, correctibility, and access ratings

Problem	Location	Blockage	Type	Reason	Drop (In)	Depth (In)	Severity	Correctibility	Access
Fish Barrier	0603404	Partial	Debris Dam	Too High	5		4	1	2
Fish Barrier	0605104	Partial	Debris Dam	Too High	36		4	1	2
Fish Barrier	0606103	Partial	Debris Dam	Too High	36		3	1	3
Fish Barrier	0710316	Total	Road Crossing	Too High	9		2	3	2
Fish Barrier	0710318	Partial	Road Crossing	Too Shallow		2	2	3	1
Fish Barrier	0803102	Partial	Debris Dam	Too High	48		5	2	2
Fish Barrier	0803103	Partial	Natural Falls	Too High	30		5	1	4
Fish Barrier	0804102	Partial	Debris Dam	Too High	60		4	1	3
Fish Barrier	0806407	Total	Road Crossing	Too High	12		3	3	1
Fish Barrier	0807102	Partial	Debris Dam	Too High	60		2	2	1
Fish Barrier	0809325	Total	Other	Too Shallow		0	3	2	1
Fish Barrier	0903102	Total	Road Crossing	Too Shallow		0.5	3	1	1
Fish Barrier	0903103	Partial	Debris Dam	Too High	30		5	1	2
Fish Barrier	0907317	Total	Road Crossing	Too High	4		3	5	2
Fish Barrier	0911206	Total	Dam	Too High	24		3	5	2
Fish Barrier	1002101	Total	OTHER	Too High	24		3	1	1
Fish Barrier	1003101	Partial	Debris Dam	Too High	36		4	1	4
Fish Barrier	1004411	Total	Road Crossing	Too High	6		3	3	1
Fish Barrier	1004413	Total	Natural Falls	Too Fast			4	3	1
Fish Barrier	1004414	Total	Road Crossing	Too High	30		2	4	1
Fish Barrier	1004415	Total	Road Crossing	Too High	6		3	3	1
Fish Barrier	1004417	Total	Natural Falls	Too High/Too Fast	12		4	4	1
Fish Barrier	1007312	Total	Natural Falls	Too High	8		5	1	3
Fish Barrier	1007313	Partial	Natural Falls	Too High	12		5	1	4
Fish Barrier	1007314	Partial	Natural Falls	Too High	5		5	1	4
Fish Barrier	1009320	Total	Instream Pond	Too High	8		3	3	1

Problem	Location	Blockage	Type	Reason	Drop (In)	Depth (In)	Severity	Correctibility	Access
Fish Barrier	1009321	Total	Road Crossing	Too High	8		3	4	1
Fish Barrier	1103402	Total	Natural Falls	Too High	8		5	1	2
Fish Barrier	1103403	Total	Natural Falls	Too High	11		5	1	2
Fish Barrier	1103407	Total	Natural Falls	Too High	12		4	2	3
Fish Barrier	1104103	Total	Road Crossing	Too High	120		3	3	1
Fish Barrier	1104105	Total	Debris Dam	Too High	6		5	1	3
Fish Barrier	1108309	Total	Road Crossing	Too High	6		4	5	1
Fish Barrier	1305202	Partial	Debris Dam	Too High	48		4	2	3
Fish Barrier	1306202	Partial	Debris Dam	Too Shallow		3	4	3	4
Fish Barrier	1307301	Total	Road Crossing	Too High/Too Shallow	24	0.5	5	2	1
Fish Barrier	1604411	Total	Road Crossing	Too High	36		2	4	1
Fish Barrier	1703403	Total	Road Crossing	Too High	24		3	3	2

Erosion Sites

Note: Please see the Methods Section-Overall Rating System (page 9) for discussion of severity, correctibility, and access ratings

Problem	Location	Type	Possible Cause	Length (ft)	Height (ft)	Landuseleft	Landuseright	Infrastructure Threatened?	Describe	Severity	Correctibility	Access
Erosion Site	0603403	Downcutting	Inadequate Buffer	1446	3.5	Pasture	Crop Field	Yes	Sheds may soon fall into water	3	2	3
Erosion Site	0605101	Widening	Below Road Crossing	9208	3	Pasture	Shrubs & Small Trees	No		3	4	2
Erosion Site	0702401	Widening	Bend at Steep Slope	3728	1.5	Forest	Forest	No		4	3	4
Erosion Site	0708302	Widening	Land use change upstream	10343	5	Pasture	Pasture	No		1	5	3
Erosion Site	0709309	Widening	Unknown	233	3	Pasture	Pasture	No		4	3	3
Erosion Site	0806402	Widening	Bend at Steep Slope	1832	2	Forest	Road	Yes	Maybe Possible Damage to Road	2	4	1
Erosion Site	0808101	Widening	Unknown	6414	6	Shrubs & Small Trees	Forest	No		2	4	3
Erosion Site	0903101	Widening	Below Road	162	6	Forest	Paved	No		4	3	1
Erosion Site	0904420	Widening	Bend at steep slope	4174	4	Pasture	Pasture	No		2	4	4
Erosion Site	0905202	Widening	Land Use Change Upstream	3824	3	Crop Field	Crop Field	No		4	4	5
Erosion Site	0907103	Widening	Below Road Crossing	1546	6	Shrubs & Small Trees	Forest	No		4	2	2
Erosion Site	0911205	Down cutting	Below road crossing	30	1	Lawn	Lawn	Yes	Path	5	2	1
Erosion Site	1003102	Widening	Other	70		Forest	Forest	No		2	3	4
Erosion Site	1004410	Widening	Bend at steep slope	300	3	Lawn	Pasture	No		4	2	2
Erosion Site	1004412	Widening	Bend at steep slope	1148	3	Forest	Lawn	No		3	3	3
Erosion Site	1005202	Widening	Land Use Change Upstream	1887	4	Pasture	Pasture	No		3	5	4
Erosion Site	1006402	Widening	Other-crops	3290	4	Crop field	Crop field	No		2	4	4
Erosion Site	1009322	Widening	Below Road Crossing	2024	1	Lawn	Lawn	No		3	4	1
Erosion Site	1103406	Widening	Bend at steep slope	200	3	Forest	Forest	No		4	2	3
Erosion Site	1107307	Widening	Pipe Outfall	4397	3	Shrubs & Small Trees	Paved	Yes	Parking lot is being eroded and fence is falling	3	4	1
Erosion Site	1108304	Down cutting	Pond discharge	569	8	Shrubs & Small Trees	Pasture	No		2	3	4
Erosion Site	1108306	Widening	Bend at Steep Slope	128	6	Crop Field	Pasture	No		3	3	3

Problem	Location	Type	Possible Cause	Length (ft)	Height (ft)	Landuseleft	Landuseright	Infrastructure Threatened?	Describe	Severity	Correctibility	Access
Erosion Site	1108312	Widening	Bend at Steep Slope	223	3	Shrubs & Small Trees	Shrubs & Small Trees	No		4	2	3
Erosion Site	1108317	Widening	Bend at steep slope	1429	2	Forest	Shrubs & Small Trees	No		3	3	4
Erosion Site	1205203	Down cutting	Bend at Steep Slope	30	20	Forest	Forest	No		3	4	4
Erosion Site	1205204	Widening	Livestock	2656	2	Pasture	Pasture	N		3	5	5
Erosion Site	1208302	Widening	Unknown	500	3	Shrubs & Small Trees	Shrubs & Small Trees	No		5	2	3
Erosion Site	1304204	Widening	Land use change Upstream	1937		Forest	Forest	No		4	4	4
Erosion Site	1307302	Downcutting	Below Road Crossing	1130		Pasture	Pasture	No		3	2	2
Erosion Site	1307320	Downcutting	Land Use Change Upstream	545	4.5	Lawn	Pasture	No		3	3	2
Erosion Site	1403417	Widening	Bend at Steep Slope	3560	2	Forest	Forest	No		3	3	4
Erosion Site	1405202	Downcutting	Bend at Steep Slope	40	5	Shrubs & Small Trees	Shrubs & Small Trees	No		4	4	3
Erosion Site	1504412	Widening	Bend at Steep Slope	3104	4	Pond	Forest	No		4	3	3
Erosion Site	1603405	Widening	Bend at Steep Slope	1280	3	Forest	Forest	N		3	3	5

Unusual Conditions/Comments

Note: Please see the Methods Section-Overall Rating System (page 9) for discussion of severity, correctibility, and access ratings

Problem	Location	Type	Describe	Description	Potential Cause	Severity	Correctibility	Access
Unusual Condition/Comment	0510202	Unusual Condition	Algae	Excessive algae in stream	Lack of oxidation/stream flow	4	5	3
Unusual Condition/Comment	0608304	Comment	Tree planting	Tree planting done last year		5	1	1
Unusual Condition/Comment	0710315	Unusual Condition	Erosion	High headcut forming, outfall needs to be stabilized	Pipe outfall	2	3	1
Unusual Condition/Comment	0905422	Unusual Condition	Algae	Algae growth w/metallic shine & red sediment	Run off from surrounding fields	2	3	3
Unusual Condition/Comment	0906201	Unusual Condition	Car	Car in the middle of the stream	Flooding	1	5	4
Unusual Condition/Comment	0911202	Unusual Condition	Stream	No flow between 2 stormwater ponds	Stream could be underground	3	5	1
Unusual Condition/Comment	1009323	Unusual Condition	Algae	Excessive algae in stream	Excess nutrients from area lawns	4	3	2
Unusual Condition/Comment	1010102	Unusual Condition	Stream	Streambed sodded over for 600 feet	Development	4	1	1
Unusual Condition/Comment	1107304	Unusual Condition	Erosion	Erosion ditch with some stream dumping		3	2	2
Unusual Condition/Comment	1108304	Comment	Erosion	Pond drainage attempts failed causing erosion		3	3	3
Unusual Condition/Comment	1108414	Unusual Condition	Erosion	Run off causing debris to gather/cause erosion		4	2	1
Unusual Condition/Comment	1307301	Comment	Road	Road culver is collapsing		4	5	1
Unusual Condition/Comment	1603408	Unusual Condition	Retaining Wall	Cement wall on banks to prevent erosion		5	1	1

Channel Alteration

Note: Please see the Methods Section-Overall Rating System (page 9) for discussion of severity, correctibility, and access ratings

Problem	Location	Type	Bottom Width (in)	Length (ft)	Perennial Flow	Sedimentation	Veg in Channel	Road Crossing	Length Above (ft)	Length Below (ft)	Severity	Correctibility	Access
Channel Alteration	0510204	Rip-Rap	360	20	Yes	Yes	No	No			4	5	3
Channel Alteration	0710310	Concrete	180	15	Yes	No	No	No			5	3	3
Channel Alteration	0711201	Rip-Rap	300	100	Yes	Yes	Yes	No			2	5	3
Channel Alteration	0810209	Rip-Rap	36	650	No	Yes	Yes	Below		650	3	5	1
Channel Alteration	0910102	Rip-Rap	48	800	No	No	Yes	No			3	3	2
Channel Alteration	1005201	Cinder Block	6	75	Yes	Yes	Yes	Below		200	5	3	3
Channel Alteration	1011202	Rip-Rap	30	100	No	Yes	Yes	Below		100	3	5	1
Channel Alteration	1306203	Rip-Rap	5	7	Yes	Yes	Yes	No			3	4	4

Trash Dumping Sites

Note: Please see the Methods Section-Overall Rating System (page 9) for discussion of severity, correctibility, and access ratings

Problem	Location	Type	Truckloads	Other measure	Extent	Volunteer Project?	Owner Type	Severity	Correctibility	Access
Trash Dumping	0606104	Residential	1		Small Site	Yes	Private	5	1	1
Trash Dumping	0706101	Residential		6 Dump Trucks	Small Site	Yes	Private	4	3	1
Trash Dumping	0906403	Farm	4		Small Site	Yes	Private	3	2	4
Trash Dumping	1107304	Residential	2		Large Area	Yes	Private	5	2	1
Trash Dumping	1403418	Residential	2		Large Area	Yes	Private	3	2	4
Trash Dumping	1703404	Residential	3.5		Small Site	Yes	Private	2	2	1

Exposed Pipe

Note: Please see the Methods Section-Overall Rating System (page 9) for discussion of severity, correctibility, and access ratings

Problem	Location	Location of Pipe	Type	Diameter (in)	Length (ft)	Purpose	Discharge	Color	Odor	Severity	Correctibility	Access
Exposed Pipe	1004416	Exposed across bottom of stream	Smooth Metal	6	10	Unknown	No			4	2	1
Exposed Pipe	1103404	Exposed across bottom of stream	Plastic	6	15	Unknown	No			4	4	3
Exposed Pipe	1108315	Exposed across bottom of stream	Smooth Metal	4	8	Unknown	No			3	4	3
Exposed Pipe	1108316	Exposed across bottom of stream	Smooth Metal	2	3	Unknown	No			3	4	3

Representative Sites A

Problem	Location	Substrate	Embeddedness	Shelter for Fish	Channel Alteration	Sediment Deposition	Velocity/Depth	Flow	Vegetation	Bank Condition	Riparian Vegetation
Representative Site	0510201	Poor	Poor	Suboptimal	Optimal	Optimal	Poor	Optimal	Suboptimal	Optimal	Optimal
Representative Site	0606102	Marginal	Poor	Marginal	Optimal	Poor	Optimal	Optimal	Suboptimal	Suboptimal	Optimal
Representative Site	0608303	Optimal	Optimal	Marginal	Optimal	Optimal	Optimal	Optimal	Marginal	Suboptimal	Poor
Representative Site	0610312	Poor	Poor	Marginal	Optimal	Optimal	Marginal	Optimal	Marginal	Marginal	Marginal
Representative Site	0707101	Marginal	Marginal	Suboptimal	Optimal	Marginal	Suboptimal	Suboptimal	Suboptimal	Marginal	Optimal
Representative Site	0707103	Suboptimal	Marginal	Marginal	Optimal	Marginal	Optimal	Optimal	Optimal	Suboptimal	Optimal
Representative Site	0709306	Suboptimal	Suboptimal	Marginal	Optimal	Marginal	Optimal	Optimal	Marginal	Marginal	Poor
Representative Site	0711202	Poor	Marginal	Marginal	Optimal	Marginal	Optimal	Optimal	Suboptimal	Marginal	Suboptimal
Representative Site	0806406	Suboptimal	Suboptimal	Marginal	Optimal	Suboptimal	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal
Representative Site	0807101	Suboptimal	Suboptimal	Optimal	Optimal	Suboptimal	Optimal	Optimal	Optimal	Suboptimal	Optimal
Representative Site	0903105	Optimal	Suboptimal	Suboptimal	Optimal	Suboptimal	Optimal	Optimal	Suboptimal	Optimal	Suboptimal
Representative Site	0905205	Optimal	Suboptimal	Optimal	Optimal	Suboptimal	Optimal	Optimal	Marginal	Suboptimal	Poor
Representative Site	0905421	Suboptimal	Marginal	Marginal	Optimal	Suboptimal	Suboptimal	Optimal	Suboptimal	Suboptimal	Marginal
Representative Site	0906405	Suboptimal	Suboptimal	Suboptimal	Optimal	Suboptimal	Suboptimal	Optimal	Suboptimal	Suboptimal	Marginal
Representative Site	1002102	Optimal	Suboptimal	Optimal	Optimal	Suboptimal	Optimal	Optimal	Optimal	Suboptimal	Optimal
Representative Site	1004418	Optimal	Suboptimal	Marginal	Optimal	Suboptimal	Optimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal
Representative Site	1009319	Poor	Poor	Poor	Suboptimal	Suboptimal	Suboptimal	Optimal	Suboptimal	Suboptimal	Suboptimal
Representative Site	1103405	Optimal	Optimal	Suboptimal	Optimal	Optimal	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal
Representative Site	1103409	Optimal	Optimal	Suboptimal	Optimal	Optimal	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal
Representative Site	1104101	Suboptimal	Marginal	Optimal	Optimal	Suboptimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
Representative Site	1108305	Optimal	Marginal	Marginal	Optimal	Suboptimal	Suboptimal	Optimal	Marginal	Suboptimal	Marginal
Representative Site	1205202	Marginal	Marginal	Optimal	Optimal	Suboptimal	Optimal	Optimal	Marginal	Marginal	Suboptimal
Representative Site	1306201	Poor	Poor	Poor	Optimal	Suboptimal	Optimal	Optimal	Poor	Poor	Poor
Representative Site	1307324	Marginal	Marginal	Marginal	Optimal	Marginal	Poor	Optimal	Marginal	Poor	Suboptimal
Representative Site	1405201	Suboptimal	Suboptimal	Optimal	Optimal	Suboptimal	Optimal	Optimal	Optimal	Suboptimal	Optimal
Representative Site	1503416	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Marginal	Marginal
Representative Site	1603407	Optimal	Optimal	Suboptimal	Marginal	Optimal	Optimal	Optimal	Marginal	Marginal	Marginal

Representative Sites B

Problem	Location	Width Riffle	Width Run	Width Pool	Depth Riffle	Depth Run	Depth Pool	Bottom Type
Representative Site	0510201		8	36		2	3	Silts
Representative Site	0606102	144	36	72	2	18	36	Silts
Representative Site	0608303	200	167	450	9	11	48	Cobble
Representative Site	0610312		300			72		Silts
Representative Site	0707101		120	120		18	30	Gravel
Representative Site	0707103	180	36	36	3	12	12	Gravel
Representative Site	0709306	200	200	272	8	13	24	Gravel
Representative Site	0711202	15	20	12	2	4	6	Silts
Representative Site	0806406	48	84	100	20	24	44	Cobble
Representative Site	0807101	72	60	72	3	10	36	Silts
Representative Site	0903105	48	36	24	1	24	36	Cobble
Representative Site	0905205	76	110	150	12	20	21	Cobble
Representative Site	0905421	24	18	48	7	8	24	Gravel
Representative Site	0906405	12	30	36	4	5	14	Cobble
Representative Site	1002102	36	48	60	2	8	24	Cobble
Representative Site	1004418	24	72	48	5	12	24	Gravel
Representative Site	1009319	36	40	80	4	6	12	Silts
Representative Site	1103405	8	4	12	6	7	6	Cobble
Representative Site	1103409	36	48	60	6	8	18	Cobble
Representative Site	1104101	48	36	144	3	12	36	Silts
Representative Site	1108305	24	60	12	1	4	3	Gravel
Representative Site	1205202	36	36	60	6	12	18	Cobble
Representative Site	1306201	0	8	6	0	6	4	Silts
Representative Site	1307324	24	10	42	2	4	12	Gravel
Representative Site	1405201	30	45	55	7	15	25	Cobble
Representative Site	1503416	18	48	72	3	4	15	Gravel
Representative Site	1603407	28	36	42	2	4	6	Gravel