# AN ASSESSMENT OF STORMWATER MANAGEMENT RETROFIT AND STREAM RESTORATION OPPORTUNITIES IN BALLENGER CREEK WATERSHED, FREDERICK COUNTY, MARYLAND

**Prepared for**

**Frederick County**
**Division of Public Works**
**118 North Market Street**
**Frederick, Maryland 21701-5422**

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**9200 Rumsey Road**
**Columbia, Maryland 21045**

**August 2005**

Versar INC.

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# 1.0 INTRODUCTION

Urban stresses on watershed health and impacts to the quality of a watershed's streams are well documented (Table 1-1). As such, Frederick County continues to sponsor a series of studies in its high priority watersheds to identify watershed restoration projects that could improve and protect water quality and stream conditions. This report documents the findings of the Ballenger Creek watershed restoration study conducted by Versar, Inc., under contract to the Frederick County Division of Public Works (Task Order No. 02-CSC-04-79374).

Table 1-1. Major pollutants (stressors) in urban or suburban areas and their effect on streams (Fairfax County 2001)

| Stressor | Source | Environmental Effect |
|---|---|---|
| Altered Hydrology | Conversion of forested/natural areas to impervious surfaces. Increases amount and rate of surface runoff and erosion. | Overall channel instability, habitat degradation or loss. |
| Nutrients (Nitrogen and Phosphorous) | Improper use (over application) of lawn fertilizers. | Stimulate algae blooms. May reduce sunlight reaching stream bottom, limiting plant growth. Rapid accumulation of dead algae decomposes aerobically, robbing other stream animals of oxygen. |
| Sediment | Poorly managed construction areas, winter road sand, instream erosion, bare soils. | Clogs gills of fish and insects, embeds substrate, reducing available habitat and potential fish spawning areas. |
| Channel Alteration | In very urban areas, concrete, metal and rip-rap stabilization of stream banks. Stream channelization, flood erosion control. | Major habitat reduction/elimination, changes flow regime dramatically. Dramatic alteration of biological communities can cause Thermal Loading and Sediment problems. Transfer erosion potential downstream. |
| Riparian Loss | Development. Clearing or mowing of vegetation all the way up to stream banks. | Increase water temperature, greater pollutant input, less groundwater recharge, greater erosion potential from streambanks. Alters community composition. |
| Toxics | Various. Underground storage tank leakage, surface spills, illegal discharges, chlorine from swimming pool drainage, etc. | Can have an immediate (acute) affect on stream biota if levels are high enough. May be chronic, eliminating the more sensitive species and disrupting ecosystem balance over time. |
| Organic Loading | Sewage leaks, domestic and livestock wastes, yard wastes dumped into streams. | Human health hazard (pathogens), similar oxygen depletion situation as Nutrients. Causes benthic community shift to favor filter feeders as well as organisms with low oxygen requirements. |
| Thermal Loading | Water impoundments (lakes or ponds). Industrial discharges and power plants. Removal of riparian tree cover. Runoff from hot paved surfaces. | Biological community structure altered, shift to species tolerant of higher temperatures, sensitive species lost. Dissolved oxygen depletion. |
| Exotic Species | Human transportation and release (intentional and unintentional). | Invade ecosystem and out compete native species for available resources (food and habitat). Some introduced intentionally to control other pests. |

## 1.1 BALLENGER CREEK WATERSHED STUDY AREA

The Ballenger Creek Watershed in Frederick County, Maryland, is located immediately south of the City of Frederick (Figure 1-1). The headwaters are in the Catoctin Mountains and the watershed drains eastward past the City and the I-270 corridor to the Monocacy River. The western third of the watershed is relatively rural, while the eastern two-thirds contain the County's most heavily developed areas, which have rapidly expanded since the mid-1970s.

Compounding the effects of urbanization, limestone geology underlying the eastern portions of the watershed is easily dissolved by both groundwater and stormwater infiltration. When the underlying limestone bedrock is dissolved, changes in groundwater elevation brought on by drought, groundwater withdraw, and other hydrologic modifications can result in surface collapse, forming karst features such as sinkholes and depressions (Figure 1-2). Additionally, karst geology can result in disappearing streams, intermittent streamflow, and rapid infiltration of surface water (which may contain pollutants) into underlying aquifers.

## 1.2 GOALS AND OBJECTIVES

Building upon previous efforts to assess watershed conditions and stressors affecting Ballenger Creek (Roth et al. 2001, Hunicke and Yetman 2005), the goal of the study was to identify and evaluate specific opportunities for additional stormwater management (SWM) controls and stream restoration that could cost-effectively improve conditions in the Ballenger Creek watershed. Utilizing the methods outlined below, Versar worked in collaboration with County personnel to: 1) use existing information to target efforts and solutions to the most promising areas, 2) conduct field site investigations to refine proposed concepts for solutions, 3) host a public meeting to solicit input from local stakeholders, 4) develop a prioritization of opportunities, and 5) prepare a report containing recommendations and conceptual plans for the best watershed restoration opportunities.

At the outset of this project, the County identified a number of objectives and guidelines, as outlined below:

- To focus primarily on urban stormwater management improvements; however, other opportunities identified in this effort, including agricultural best management practices (BMPs) can be pursued via the County's extensive network of Community Restoration partners.

- The best opportunities for addressing urban stormwater issues will be:

– located on County-controlled land or that originate on private property and impact County-controlled infrastructure

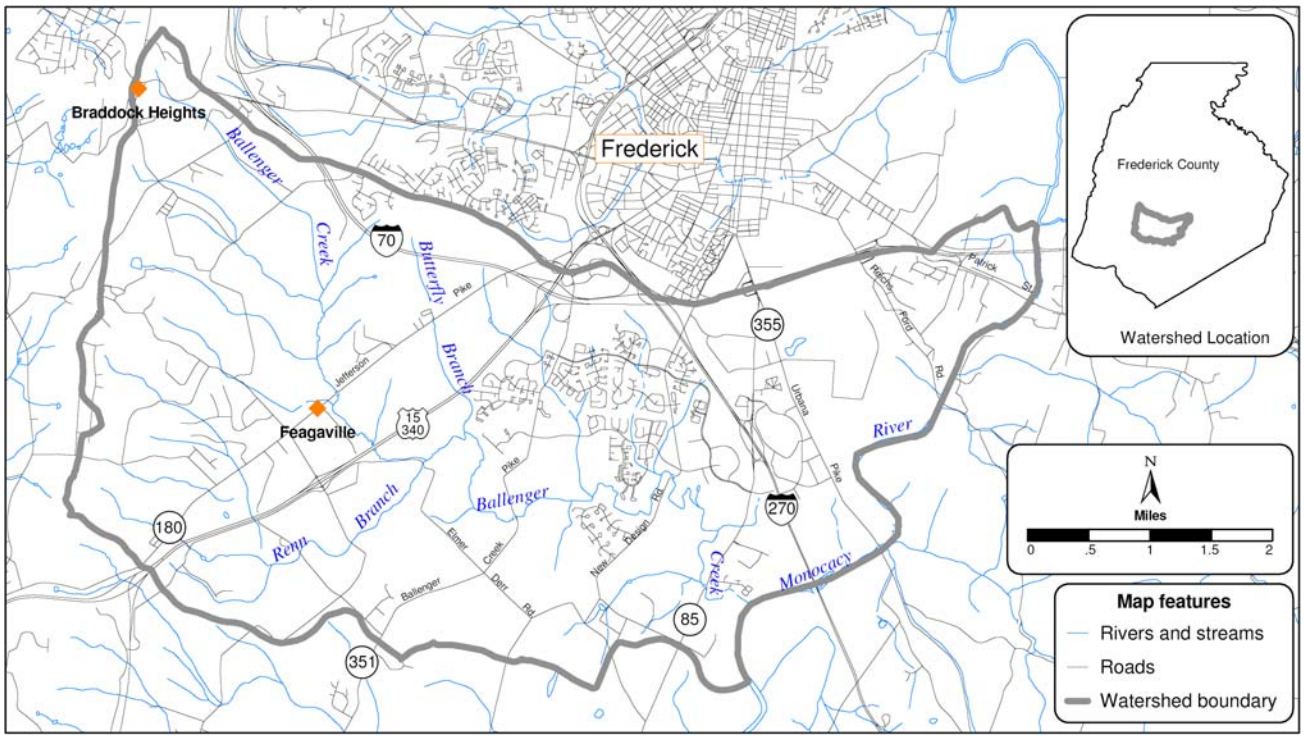


Figure 1-1. Ballenger Creek Watershed, Frederick County, MD

Figure 1-2. Sinkhole repair in the bottom of a stormwater management facility, Gilford Road across from Wal-Mart, July 2000.

  - have synergies with Frederick County's existing Capital Improvement Program (CIP) projects (e.g., Ballenger Creek Trail Project)
  - address or accommodate the genesis of the problem (i.e., increased volume and velocity of stormflow), and
  - have good visibility to encourage public acceptance of new and potentially innovative restoration measures.
- To incorporate public input into the problem identification and site selection process.
- Selected projects will likely be implemented through the County's CIP, which has minimum project requirements, namely projects must cost greater than $100,000 and have more than a 10-year life-span.

Based on these guidelines, two types of projects have been identified: those that could be implemented through the County's CIP and those more suitable for implementation by the County's Community Restoration partners. To facilitate decision-making, a prioritized list of projects was developed to help focus implementation efforts, with detailed conceptual plans prepared for the best CIP opportunities; the remainder of opportunities, both CIP and Community Restoration, have been recorded for use as opportunities arise. While many of the individual projects identified in this study do not meet the minimum cost threshold, grouping projects based on location (e.g., by subwatershed) and type will likely increase the benefit and efficiency of implementation, as well as exceed this minimum cost threshold.

An additional objective is to address the County's current National Pollutant Discharge and Elimination System (NPDES) Municipal Separate Storm Sewer System Discharge Permit goal to provide treatment for 10 percent of impervious areas that are currently not served by stormwater management. Based on impervious estimates from the County's 2002 NPDES Annual Report, there are 804 untreated urban impervious acres within the County's portion of Ballenger Creek's watershed. To this end, providing stormwater management controls for 80 untreated impervious acres would help satisfy the watershed's proportion of the County's overall 10 percent untreated goal.

It is also important to note that if left unchecked, many of the stormwater runoff and associated nonpoint source pollution problems noted in this study may lead to long-term impacts to the quality of Frederick County's water resources, as well as exacerbate

regional water quality problems by contributing to cumulative impacts downstream in the Monocacy and Potomac Rivers, and ultimately in the Chesapeake Bay. Potential impacts to water resources include:

- Destabilization of drainage pathways and stream channels
- Damage to infrastructure and private property from erosion
- Reduction of drinking water quality and increased treatment costs for local water supplies, and if left untreated, potential public health and safety concerns
- Reduction of the quality and diversity of physical habitat available to aquatic organisms
- Reduction in species diversity and abundance within stream biological assemblages
- Reduction in economic, social, and aesthetic benefits to local communities (e.g., tourism, recreational fisheries, sense of well-being, community identity, etc.)